Making Rooftops Bloom:
Strategies for encouraging rooftop greening in Montréal

Rotem Ayalon
McGill University School of Urban Planning
Supervised Research Project

Final Draft
Submitted April 28, 2006
To Professor Lisa Bornstein
For the degree of Masters in Urban Planning

McGill

Table of Contents:

List of Tables and Figures:

Acknowledgements:

This project was successful thanks to the help and support of many people.

Thank you to Lisa Bornstein for her openness to support me in pursuing my research interests. She gave me great guidance and was very flexible. I thank Ray Tomalty for offering to be my second reader and giving such helpful and insightful comments.

I would like to thank the whole Rooftop Garden Project team (Alex, Jane, Ismael, Benjamin, Sara) and the many volunteers and friends involved, for their encouragement and contagious energy – you are an inspiration and I look forward to continue working with all of you. *Merci.*

I appreciate the time and interest given to me by everyone I interviewed: Julia Bourke, Stefanie Dunn, Helen Fotopulos, Ismael Hautecoeur, Alex Hill, Daniel Lauzon, Jacob Nerenberg, Steven Peck, André Pednéault, Jane Rabinowicz, Daniel Reid, Martha Stiegman and Ray Tomalty.

Finally, I am grateful to my friends, classmates (Amy especially) and family for their constant support. And to Mark for believing in me and being my biggest fan. I couldn't have done this project or this degree without you - you have pushed me to be who I am, to evolve and to discover 'the story'.

1] Introduction

> Space with power. What words could better describe a garden? The space is self evident. The power, they say, no man has ever fully measured. It is a wonderful combination of sun, rain, and the invisible forces of the soil. This power is all ready to be turned on. All it needs is men who are skillful enough to guide it.[1]

Imagine a space in the center of the city that allows you to escape the noise of the traffic and the heat of the pavement. A space alive with greenery, that is cool, calm and open to other people seeking a similar refuge. A space with power to transform concrete into life, to bring people from different walks of life together, to create communities around the most important source of life – food. Imagine friendships developing over gardening tasks, stomachs filled and taste buds awakened with freshly grown cherry tomatoes, and more gardens spread throughout the city by inspired gardeners. With a clear view of the sky, the city limits and the natural geography such as the mountain and the river, this space is unlike any other. It is not imaginary. It is the rooftop garden on Avenue Henri-Julien in the Plateau-Mont-Royal neighborhood of Montréal. The garden brings together people with similar hopes for a future city covered with green, full of spaces that come alive with climbing beans, edible flowers and people. It is a space no longer deserted and bleak, but rather one that has awakened with plant and human life.

The world's massive urbanization and the need to create "sustainable cities" that provide enough food, shelter, basic services and jobs for all urban residents now and in the future will be a great challenge for the next millennium. This challenge will require creativity by municipal governments and citizens. How can cities help citizens address their needs of food, shelter and employment? How can urban environmental problems be solved? To solve these problems creatively, cities and citizens will need to rethink the use of

[1] Dora Williams, Gardens and their Meaning. 1911. quoted in: John Henning, "Cities Feeding People: An Overview" (paper presented at the Cities Feeding People: A Growth Industry, IDRC Development Forum, Ottawa, May 21 1997).

available space and begin to question: How can “empty space” become “space with power”?

Making use of unused spaces such as rooftops, which are abundant in cities, for urban food production is one such creative solution that can contribute to resident’s food security and employment. The term ‘urban agriculture’ is often thought of as a contradictory term. Few would imagine that food could be grown in cities, the centers of development and abundant pavement. But cities are actually ideal locations for growing food. Doing so shortens distances food travels from field to table and helps people become more connected to their food sources, enabling them to take food security into their own hands.

Rooftop greening can also help solve some environmental problems unique to cities. The pavement and buildings in urban areas have been built upon the soil. This characteristic reduces the surface area for rain to fulfill the water cycle by returning to the earth. Black tar and concrete also cause the temperature in cities to be much higher than surrounding rural lands. It is our collective responsibility to recognize humankind’s contribution to these environmental problems, and seek ways to resolve them. Covering rooftops with vegetation is one such way to reduce the negative consequences of the current state of our development.

Objectives

Rooftop greening is currently happening in Montréal on several small-scale demonstration projects: a handful of green roofs and several rooftop gardens sit atop the city’s skyline. Compared to other cities around the world, such as Chicago, Toronto, Tokyo and Linz, Montréal is behind in its rooftop transformation. The goal of my research is to provide a set of recommendations, largely to the City of Montreal, that will help move the implementation of rooftop gardens forward in the city.

The research questions that will help achieve this objective include: What are the benefits to rooftop greening? How can rooftop greening address urban environmental, agricultural and food security issues? What cities around the

world can be examples for Montréal as it looks to expanding rooftop greening? Why have other cities incorporated rooftop greening into their urban policies? What are the barriers preventing the expansion of rooftop greening in Montréal? What are the opportunities for progress? What examples of successful policies can be found in other cities? What strategies will work in the City of Montréal to facilitate city-wide rooftop greening?

Methodology

Four main methods were used to address the above research questions: literature review, interviews, study of policies and generation of recommendations. Each method is described below.

Literature review

The purpose of the literature review is to address the following research questions: What are the benefits of rooftop greening? How can rooftop greening address urban environmental, agricultural and food security issues? And, what cities around the world can be examples for Montréal? I summarize the literature on rooftop greening as it relates to urban environmental issues, food security and agriculture. In addition, described in this section are the benefits of adding greenery to rooftops and the benefits of urban food production.

Many studies of the benefits of rooftop greening have been conducted in Europe and North America, therefore, most of the sources used for this project are produced by European and North American institutions, governments and community or non-profit organizations. Literature currently available concerning rooftop greening is focused on green roofs as opposed to rooftop gardens. This research focuses on the latter, but due to availability, much of the literature review is based on sources about green roofs.

Interviews

I conducted informal interviews with individuals involved in or knowledgeable about rooftop greening in Montréal. The purpose of these

interviews was mainly to identify the barriers preventing the expansion of rooftop greening in Montréal and to begin generating ideas for how the City could overcome these barriers. In order to get a holistic view of challenges specific to Montréal, I wanted to interview a variety of people, including city officials, community organizers and industry specialists involved in urban greening. Despite time limitations, I was able to interview 13 people (Appendix, Table 2); included, were one industry specialist, two city officials, two city employees, two university professors and six community organizers.

All interviews were casual, with open-ended questions that focused on determining the barriers to rooftop greening in Montréal, based on the knowledge and specialty of the interviewee. Length of time depended on the availability of the interviewees, but ranged from 15 minutes to one hour. All interviews were conducted in person except for two which were conducted by phone.

To facilitate analysis of the interviews, I classified responses into six types of barriers (Appendix, Table 3): financial, awareness, technical, horticultural, administrative and site-specific. Barriers listed in the literature, such as in documents written specifically about rooftop greening in Montréal, were used to supplement the interview material.

Study of policies

The main goal of this phase of the research was to identify policies and programs used by other cities to encourage rooftop greening and urban food production, in addition to assessing why other cities have incorporated rooftop greening into their urban policies. Montréal's policy context is also reviewed and analyzed in order to place any recommendations into the existing policy framework. This was done by reading policy documents from various cities and using some key studies that assess urban policies related to rooftop greening. I outline environmental, food security and urban agriculture policies in general, with specifics about these policies as utilized by municipal governments around the world. To assess the environmental, food security and urban agriculture

policies specific to Montréal, I consulted official municipal documents such as the Master Plan and other policies.

Recommendations

This section culminates the preceding research. I provide recommendations to develop the possibilities for widespread rooftop greening. The recommendations are based on my analysis of local issues such as the political climate, the municipal structure and urban environmental issues. In addition, suggestions are modeled after successful initiatives in other cities.

It is my hope that this research will provide city officials, community organizations and citizens with inspiration and practical tools to change the city's landscape. Empty space can be envisioned as powerful space if it is cultivated and opened up to the community.

2] Literature Review

Right smack dab in the middle of town
I found a paradise that's trouble proof
And if this old world starts a getting you down
There's room enough for two
Up on the roof...[2]

In this section, I review the literature about urban agriculture and urban food security, and their connection to rooftop greening. I outline the types of rooftop greening and the various benefits that can be achieved by adding vegetation to rooftops, such as environmental, energy conservation, building-specific, and food security benefits. Finally, I give a brief history of urban agriculture and examples of rooftop greening throughout the world, with specifics about Montréal on both issues.

Urban agriculture

Urban agriculture is not a new phenomenon, and few cities, even in the more industrialized nations, are devoid of agriculture. What is new, however, is that municipalities are beginning to introduce urban agriculture as social policy and North American cities are beginning to recognize the importance of local food production. Urban agriculture is broadly known as the cultivation of plants, medicinal and aromatic herbs, fruit trees, and the raising of animals in cities to support household economies.[3] Urban agriculture is widespread in cities of low-income countries, but western cities have the potential to increase space for food production, especially in underused areas.[4] Urban agriculture is still not recognized as an integral part of urban planning and design. Perhaps a reason for this divide between urban agriculture and planning is that agricultural activities in urban areas are often seen as a contradiction; cities are dedicated to industrial, manufacturing, commercial and service activities, while rural areas are 'supposed

[2] Carole King. "Up on the Roof" lyrics.
[3] Vikram Bhatt and Rune Kongshaug, eds., *Making the Edible Landscape: A Study of Urban Agriculture in Montreal* (Montreal: Minimum Cost Housing Group, 2005).Project background.
[4] Ibid.

to be' the locations of food producing activities. This separation of activities has led to today's phenomenon: most food eaten by North American city dwellers is produced by 'industrial agriculture.'[5] Urban agriculture challenges conventional industrial notions by encouraging agricultural activities to happen on a smaller scale and closer to where people live – in cities.

Urban agriculture can have many different purposes, including food security, ecology and income generation. This diversity of purposes means that food production can play an important role in cities for a variety of stakeholders in many different situations.[6] An important component for sustainable city development is that urban agriculture is seen as a permanent part of the urban system because of its many social and community benefits.

Countries throughout the world are recognizing the need for urban residents to have access to food production. The Cuban government facilitated urban agriculture by giving urban farmers access to unused land, issuing land grants to vacant space with food production given the highest land use priority, and establishing an extensive support system for urban food production.[7] Pretoria, South Africa, has incorporated urban agriculture into its open space management and set aside land for urban agriculture in designated sectors of the city.[8] In addition, the municipal government of Dar es Salaam, Tanzania has shown support for urban agriculture at various policy levels and is now accepted as a land use in the city. The city's commitment can be seen in The Strategic Urban Development Plan, which has designated special land-use zones for agriculture.[9]

The situation in North American cities shows the need for municipal and federal policies encouraging urban agriculture. Food insecurity, or the lack of access to affordable, quality foods, is a growing problem in cities. Urban

[5] Ibid. 3.
[6] Hank de Zeeuw, Sabine Guendel and Hermann Waibel, "The Integration of Agriculture in Urban Policies" (paper presented at the Growing Cities, Growing Food - Urban Agriculture on the Policy Agenda, Havana, Cuba, October 1999). 162.
[7] Bhatt and Kongshaug, eds., *Making the Edible Landscape: A Study of Urban Agriculture in Montreal*. 16.
[8] de Zeeuw, "The Integration of Agriculture in Urban Policies". 167.
[9] "Special Issue for the World Summit on Sustainable Development," in *Urban Agriculture Magazine* (Johannesburg: Resource Center for Urban Agriculture (RUAF), 2002). 17.

agriculture can be seen as a strategy to improve many people's food security. Some ways agriculture helps address food security is by providing individuals with fresh and nutritious food options, income from the sale of produce, in addition to inexpensive means to feed themselves. Municipal officials can empower citizens to grow their own food in order to improve their food security by providing access to resources such as land (or other spaces for cultivation such as rooftops), water, labor and inputs.[10]

Most urban dwellers are far removed from where their food is grown. Urban sprawl has devoured farmland close to cities, and the transport, refrigeration and packaging uses large quantities of fossil fuels and produces large amounts of waste and pollution.[11] Urban supermarkets sell produce that, many claim, does not taste good and lacks nutritional value because of the long distances the fruits and vegetables have been forced to travel from factory farm to urban market. For example, fruits and vegetables in western industrial countries often travel between 2,500 and 4,000 kilometers from farm to store.[12] In turn, the energy needed to fuel this transport is great. Transportation of raw and processed food products accounts for about 1.4 quadrillion BTU/year of energy, which is roughly 14% of the total amount of energy used in food production.[13] North Americans can buy ripe tomatoes year-round because 80% of fresh tomatoes on the market are ripened with ethylene and because stores import tomatoes from far away.[14] Chemicals and long-distance transport cannot improve the taste of produce and additionally, studies have shown that eating fruits and vegetables out of season can be hazardous to your health.[15]

The environmental costs of long-distance food delivery are increasingly unsustainable at today's levels. For example, a head of lettuce grown in

[10] de Zeeuw, "The Integration of Agriculture in Urban Policies". 163.
[11] Brian Halweil, *Eat Here: Reclaiming Homegrown Pleasures in a Global Supermarket*, 1st ed. (New York: W.W. Norton, 2004). 13.
[12] Danielle Murray, "Oil and Food: A Rising Security Challenge," (Earth Policy Institute, 2005).
[13] Martin Heller and Gregory Keoleian, "Life Cycle-Based Sustainability Indicators for Assessment of the Us Food System," (Center for Sustainable Systems, 2000).
[14] Halweil, *Eat Here: Reclaiming Homegrown Pleasures in a Global Supermarket*. 36.
[15] Marian Burros, "Food-Borne Illness from Produce on the Rise," *New York Times*, November 23 2003. "Illnesses have risen because people are eating more fresh produce year-round, leading to an increase in imports from countries with less stringent sanitary standards."

California and shipped elsewhere in North America requires about 36 times as much fossil fuel energy in transport as it provides in food energy when it arrives.[16] Scientist Anika Carlsson-Kanyama further explains the unsustainability of our current food system by showing that a basic diet composed of imported ingredients can use four times the energy and four times the greenhouse gas (GHG) emissions than an equivalent diet with local ingredients.[17]

Mass produced agriculture is harmful to the environment for many additional reasons. The current system of industrial agriculture has led to the demise of family farms and as a result of the widespread introduction of chemical fertilizers and pesticides after WWII, has been causing widespread water pollution and erosion.[18] Mechanization results in single-crop farms, leading to the loss of varieties of seeds and plants and a very inefficient or "leaky" use of fertilizer. Low biodiversity levels found on industrial farms have an impact on soil nitrogen retention, while excess fertilization leads to contamination of local water supplies, in addition to far-reaching polluted runoff.[19] On the other hand, small farms that function as "polycultures," growing several crops at the same time using various root depths, plant heights or nutrients, can be more productive than factory farms.[20] Loss of biodiversity is exemplified by today's typical supermarket, containing over 30,000 items, half of which are produced by only 10 multinational companies.[21] Although supermarkets appear abundant with a variety of choices, this is not from agricultural variety, but rather from a variety of processing, branding and packaging styles.

Another example of the impact of industrial agriculture on biodiversity is the use of genetic engineering. Multinational corporations design plant species to increase uniformity and shelf-life of produce that is shipped thousands of

[16] Halweil, *Eat Here: Reclaiming Homegrown Pleasures in a Global Supermarket*. 37. Note: lettuce is mostly made of water and provides relatively few calories.
[17] Annika Carlsson-Kanyama, "Climate Change and Dietary Choices — How Can Emissions of Greenhouse Gases from Food Consumption Be Reduced?" *Food Policy* 23, no. 3/4 (1998).
[18] Halweil, *Eat Here: Reclaiming Homegrown Pleasures in a Global Supermarket*. 63.
[19] Ibid. 72-73.
[20] Ibid. 75.
[21] Frances Moore Lappé and Anna Lappé, *Hope's Edge: The Next Diet for a Small Planet* (New York: Jeremy P. Tarcher/Putnam, 2002). 199-209.

kilometers, in addition to producing and selling genetically engineered agricultural products and preventing farmers from harvesting and developing their own seeds. A symbol of this corporate control is the Canadian Supreme Court Case of Percy Schmeiser, a farmer who was sued by the giant agricultural chemical and seed company, Monsanto, for illegally using their seeds. The court ruled that the Saskatchewan farmer infringed upon Monsanto's rights when he planted the company's patented herbicide resistant canola seeds without the company's permission. Schmeiser, in contrast, claimed that the seeds blew onto his fields or had fallen off a truck.[22]

The above issues related to fossil fuel use, pollution and loss of biodiversity have led to an increased concern for freshness, health, ecology, natural resources, and energy conservation. More and more urban residents wish to buy locally-grown produce for these reasons. Evidence of this, locally in Montréal, can be seen in the growth of citizen participation in community-supported agriculture facilitated by Equiterre,[23] groups forming around local food production and consumption,[24] local non-profit organizations such as Action Communiterre helping to establish collective gardens,[25] and in the long lists of residents waiting to get plots in downtown city-run community gardens.[26]

There are many benefits for municipal government-supported urban agriculture. Environmentally, urban agriculture contributes to the development of a 'healthy city' by removing air pollution, regenerating soil and providing space for composting organic wastes, allowing a closing of the urban 'nutrient loop.' Additional environmental benefits to growing food in urban areas include reducing the long distances of food transportation, which reduces fossil fuel emissions, refrigeration costs, and packaging needs. Other possible benefits to

[22] Dana Flavelle, "Monsanto Wins Landmark Case; Supreme Court Rules against Farmer," *Toronto Star*, May 22 2004.
[23] Equiterre, *2006 Season of Community Supported Agriculture* (2006 [cited March 20 2006]); available from http://www.equiterre.org/agriculture/paniersBios/listeFermes.php.
[24] Jepermaculture, *Research on Local, Healthy and Affordable Foods* (2005 [cited March 20 2006]); available from http://jepermaculture.forumactif.com/index.htm.
[25] ActionCommuniterre, ([cited March 20 2006]); available from http://www.actioncommuniterre.qc.ca.
[26] Some residents can wait from 3 to 8 years to get a plot. André Pednéault, Informal interview, October 6 2005.

the city as a whole include: increase in urban biodiversity, reduction in storm water runoff, and increased temperature control via shade and transpiration provided by plants.[27] Urban gardens, on land or rooftops, are examples of environmentally restorative technologies. Their least important economic benefits are the food they grow. Each plot might produce $400 worth of food, but with composting, adding permeable surfaces instead of runoff going into sewers, and plants taking in carbon dioxide and pumping out oxygen, the actual money saved is “amazing”.[28] For example, if a garden serves as a neighborhood drop-off for compost, it saves the city at least $500 in waste collection and by soaking up rain water that otherwise enters the sewage system, gardens save the city money on water treatment and reduces the pressure on city infrastructure.[29]

Socially, urban food production may contribute to the local economy by supporting local employment and sale of locally-produced goods. For people who participate, urban food production contributes to their sense of community and self-reliance. Community gardens provide space to gather and socialize in the community, in addition to contributing to household food supply and additional spending income. Finally, the food system becomes visible in urban areas by putting people in contact with the process and source of their foods.

In urban planning terms, Wayne Roberts of the Toronto Food Policy Council, calls urban agriculture “the Swiss army knife of compact planning tools" because it “takes advantage of both elegance and unused capacity.”[30] He explains that city farms could create rather than take up free space in cities. One misconception is that urban agriculture competes with housing for large chunks of land that are scarce and expensive. Food production does not need large tracts of land; it can do well with ‘nooks and crannies’. Roberts clarifies and

[27] Jacinda Fairholm, "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations," in *Cities Feeding People* (LifeCycles, 1998). 7.
[28] Wayne Roberts, "The Way to a City's Heart Is through Its Stomach: Putting Food Security on the Urban Planning Menu," (Toronto: Toronto Food Policy Council, 2001). 31.
[29] Ibid.
[30] Ibid. 24.

gives evidence that "successful and useful urban agriculture exists in synergy with housing, not in competition."[31]

Crops can be grown intensively on small empty lots and, unlike at rural farms, most inputs for farming can be found anywhere in the city for free. Wastes can be composted and used in urban agriculture, a cheaper solution for the municipality than sending waste to a land fill. Rain water can be collected and used in urban gardens, instead of allowing it to run off as storm water into the sewers. In addition, cities have an excess of heat, which - if collected - could be used for greenhouses. Finally, urban farmers have easy access to a large number of customers. This reduces the distance food has to travel from farm to plate, taking advantage of the compact, dense qualities of a city.[32]

North American cities generally incorporate urban agriculture in the form of community gardens. Empty lots are turned into gardens that are divided up into individual plots. Growing food in cities gives people the opportunity to regain cultural and horticultural knowledge that has been lost in urban areas of North America.[33] Community gardens have become "symbols of the rediscovered commons", the non-governmental social safety net, providing a wide variety of benefits improving the quality of life and environment for urban residents.[34] Based on surveys of North American community gardens, the most common reasons reported for participation were access to fresh or better tasting food, to enjoy nature, and because of health benefits, including mental health.[35]

Urban food security and planning

At the World Food Summit in 1996, the Food and Agriculture Organization and the World Health Organization defined food security as: "The physical and economic access by all human beings, at all times, to sufficient food that is nutritious and safe, allowing them to satisfy their energetic needs and their food

[31] Ibid. 25.
[32] Ibid. 24.
[33] Fairholm, "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations." 8.
[34] Roberts, "The Way to a City's Heart Is through Its Stomach: Putting Food Security on the Urban Planning Menu." 11-12.
[35] Donna Armstrong, "A Survey of Community Gardens in Upstate New York: Implications for Health Promotion and Community Development," *Health and Place* 6, no. 4 (2000).

preferences to allow them to have a healthy and active life."[36] This definition was written for important reasons. Urban dwellers are extremely prone to food insecurity. As explained by planning academics Pothukuchi and Kaufman, city households spend 10 to 40% of their incomes after taxes on food, with poorer households spending more than affluent households. In addition, a large number of lower-income residents depend on emergency sources of food to survive.[37] Food has an impact on other aspects of city life, in that food waste makes up close to one-third of the total waste in city landfills. Also, household trips to grocery stores and other food outlets make up a significant portion of urban traffic.

As explained by Montréal community organizer Jane Rabinowicz, the problem with the present urban food system is that

> Consumers have no power over either production or consumption of their food. Production is far removed from urban centers, and large conglomerates have increasing control over what is planted and therefore consumed. […] Reversing dependence on distant corporations and becoming more autonomous in food production could bring increased food security to growing urban populations, and one of the first places to look for a logical response is at the local level.[38]

Local food production is becoming more accepted in mainstream urban life; help from local governments could strengthen the link between urban residents and the source of their food. Although the prevailing attitude is that urban areas are not proper for growing food or raising livestock, cities have always been locations of food production. Historically, people in Toronto grew food in their backyards, hence the name “Cabbagetown” for one neighborhood and the city’s nickname “Hogtown,” because people could raise livestock within city limits.[39] Additionally, starting in the early 1900's in many northeastern cities, including Montreal, immigrants settled on the outskirts to grow food on cheaper land. As the years passed, urban areas became denser and there were changes

[36] Équiterre, "Système Alimentaire Et Sécurité Alimentaire: Comprendre Et Agir," (Montréal: Direction de la Santé publique de Montréal, 2005). 9.
[37] K. Pothukuchi and Jerome L. Kaufman, "The Food System: A Stranger to the Planning Field," *Journal of the American Planning Association* 66, no. 2 (2000). 118.
[38] Jane Rabinowicz, "Urban Food Security and the Potential for Urban Agriculture," (2002). 5.
[39] Roberts, "The Way to a City's Heart Is through Its Stomach: Putting Food Security on the Urban Planning Menu." 10.

in demographics and the labor market. Families became smaller, women joined the workforce and many people moved to the suburbs. These were some of the factors that led to the decline in urban gardening traditions.

As urban food production becomes more accepted and understood again, urban planners can incorporate urban agriculture into a city's strategy to meet resident food security needs. It is important for planners to recognize that the rise of hunger is not only due to falling incomes and rising housing costs; this comes from an assumption that food is a commodity that can only be bought. Hunger in cities is not only caused by low incomes of marginalized groups. Other causes include insecurity within labor markets, a purchasing power too low to afford basic needs, including food, a lack of basic services, and (for at least some) discrimination.[40] Hunger is a social problem, exemplary of a decaying urban social safety network, the result of cutbacks to government social programs, and as Wayne Roberts describes, a decline in the "non-governmental social safety net known as 'the commons'".[41] The commons, otherwise known as land, capital, tools, or cultural knowledge, become the responsibilities of public health and urban planning. The challenge for urban planners and social planners is to re-establish certain forms of public space, providing opportunities for people to learn how to help themselves and become food secure outside of the cash economy.[42]

Pothukuchi and Kaufman argue that the chain of activities connecting food production, processing, distribution, consumption, and waste management, including associated regulatory institutions and activities, are all absent from the writings of planning scholars and people in the field of urban planning.[43] According to these planning scholars, Ebenezer Howard's Garden City idea (1902) is the best example of a planner giving systematic attention to food

[40] Diana Mitlin, "Chronic Poverty in Urban Areas," *Environment & Urbanization* 17, no. 2 (2005). 6.
[41] Roberts, "The Way to a City's Heart Is through Its Stomach: Putting Food Security on the Urban Planning Menu." 11.
[42] Ibid. 11.
[43] Pothukuchi and Kaufman, "The Food System: A Stranger to the Planning Field." 113.

issues.[44] His plans addressed food production, distribution, preparation and consumption, as well as waste recycling.[45] However, such concerns rarely entered into planning debates during the 20th century. Today, food system planning is not on top of most planners' priorities. Based on a survey of 22 U.S. city planning agencies, Pothukuchi and Kaufman identified reasons why planners do not get involved in food planning, including: food system planning falls outside of their focus on physical development and the built environment; food issues fall under rural, not urban, policy and agriculture; and the food system is driven by the private market so cities cannot control what is produced and distributed.[46] It is unfortunate that urban planners neglect food systems planning. Food is unique among the various human needs because it is connected to the land and people's health, and has social, economic, and political implications connected to the location of the source of the food.[47] High-quality, livable cities assure the safe and adequate provision of all human needs, which include air, water, shelter and food.

This neglect of food security issues by urban planners exemplifies the absence of government support for urban food production. Challenges to increasing food producing spaces in cities include existing bylaws and policies that prevent agriculture alternatives such as greenhouses, nurseries, and urban farms because of the strict separation between urban and rural areas along food production lines.[48] There are several measures local governments can take to encourage urban agriculture, such as zoning, development control and other initiatives, as discussed in following chapters.

[44] Ebenezer Howard and Frederic James Osborn, *Garden Cities of to-Morrow* (London: Swan Sonnenschein, 1902).
[45] Pothukuchi and Kaufman, "The Food System: A Stranger to the Planning Field." 114.
[46] Ibid. 116.
[47] Ibid. 118.
[48] Fairholm, "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations." 15.

Rooftop Greening: Green roofs and rooftop gardens

Rooftop greening is a particular form of urban greening that uses the rooftops of buildings for growing plants. There are two main forms, green roofs and rooftop gardens, as described below. While both are of interest to urban areas, this research focuses on the latter. Adding greenery to rooftops is a way for urban municipalities to address several urban issues. Some of these issues include concern for lack of space for agricultural activities, food insecurity of urban residents and urban environmental problems. The following is a brief explanation of the difference between the two types of rooftop greening, including examples from elsewhere and in Montréal where they are already being used.

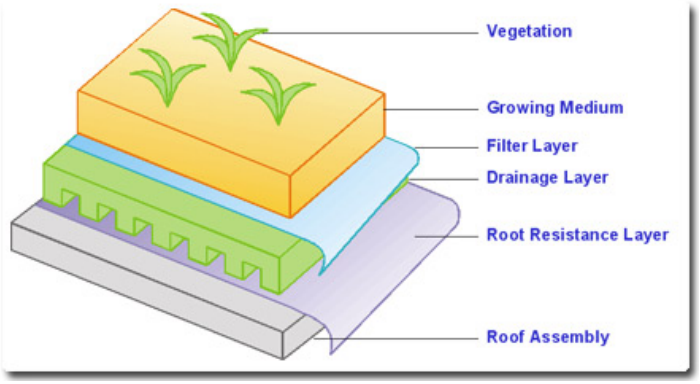
Green roof, Chicago City Hall.
Photo: www.sierraclub.org

Green roofs are innovative architectural and engineering projects that usually consist of a layer of grasses and low growing plants integrated into the roof of a building or built onto existing roofs.[49] Generally, green roofs are not meant to be accessed by building inhabitants or users; rather, they are an alternative to a typical roof, installed as part of the roofing system. According to the Canadian Mortgage and Housing Corporation, green roof technology includes the following components:[50]

- Plants
- Specialized growing medium
- Landscape or filter cloth to contain the roots and soil
- Drainage system

[49] "Green Roofs a La Montrealaise: A Demonstration Project," (Urban Ecology Center, 2004).
[50] CMHC, "Greenbacks from Green Roofs: Forging a New Industry in Canada," in *Research Highlight Technical Series 01-101* (Ottawa: Canada Mortgage and Housing Corporation).

- Waterproofing membrane, often with root repellent
- Roof structure, and possibly some insulation



Green roof layers. Image: www.nrc-cnrc.gc.ca

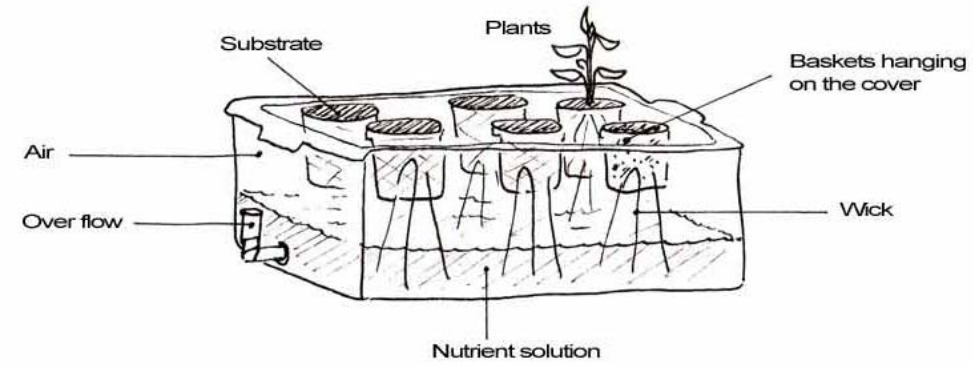
There are two types of green roof systems: extensive and intensive. Extensive green roofs generally are light-weight, have low capital cost and minimal maintenance. They are often designed for buildings with a conventional roof and act as a new roof. Intensive green roofs have a greater soil depth, irrigation system and more favorable conditions for plants. As intensive green roofs have greater soil depth, the structures are heavier, cost more and have higher maintenance requirements.[51]

In comparison, rooftop gardens consist of movable growers strategically placed on existing rooftops that do not always require structural reinforcement. In this document, rooftop gardens refer to any type of system – other than intensive or extensive green roof structures – used to grow edible plants on a roof.[52] Systems can be as simple as pots or containers filled with soil or other growing medium to support plant growth. Containers can be placed on a roof that is accessible to gardeners.

[51] Ibid.
[52] Intensive green roofs can also be used for food production, but here I focus on rooftop gardens.

Roof garden, Senegal. Photo: Sara Finley.

Other rooftop gardens can consist of lightweight, simplified hydroponic systems: containers with a reservoir of water, wicking material and soil-less substrate for plant growth, such as perlite, vermiculite, vermicompost, coconut fiber and pro-mix, which is made of peat moss.



Example of lightweight, simplified hydroponic system. Image: Rooftop Garden Project.

The Rooftop Garden Project of Montréal is currently in the process of research and experimentation to improve the design of this lightweight system for rooftop gardening. The purpose of this specific research project is not to detail or analyze the techniques of rooftop greening, but rather to determine how the City of Montréal can encourage residents to green the city's rooftops using various methods.

Benefits of rooftop greening

Green roofs and rooftop gardens achieve different environmental benefits as a result of their different structures. Green roofs are meant to cover all or most of the surface of a roof and not have much disturbance by human foot traffic, while rooftop gardens cannot cover the whole surface because they are meant to be accessed and used by people on a daily basis. This difference in roof coverage by greenery means that rooftop gardens will have less environmental and energy-related benefits than green roofs. However, rooftop gardens provide many benefits to the building inhabitants, to the local environment, and to the wider community, in addition to those described earlier about urban agriculture. Some of these benefits include protecting and extending the lifespan of rooftops, decreasing energy requirements, reducing greenhouse gas (GHG) emissions, increasing green space, and reducing storm water runoff. The social benefits of rooftop gardens, such as creating new community spaces and providing novel spaces for citizens to grow their own food and achieve food security, are not generally associated with green roofs.

Environmental benefits

Rooftop gardens, similar to green roofs, have an impact on the building itself, the local urban environment, and the community as a whole. Most research of environmental impacts of rooftop greening has previously been done about green roofs. The following is a brief summary of some pertinent findings.

Green roofs reduce storm water runoff.[53] A concentration of impervious surfaces such as asphalt in cities can result in overloaded sewage systems and wastewater treatment plants, causing untreated water to spill into nearby bodies of water. Two ways cities can deal with these negative and expensive outcomes are to extend and enlarge the sewer system and treatment plants, or to decrease and delay storm water runoff. One engineering evaluation measured a reduction

[53] Ulrich and Manfred Köhler Porsche, "Life Cycle Costs of Green Roofs: A Comparison of Germany, USA, and Brazil" (paper presented at the Rio 3 – World Climate and Energy Event, Rio de Janeiro, Brazil, 1-5 December 2003).

in runoff by a green roof of 54%.[54] In addition, in Toronto, where the average rainfall event is 1.6 inches, a three-month long summer study showed that a green roof with a 2.8 inch deep vegetation layer produced no runoff, while the soil surface at grade, without planting, produced 42% runoff and a gravel surface produced 68% runoff.[55]

With the use of models, scientists at Environment Canada have shown that green roof systems are also effective in reducing the urban heat island effect. Heat islands form in cities as vegetation is replaced by asphalt and concrete for roads, buildings, and other structures. These surfaces absorb - rather than reflect - the sun's heat, causing surface temperatures and overall ambient temperatures to rise.[56] With uniform green roof coverage of 50% throughout the City of Toronto, there could be a citywide cooling of 0.1-0.8 degrees Celsius. If there is enough moisture available for evaporation, the green roof systems could reduce the citywide temperature by up to 2 degrees Celsius.[57] Based on research done in Singapore, rooftop gardens can reduce the local ambient air temperature by about 4.2 degrees Celsius.[58]

Energy-related benefits

There are also energy-related benefits to rooftop greening. Karen Liu, a building engineer and researcher with the National Research Council of Canada, determined that a green roof in Ontario, Canada, reduces the daily energy demand of a building for air-conditioning during the summer by more than 75%.[59]

---

[54] K. Liu, "Engineering Performance of Rooftop Gardens through Field Evaluations" (paper presented at the RCI 18th International Convention and Trade Show, Tampa, Florida, March 13-18 2003).
[55] CMHC, "Greenbacks from Green Roofs: Forging a New Industry in Canada."
[56] EPA, *Heat Island Effect* (U.S. Environmental Protection Agency, 2004 [cited 2006 March 22]); available from http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ActionsLocalHeatIslandEffect.html.
[57] K. Liu, "Sustainable Building Envelope – Garden Roof System Performance" (paper presented at the RCI Building Envelope Symposium, New Orleans, Louisiana, November 4-5 2004).
[58] *Field Measurements of Thermal Parameters of Rooftop Gardens in a Multi-Storey Carpark and a Commercial Building* (Singapore National Parks Board, Date not published [cited June 2005]). (Singapore National Parks Board, date unpublished). 6.
[59] K. Liu, "Research Quantifies Benefits of Rooftop Gardens," *Construction Innovation* 7, no. 1 (2002).

A green roof does not cool a building; rather it behaves as a very good insulation device in the summer, reducing the heat flux through the roof.[60]

Further research by Karen Liu has shown that the annual heat flow through the roof of a building with a green roof is reduced by 30 to 50%. This corresponds to a reduction of about 20 to 25 kWh/m^2/year in heating and cooling energy demand or 5 to 7 tonnes of CO_2/m^2/year in associated greenhouse gas (GHG) emissions. Green roofs can also reduce cooling energy consumption by about 5%.[61] Heat gain through the roof is reduced by shading, insulation, evapotranspiration and thermal mass. Compared to a roof with no greenery, a green roof can reduce 95% of the heat gain and 26% of the heat loss.[62]

In terms of the environmental impact of rooftop gardens, research conducted during 2005 showed that a single grower on a roof reduces the amount of heat flowing into a building in a square meter area by approximately 28% during the summer months, while a cluster of growers can reduce the amount of heat flowing through a roof by approximately 44%.[63] If the amount of heat flowing into the building is reduced, less energy will be needed to cool the building during summer. If energy use can be reduced, even slightly, by a large percentage of a city, the amount of energy wasted on cooling buildings will decrease. This will in turn have an impact on the amount of GHG emissions produced by buildings in the city and their contribution to the urban heat island effect. In addition, using rooftops as spaces for food production reduces the distance food has to travel from farms to individual homes. Shortening the distances of food travel reduces the amount of energy used in food transport.

Additional benefits

Additional benefits of green roofs include doubling the lifespan of the roof and noise reduction. Based on research by Karen Liu at the Ottawa field

[60] Elena Palomo Del Barrio, "Analysis of the Green Roofs Cooling Potential in Buildings," *Energy and Buildings* 27 (1998).
[61] Karen Liu and Bas Baskaran, "Green Roof Infrastructure – Technology Demonstration, Monitoring and Market Expansion Project," in *Part 1: Field Monitoring and Technical Analysis* (National Research Council, Institute for Research in Construction, May 2002 – June 2003).
[62] Liu, "Engineering Performance of Rooftop Gardens through Field Evaluations".
[63] Rotem Ayalon, "An Assessment of the Environmental Impacts of Rooftop Gardens," (Montreal: Alternatives, 2005).

research roofing facility, median daily temperature fluctuations in the green roof membrane are reduced from 46 degrees Celsius to 6 degrees C, thereby reducing the thermal stress in the membrane and extending its life.[64] Also, while conventional roofs reflect sound, green roofs absorb it, reducing the noise level in a building by 2 to 3 decibels compared to gravel roofs. A green roof can therefore also be considered as an alternative to structural noise control.[65]

Rooftop gardening, if implemented on a city-wide scale, could have a large impact on urban food security for residents, as explained in-depth in the previous section. By opening up spaces that are generally not used for food production, citizens could take food security into their own hands and grow food in the middle of the city despite lack of available land. It is becoming more obvious that cities need to develop plans to improve urban and peri-urban food production. They also need to diversify their food supply, moving away from reliance on the energy-intensive, capitalist "supermarket" model, which is based on external mass and commercially produced food supplies (see above for more details).

Experience in practice

Outlined in the following section are some tangible examples of urban agriculture and rooftop greening from other cities around the world and within Canada. Also, the history and current condition of urban agriculture and rooftop greening in Montréal are summarized.

Urban agriculture

Gardening is known as the favorite past time of Canadians and Canada has a long history of community gardens. The first community gardens appeared between 1890 and 1930 in the form of Railway Gardens and School Gardens. Wartime economic climate gave gardening increased importance. During World War I, citizens were mobilized to grow Relief Gardens to boost citizen's access to

[64] K.K.Y. Liu, "Energy Efficiency and Environmental Benefits of Rooftop Gardens," *Construction Canada* 44, no. 2 (2002).
[65] Porsche, "Life Cycle Costs of Green Roofs: A Comparison of Germany, USA, and Brazil".

food. Between the wars, Vacant Lot Gardens were grown in economically-declining cities, and during WWII, Victory Gardens were widespread.[66] During the post-war era of suburban growth, gardening in Canadian cities declined, with urban and suburban residents becoming more disconnected from food production. Between 1965 and 1979, with the rise of the counterculture movement, urban community gardening saw a revival.[67] Today, most Canadian cities have community gardens supported by municipalities; Montréal, QC has a large presence (73 gardens) while Victoria, BC has a relatively small number (9 gardens).

The City of Montréal has an extensive community garden network, with 73 community gardens which are run by the City. There are also some community organizations that facilitate additional community and collective gardens; collective gardens consist of a group of gardeners working together to garden a large space and share the produce, whereas a community garden generally is made up of various plots that are cared for by individuals. The first community gardens were established in 1974 during the energy crisis, with more being built soon after. By 1981 there were 43 community gardens in the city, growing to 72 gardens by 1996.[68] Community gardens require minimal maintenance and operational cost for the city and at the same time they service a large number of residents. Montréal has over 6,000 garden plots, providing about 14,000 people alternative access to food (about 1.5% of the city population). Two-thirds of the gardens are located on land zoned as parkland, providing the gardens with long-term protection from development.[69] In terms of infrastructure and resources, the City-run community gardens have a budget and dedicated staff members. There is a "Superintendent" who supervises the program, and 5 horticultural animators are liaisons between the gardens and the administration. The municipally-run community garden network provides community services, such as access to land,

[66] Fairholm, "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations." 13.
[67] Ibid. 10.
[68] Bhatt and Kongshaug, eds., *Making the Edible Landscape: A Study of Urban Agriculture in Montreal*. 30-33.
[69] Fairholm, "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations." 9.

protection of gardens, infrastructure and maintenance resources.[70] Action Communiterre, a local community organization, also manages 10 organic collective and community gardens in the Notre-Dame-de-Grâce neighborhood with the goals of enhancing food security, improving the urban environment, preserving bio-diversity and strengthening community ties.[71]

Currently Montréal's community garden plots are full. There are waiting times of between two to eight years to get a plot.[72] The longest waiting times are found in the downtown boroughs of Plateau-Mont-Royal and Ville-Marie, which are the densest boroughs with the least amount of free space. Land is valuable on the island. There are many issues and constraints to utilizing undeveloped land for gardens. Different neighborhoods have varying needs and claims for open spaces, ownership of the land is an important consideration and not all land is suitable for gardening. Furthermore, land that is available was often contaminated by old industries that were not required to remediate or clean contaminated soil. In order to create a garden on contaminated land, the soil must first be decontaminated to comply with regulations set by Environment Canada. This is a very expensive procedure, costing between $400,000 to $1 million per garden,[73] a substantial portion of which must be paid by the City of Montréal. In comparison, large, flat and empty rooftops are abundant throughout the city on institutional, industrial, municipal and commercial buildings. These underutilized spaces would be ideal options to create gardens in areas of the city without empty lots, relieve long waiting lists and allow people who want to garden to get their hands dirty and make rooftops bloom.

Rooftop greening

Most documented examples and academic studies of rooftop greening throughout the world are about green roofs. Rooftop gardens are also common, but are generally underrepresented in the literature. In developing countries,

[70] Bhatt and Kongshaug, eds., *Making the Edible Landscape: A Study of Urban Agriculture in Montreal*. 78.
[71] ActionCommuniterre, ([cited).
[72] Pednéault. Personal communication.
[73] Bhatt and Kongshaug, eds., *Making the Edible Landscape: A Study of Urban Agriculture in Montreal*. 36.

many urban residents garden anywhere they can, which often includes rooftops. The Montréal-based Rooftop Garden Project has been studying initiatives in other cities including Dakar (Senegal), Havana (Cuba), Techuan (Mexico), and Casablanca (Morocco) to learn more and improve their own techniques.[74] Earth Pledge, an organization in New York City, has built a rooftop garden on its office building that uses compost and vermicompost from employees' food scraps to use as growing medium. In addition, Earth Pledge has been working to promote and facilitate green roof development elsewhere in New York City.[75]

In Canada, Toronto has several examples of rooftop gardening initiatives and the Rooftop Garden Resource Group advises people interested in building rooftop gardens. In 1996, as part of a Master's thesis, Joseph St. Lawrence built a rooftop garden to grow marketable lettuce on the roof of Field to Table, a non-profit organization in Toronto. This project turned into a business called Annex Organics which successfully produced and marketed heirloom tomatoes,[76] open-pollinated varieties commonly grown during earlier periods in human history, but which are not used in modern large-scale agriculture.[77]

For the past three years, two Montréal-based organizations, Alternatives, which works on international development, and Santropol Roulant, a community meals-on-wheels program, have been working on a joint Rooftop Garden Project.[78] They have created a community-run demonstration rooftop garden on the roof of an institutional building in Montréal. All of the fruits and vegetables grown in the demonstration garden are cultivated entirely by volunteers and community members, and go directly to the Santropol Roulant kitchen to provide meals for seniors and others living with a loss of autonomy. Alternatives and Santropol Roulant have been working to develop ecologically sustainable "soil-less" gardening techniques and to promote urban greening by simplifying it thereby making urban agriculture accessible to more people.

---

[74] Alex Hill, *International Rooftop Garden Projects* (Rooftop Garden Project, 2005 [cited December 12 2005]); available from http://english.rooftopgardens.ca/files/intl_description.pdf.
[75] *Green Roofs Initiative* (Earth Pledge Foundation, 2005 [cited December 12 2005]); available from http://www.earthpledge.org/GreenRoof.html.
[76] Michelle Nowak, "Urban Agriculture on the Rooftop" (Cornell University, 2004). 9.
[77] Definition from www.wikipedia.org.
[78] For more information, see: www.rooftopgardens.ca.

Santropol Roulant and Alternative's demonstration rooftop garden. 2005. Photo: Rooftop Garden Project.

Montréal has seen other rooftop garden endeavors in the past. As early as the mid-1970's, a group from McGill University, Rooftop Wastelands, constructed a rooftop garden in the Milton-Park neighborhood. Unfortunately, the project came to an end when funding ran out and the project experienced some difficulties when the roof of the building collapsed under the weight of the garden. The garden had to be demolished and the building renovated.[79] Also, in 1999 or 2000, Eco-Initiatives (now Action Communiterre) attempted to build a rooftop garden on the roof of the Notre-Dame-de-Grâce (NDG) neighborhood YMCA.[80] Eco-Initiatives worked with the architecture firm 'L'Oeuf' and the YMCA in NDG to try to create a rooftop garden because the YMCA was going to have its roof replaced. Unfortunately, the project was not carried out.

Montréal's Urban Ecology Center has also been involved in rooftop greening. During the summer of 2005, the Center installed a green roof on an existing residential triplex in the Plateau-Mont-Royal borough to demonstrate the advantages of vegetated roofs in the city. The project aims to expand local expertise in green roofs and reduce green roof construction costs in the long term. The Urban Ecology Center is documenting details and progress of the

[79] Judith Altieri, Lila Fraser, and Indika Samarakoon, "Recycling Rooftops," (Montreal: McGill University, 2002). 20.
[80] Martha Stiegman, Informal interview, February 2 2006.

project using media to spread awareness about the benefits of green roofs. Additionally, the Center's goals are to stimulate an increase in private and governmental initiatives and to show, by example, that a green roof is a useful and possible endeavor.[81] The Center has also expanded public awareness by leading walking and biking tours to explore the city's existing green roofs, which are difficult to see from street level.

Some green roofs that have already been installed on buildings in Montréal include an institutional building – the École Polytechnique at the Université de Montréal, a commercial building – the Mountain Equipment Co-op (MEC) store, and a federal building – 740 rue Belair.[82] Additionally, some buildings were designed many years ago with intensive gardens built into their roofs, such as the Hotel Bonaventure and above the parking lot and sport facility of the La Cité apartment complex. There are some proposals for new green roofs in Montréal, such as on McGill University's new Life Sciences complex, the Bellini building, and on the Society for Arts and Technology building in downtown.[83]

Summary

In sum, rooftop greening has many benefits for urban areas. Creating spaces for residents to garden can have many positive social impacts. Adding greenery to rooftops can benefit the wider urban environment by reducing the urban heat island effect, reducing stormwater run off and improving biodiversity. A building's energy demand can also be reduced by adding vegetation to the roof, which acts as a natural insulator. Additionally, increasing space and access to resources for residents to grow their own food can contribute to an improvement in resident's food security.

Montréal has examples of rooftop greening initiated by a variety of players: community organizations, institutions and private developers. Projects

[81] Maude Landreville, "Toitures Vertes À La Montréalaise: Rapport De Recherche Sur L'implantation Des Toits Verts À Montréal," (Montréal: Centre d'écologie urbaine, 2005). 13.
[82] Ibid. 73.
[83] SAT, *Society for Arts and Technology* ([cited March 28 2006]); available from http://www.sat.qc.ca/.

have been installed on a variety of building types including residential, commercial, governmental and institutional buildings. Motivations for the implementation of rooftop greening projects vary; environmental consciousness in society is increasing, businesses and institutions want to become leaders in environmental responsibility and community organizations are taking the initiative to become socially and environmentally responsible. Until now, the City of Montréal has taken a 'backseat' approach in their support of rooftop greening projects with small financial contributions and some public support through attendance at important events. Until the City decides whether or not it will show its support for green roofs through policy, advancements in municipal backing for new projects is unknown.

3] Barriers to rooftop greening in Montréal

Montréal is home to a successful demonstration rooftop garden and several green roofs. Despite these examples, there are various issues to be resolved before rooftop greening can become an integral part of Montréal's urban landscape and be adopted as part of the City's Strategic Plan for Sustainable Development. The barriers described here are based on informal interviews with 13 stakeholders, including City officials, community organizers and industry specialists, directed at better understanding the barriers to rooftop greening specific to Montréal (see Appendix, Table 2). Six types of barriers are identified (see Appendix, Table 3): financial, awareness, technical, horticultural, administrative and site-specific.

Financial

Most respondents said that cost was a major barrier to rooftop greening. Reasons for this varied and include government funding, technical costs, and Montréal-specific issues. Several people explained that there is a lack of government funding for environmental initiatives or gardening because the government has many other issues of concern. A couple respondents recognized that the benefits of rooftop greening touch many different sectors, so it would be difficult to determine which municipal department(s) would contribute money to the cause. Daniel Lauzon from the City of Montréal explained that the municipal and provincial governments lack funds, so usually money is given to health, safety and education, rather than environmental issues. Often, the City must choose between different initiatives to fund such as infrastructure or public safety. The goal of the City is to provide services to the public now or it will be seen as negligent. Therefore, instead of giving money to green roofs, the City will probably support people to do it themselves.[84]

In terms of technical costs, people interviewed said that retrofitting old buildings with green roofs or rooftop gardens is very expensive and not

[84] Daniel Lauzon, Informal interview, February 2 2006.

economically feasible in every case. Generally, green roof structures are more expensive than creating rooftop gardens, but not every building can support the added weight of either type of greening without structural support. Specifically related to Montréal, an important issue is that savings from rooftop greening during the summer months (offsetting costs of air conditioning) would not be as great as cost savings from heating because Montréal's winter is much longer than its summer. City representative Daniel Lauzon explained that since Québec uses cheap hydroelectricity, the province must develop its own model and reasoning for supporting green roofs that is not based on other cities' calculations of benefits and costs.[85] Additionally, Jacob Nerenberg of the Urban Ecology Center recognized that there is not much of a cost incentive for individuals to install green roofs because the City of Montréal does not currently recognize reductions in stormwater runoff for tax deductions.[86] Helen Fotopulos, Mayor of the Plateau-Mont-Royal borough stated that cost is a barrier to rooftop greening because of the city's building stock. For example, the City wanted to help retrofit the roof of the Montréal Botanical Garden with a green roof, but the building was old and structurally weak. The cost for the building's restructuring would have been too much, taking money away from other greening initiatives in the city.[87]

Furthermore, Julia Bourke, a green architect, said that doing a cost-benefit analysis of green roofs is a barrier in itself. Her reasoning for this is cost-benefit analyses do not easily take into account the quality-of-life benefits that are gained from rooftop greening. If Montréal is trying to improve the city's quality-of-life, the municipal government must recognize the contribution of rooftop gardens and green roofs.[88]

Awareness

A majority of respondents also expressed that people's misunderstanding of rooftop greening acts as a barrier to the advancement of the field. Rooftop gardening is a new concept and different from green roofs; people neither

[85] Ibid.
[86] Jacob Nerenberg, Personal interview, January 19 2006.
[87] Helen Fotopulos, Personal communication, January 31 2006.
[88] Julia Bourke, Personal interview, February 9 2006.

understand how various forms work nor can they name the benefits. This was a common response by several people, who commented that there is a lack of awareness by city officials. Another frequent theme is that rooftop greening is still new to Montréal, which causes challenges in itself ranging from technical issues to organizational hurdles. Helen Fotopulos also said that "The most difficult thing [about rooftop greening] is people's perceptions and lack of education." Fotopulos has been a key initiator of a municipal committee to create a green roof policy, but there has been resistance from the community and municipal departments. For example, representatives from the fire department fear green roofs could pose barriers for fighting fires and they are worried about brush fires starting because of dried out plants on roofs. The city's building department was also resistant because a large portion of the architecture in Montréal cannot support green roofs. Fotopulos reasoned that there is not enough public knowledge about the benefits of green roofs and there is a need to involve the building industry to make people aware about the economic reasons for rooftop greening.[89]

Finally, representatives from the Rooftop Garden Project said that most people do not understand the difference between rooftop gardens and green roofs. This creates challenges because the Project's team finds themselves forced to explain the goals of rooftop gardens to almost everyone; it is still not common knowledge. This, the Project members find, hinders the advancement of rooftop gardening.

Technical

Technical considerations were also a common response given by interviewees and included the following oft-repeated possible issues:

- Structural considerations when adding weight to a roof
- Access to a roof (related to design and safety issues)

[89] Fotopulos.

Not all buildings can support the extra weight caused by green roofs and rooftop gardens, so engineers or architects should be consulted before adding greenery to an existing building. Most buildings in Canada are built to support a load of 195 kg/m^2 (40 lb/ft^2), [90] which includes the snow load, but anything over this needs to be assessed by an engineer to determine necessary structural reinforcements. [91] Additionally, when designing a rooftop garden on an existing building, accessibility and safety need to be considered. If a building is private, how will gardeners who may not live or work in the building have access to the roof? And in order to allow access to the roof there must be adequate safety precautions such as guard rails and quick exit routes.

REAL-WORLD EXAMPLE OF BARRIER
Eco-Initiatives rooftop gardening experience [i]

Eco-Initiatives (now Action Communiterre) attempted to build a rooftop garden on the roof of the Notre-Dame-de-Grâce (NDG) neighborhood YMCA in 1999 or 2000. The organization worked with an architecture firm, 'L'Oeuf', and the YMCA in NDG to try to create a rooftop garden because the YMCA was going to have its roof replaced. Several barriers stopped the project. For one, the building was old and had many limitations to its structural capacity. A new roof, in addition to structures for a rooftop garden, would have required major structural changes to the building. Secondly, Eco-Initiatives wanted to implement organic hydroponic gardening, which they discovered to be quite a challenging endeavor. Additionally, the organization faced barriers such as municipal requirements for roof structures to not be visible from street level, safety issues, and a lack of awareness by city officials about rooftop greening. Finally, Eco-Initiatives was excited about creating a rooftop garden, but realized that it would be a difficult endeavor for a new organization. They recognized the difficulties associated with creating a rooftop garden and decided to continue focusing on collective garden spaces for the community at ground level.

i. Based on informal interview with Martha Stiegman, Action Communiterre Board Member. 2 February 2006.

Ismael Hautecoeur, from the Rooftop Garden Project, said that a technical barrier is Montréal's building stock. Based on information from a City official, about 30% of the buildings owned by the City are obsolete; they are too old and not structurally sound enough to support any form of rooftop greening. Typically, community organizations that would provide space for community-based rooftop gardening are located in buildings of this type.[92]

---

[90] Landreville, "Toitures Vertes À La Montréalaise: Rapport De Recherche Sur L'implantation Des Toits Verts À Montréal." 31.

[91] Recently, the Ontario building code changed the standards for snow loading. In regions such as Toronto, general snow loads are not more than 107 kg / m^2 (22 lb / pi^2) on a roof, with larger snow loads permitted only where there is snow accumulation. This leaves 88 kg / m^2 (18 lb / pi^2) for the installation of a green roof, which is enough for a simple extensive green roof system. (ibid).

[92] Ismael Hautecoeur, Personal interview, February 21 2006.

Horticultural

Many people also mentioned the horticultural challenges of rooftop greening. Gardening on a roof requires slight changes in technique from gardening at grade because of the increased sun and wind exposure and the need to limit the weight on a roof. Structures protecting plants from too much sun and wind would be necessary, in addition to having access to a source of water on the roof. The Rooftop Garden Project has been working on developing a light-weight 'soil-less' garden technique to reduce the weight of planters on a roof, in addition to overcoming other horticultural challenges. This has been a challenge to develop while maintaining horticultural productivity at par with gardens at ground level.

Roofs with vegetation – gardens or grasses – require more maintenance than standard black tar roofs. Someone or some organization needs to be in charge and gardeners need to have easy, continuous access to the roof, which can pose challenges to creating new community gardening spaces on rooftops. In terms of green roofs, potential issues arising out of lack of maintenance are weeds such as ragweed, which cause allergies and could be a public health issue, and trees that start growing in the green roof, possibly ruining the roof structure.[93]

Finally, an interesting issue related to horticultural barriers brought up by Alex Hill of the Rooftop Garden Project, is that of individual lifestyle habits. Although gardening is the number one hobby of Canadians, people's lifestyles are often not in line with the requirements of maintaining a garden (watering, weeding, etc.) and those who volunteer may not carry through adequately with necessary tasks.[94]

Administrative

There are also barriers to rooftop greening that stem from government regulations. Several people said that municipal safety and heritage protection policies are quite strict and act as challenges, or bureaucratic 'red tape,' to

[93] Lauzon.
[94] Alex Hill, Personal interview, February 22 2006.

completing projects in a timely manner. Jacob Nerenberg of the Urban Ecology Center's Green Roofs Project explained that the city is currently lacking a policy on green roofs. This slows down the process of implementing new projects since there is no standard procedure for approval and permitting.[95] Steven Peck, of Green Roofs for Healthy Cities, addressed the issue of administrative or bureaucratic challenges based on his experience working on Toronto's green roof policy. He explained that in order for rooftop greening to be taken seriously by the municipal government, there needs to be collaboration between various city departments to jointly address policies and actions.[96]

Finally, Julia Bourke brought in her personal experiences working with institutions to introduce sustainable design features such as green roofs. She described a divide between the various forms of government (federal, provincial and municipal) in terms of environmental sustainability. For example, institutions, which get funding from the provincial government for construction and renovation, have no incentive to reduce their operating costs by minimizing a building's energy usage with the addition of a green roof. No extra money is given for renovation to allow reduction in future operating costs. So, if the City wants institutions to be more environmentally sustainable, the provincial and municipal governments need to work together for change and for environmental protection.[97]

Site-specific

Finding a location for rooftop greening, specifically gardens, is a challenge mentioned by three of the respondents. Jane Rabinowicz and Ismael Hautecoeur, who both work with the Rooftop Garden Project, mentioned that identifying and gaining access to buildings with adequate space and structural support for rooftop gardening poses a barrier.[98] Some difficult issues include finding the right person who can grant access to a building's roof and convincing

[95] Nerenberg.
[96] Steven Peck, Telephone communication, February 17 2006.
[97] Bourke.
[98] Jane Rabinowicz, Personal interview, February 13 2006. and Hautecoeur.

this person that allowing a community rooftop garden is in the interest of the building and the community. In our interview, Ismael Hautecoeur detailed the challenge of gaining access to the roof of an institutional building, where the Rooftop Garden Project's demonstration rooftop garden was located for the past two years. After much 'learning by trying,' he discovered that large institutions often hire private companies to manage their buildings. These managers do not make decisions about the use of spaces in a building. He explained that institutional buildings do not have an owner, rather someone from within the university (a 'big boss') makes decisions about building issues. Therefore, it took time and many trials before finding the right person who could approve access to the rooftop space.

Another person I interviewed, Daniel Reid of Montréal's Community Gardening Program, explained that location is a determining factor for where rooftop gardens can be placed. He says that it does not make sense to locate rooftop gardens in areas of the city with space available on the ground for gardening; it only makes sense in parts of the city that are built up and have no empty lots for gardens. According to Reid, the neighborhoods most likely to participate in rooftop gardening are Centre-Ville (Ville Marie), Plateau-Mont-Royal and Côte-des-Neiges; these are the areas that lack available land for gardens and where real-estate is expensive.[99]

Other barriers

There are some other barriers to rooftop greening in Montréal that were not covered by the interviewees. A group of McGill University School of Environment students recently conducted a focus group study to identify Montréal residents' perceived barriers to rooftop gardening.[100] The most common barriers mentioned during the ten focus groups included difficulties with rooftop access, landlord resistance to tenants establishing rooftop gardens and

[99] Daniel Reid, Personal interview, October 15 2005.
[100] Joseph Bottone et al., "Perceptions Related to Rooftop Gardening in Montreal," (Montreal: McGill University School of Environment, 2005).

concerns about garden maintenance.[101] Other barriers pointed out by residents included concerns about safety when accessing a roof, structural capabilities to support added weight and misconceptions or lack of education about what rooftop gardening is (confusion between green roofs, which are very costly, and rooftop gardens which can be created inexpensively).[102]

Additionally, even on the edges of cities, the proximity of urban residents to agricultural production raises concerns about noise, dust, odors, and other hazards. Thus, agricultural activities occurring in the center of a city must also deal with zoning and permitting constraints.

In sum, there are quite a few barriers to rooftop greening. These barriers include the cost of building green roof structures, cost of reinforcing building structures to support added weight to the roof, lack of popular knowledge of the concept, design and structural issues, horticultural technicalities, bureaucratic approval and site-specific issues. The remainder of this report turns to feasible strategies that the City of Montréal could use to overcome these barriers and encourage rooftop greening throughout the city.

[101] Ibid. 13.
[102] Some of these barriers do overlap the ones given by my interviewees, but I thought they were still necessary to mention and give the voice of city residents.

4] Municipal Policies: Environmental, Food Security and Agriculture

> Environmental policy is a problematic term, as if the environment is something surrounding us, yet separate, that we can damage, restore, and care for. In reality, we must acknowledge our link to the biosphere.[103]

This purpose of this chapter is to understand how municipalities can support rooftop greening by using environmental, food security and urban agriculture policies. To begin, policy-making in general is outlined, followed by specifics of the three policy types. This is followed by an examination of the policy-making power of municipal governments. Examples of municipal policies used in Canada and elsewhere support general explanations and analyses. Finally, Montréal's policy context in the areas of environment, food security and agriculture are explained and assessed to set the stage for the following chapter of recommendations.

Policy is "a method or course of action adopted by a government, business, organization, etc. designed to influence and determine decisions" and requires "the union of laws, regulations, implementation procedures and enforcement of actions towards a goal."[104] Important factors in policy-making include political will and strong supporting constituencies.[105] Public policies produced by local governments are the outcomes of the interactions of all factors, such as voter turnout, party politics, planning regulations, structures of governance, relations with provincial governments, and internal administrative organization. Policies are important because they define how local governments interact with their citizens; the policies local governments adopt are the 'face' of

---

[103] Edmund P. Fowler and Franz Hartmann, "City Environmental Policy: Connecting the Dots," in *Urban Policy Issues: Canadian Perspectives*, ed. Edmund P. Fowler and David Siegel (Toronto: Oxford University Press, 2002). 164.
[104] *The American Heritage® Dictionary of the English Language*, Fourth ed. (New York: Houghton Mifflin Company, 2000).
[105] Martin Bourque, "Policy Options for Urban Agriculture" (paper presented at the Growing Cities Growing Food: Urban Agriculture on the Policy Agenda, Havana, Cuba, October 1999). 127.

local government.[106] Generally, public policy is directed at goods and services that the market either does not provide or provides unequally; it is directed at those able to afford the good or service because services such as education or parkland, which should be available to all, are provided collectively with finances from taxes.[107]

Each level of government has its own policy-making processes, which affect how issues are defined and what policies are adopted. For example, Canadian cities have a mayor, the chief executive, who is the head of the majority party.[108] All parties define and structure policy issues by constructing platforms, contesting elections, holding caucus and cabinet discussion on policy, and voting as disciplined groups in the legislature. This means that many policies are defined and implemented as much to the advance of the political party as to solve problems in the city.[109]

Local governments are in charge of meeting the basic needs of citizens such as police and fire protection, waste management, parks and public health. Without efficient provision of services, people could not go about their daily lives such as shopping, conducting business or living in a municipality. For this reason, local governments are concerned with land use policy, which involves the coordination of services and human purposes in a single place and can only be done by a municipal government that has in-depth local knowledge (provincial and federal governments cannot have such local knowledge, which is why they decentralize this type of responsibility to municipalities).[110] Although local government is considered the lowest level on the chain of command, below federal and provincial governments, municipalities are not completely without power. According to Mark Roseland, "the success of local governments in sustainable development can be attributed to the efficiency, accountability and flexibility of policies developed at the level of government closest to the

[106] Edmund P. Fowler and David Siegel, *Urban Policy Issues: Canadian Perspectives,* 2nd ed. (Toronto: Oxford University Press, 2002). 1.
[107] Ibid. 3.
[108] This applies only if the municipality has political parties. Many Canadian cities do not have political parties.
[109] Fowler and Siegel, *Urban Policy Issues: Canadian Perspectives*. 4.
[110] Ibid. 5.

people."[111] In this way, cities are able to develop their own unique policies that address specific environmental, historical, political, economic and cultural situations. In some policy fields, such as environment, social services and housing, municipalities have acted in innovative ways to achieve certain goals.

Local policy-making is not an easy task. Urban governments face many challenges when trying to create policy. Fowler and Siegel explain the difficulties of policy-making in Canada, one of which is that policies are often made in isolation from one another, with departments operating as separate 'fiefdoms.' Secondly, urban areas are experiencing urban sprawl, creating more territory and fragmented local governments. This means policy-making becomes even more difficult to coordinate. Thirdly, councils often lack focus and coordination, partly because of political party differences. Another challenge is that municipalities do not have a strong policy-making role. Finally, municipalities need the capacity to develop, analyze, and evaluate policies on their own.[112] If these challenges can be overcome, local governments will have more success creating policies specific to local needs. Difficulties with policy-making specific to Montréal include the multiple levels of local government, demergers of some boroughs, party politics and the ethnic/language divide, to name a few. Results of the demergers have left the City of Montréal with less revenue from taxes and antagonistic relationships with demerged boroughs, but the City maintains control over its most important functions.[113]

In a municipal resource book, Mark Roseland outlines instruments municipalities can use to make change in the form of sustainable development policy frameworks; he divides them into four categories: regulations, voluntary instruments, expenditure and financial incentives.[114] Roseland explains that regulations are the most pervasive policy instruments. Quid Pro Quos are another form of regulation that can be used by governments to require firms to do something in exchange for the right to build or produce a product; one example

[111] Mark Roseland, *Toward Sustainable Communities: Resources for Citizens and Their Governments*, Revised ed. (Gabriola Island, BC: New Society Publishers, 2005). 40.
[112] Fowler and Siegel, *Urban Policy Issues: Canadian Perspectives*. 14.
[113] Robert K. Whelan and Pierre Joncas, "Montreal Demergers: An Update," *Inroads* Winter, no. 16 (2005).
[114] Roseland, *Toward Sustainable Communities: Resources for Citizens and Their Governments*. 33.

of these is linkage fees.[115] Linkage fees require that developers either build rooftop gardens, for example, or pay into a trust fund to support rooftop gardens elsewhere in the city.

Voluntary instruments generally do not require regulations or financial incentives, but might involve some expenditure by government. One example is education campaigns, which allow politicians to educate people and influence public behavior without large expenditures.[116] On the other hand, Roseland outlines expenditure as a policy instrument that is any use of public money for means such as contracting, monitoring, investment, procurement, enterprise or public-private partnerships. In this way, government can work towards community objectives by spending money on specific activities.

A final policy tool for municipalities, as described by Roseland, is financial incentives, which do not necessarily require expenditure on enforcement. Financial incentives are an alternative to traditional regulatory tools. Some sample tools include: pricing, taxes, subsidies, tax incentives, grants, loans, rebates, rewards, surety bonds and vouchers. One example of financial incentives being used toward environmental policy is the Netherlands Green Fund. This is a source of private funding for ecological projects and investments that is operated by private banks. All investments are certified and guaranteed by the government, with 70% of the funds invested into certified green projects which have supported endeavors such as organic farming and sustainable building.[117]

Environmental policy

Policies that are made in cities regarding environmental issues are usually only reactions to a situation that has already gone wrong; therefore, people thinking about greening cities are not just policy-makers. There are many people changing their lifestyles to address environmental problems, such as by living more simply, consuming less, growing their own food and living in energy-

[115] Ibid. 34. Currently, linkage fees are not used by the City of Montréal and would require a change to the City's Charter in order to be able to use them officially.
[116] Ibid. 35.
[117] Ibid. 37-39.

efficient homes.[118] These people do not wait for policy to be made; rather they change their lifestyles to adapt to their beliefs and what they want to improve in their surrounding environment. Interest in urban sustainability is continuing to grow. According to Mazmanian and Kraft, this interest is a result of people learning about environmental destruction, in addition to nostalgia for simpler times, more open space and less traffic congestion. An important lesson about sustainability is that lasting gains in quality of life cannot be achieved without effective integration of environmental, social, and economic goals at the community and regional level.[119]

Mazmanian and Kraft explain how difficult it is applying sustainability criteria to everyday matters of public policy; they argue that "to build communities in which environmental quality, social justice and economic vitality coexist in a sustained manner, a community would need a combination of long-range foresight and short-term adaptability."[120] In order to inform environmental policy choices, according to Mazmanian and Kraft, communities need to incorporate more comprehensive and sophisticated data into their environmental and economic planning and decision-making. Something concrete that communities can do to foster sustainability is to encourage pilot programs. This could be done by providing grants allowing communities to leverage local and private investments that aspire to integrate economic development, environmental protection, and social well-being through community partnerships and education.[121]

Municipalities can also be proactive with their environmental policies. Sandra Marshall, of the Canada Mortgage and Housing Corporation, highlights some sample tools that municipalities can use to encourage rooftop greening specifically. Included in these tools are *indirect financial incentives*. Municipalities can implement indirect incentives when they recognize that green

[118] Fowler and Hartmann, "City Environmental Policy: Connecting the Dots." 168.
[119] Daniel A. Mazmanian and Michael E. Kraft, *Toward Sustainable Communities: Transition and Transformations in Environmental Policy, American and Comparative Environmental Policy* (Cambridge, Mass.; London: MIT Press, 1999). 43-44.
[120] Ibid. 45.
[121] Ibid. 287-288.

roofs are one tool among many to address a city's environmental problems. Examples include energy efficiency and stormwater disposal taxes. For both of these examples, green roofs are one way building owners can improve a building's energy efficiency and reduce the amount of stormwater runoff from the property. *Direct financial incentives* are a second type of tool for municipalities that can cover some of the costs for building green roofs. Usually there are special conditions accompanying this type of incentive such as amount of roof coverage, water retention capacity and roof maintenance. There are other incentives that do not require financial investments from municipalities, such as tax credits, fee waivers and density bonuses. Density bonusing is a tool used by municipalities to allow zoning requirements to vary in exchange for provision of certain facilities and services that are of benefit to the community.[122] For example, a developer could be permitted additional floor area or density in exchange for the provision of an identified service or facility which could include green roofs or rooftop gardens. Finally, *regulatory measures* are compulsory rooftop greening tools that can help a municipality achieve specific goals such as improvements in air quality and urban heat island effect.[123] For example, the City of Tokyo requires at least 20% of a roof to be greened in new developments larger than 1,000 m^2 for private developments or 250 m^2 for public developments. Failure to comply with the regulation results in payment of a fine.[124]

Examples of environmental policies from elsewhere

The above section outlined general types of urban environmental policies, while this section is more specific, with examples of cities introducing environmental policies and programs that focus on rooftop greening. The following chart is a synthesis of some North American cities efforts to incorporate rooftop greening policies. Assessed here are the rationales, measures and outcomes that led the municipalities to encourage rooftop greening.

---

[122] Ray Tomalty, Anna Hercz, and Peter Spurr, "Research Report: Municipal Planning for Affordable Housing," (CMHC, 2002).
[123] Sandra Marshall, "Green Roofs: A Resource Manual for Municipal Policy Makers," (Canada Mortgage and Housing Corporation, 2006). 15-16.
[124] Ibid. Fine is about 200,000 yen ($2,000 US, $2,300 CAD).

Table 1: North American environmental policies encouraging rooftop greening

City	Rationale	Measures	Outcomes
Toronto	Reduced stormwater runoff	Feasibility study	Green roof policy
	Reduced urban heat island effect and pollution	Demonstration projects	Pilot programs for financial incentives
	Replacement of green spaces	Cost-benefit analysis	
Vancouver	Reduced impervious surfaces	Demonstration project with monitoring	Green building strategy for the future
	Stormwater management	Stormwater management guidelines	City-wide green roof strategy (forthcoming)
	Reduced urban heat island effect		
Waterloo	Stormwater management	Feasibility study	Restrictions on impervious surfaces
	Improved air quality	Report to guide decision-makers	Steering committee considering green roof policy
		Demonstration project on City Hall	
Chicago	Reduced urban heat island effect	Demonstration projects	Green roof policy
		Publicity	Density bonus for developers
			Energy conservation code
New York City	Stormwater management	Awareness building	Green roof policy taskforce
		Workshops, resources for professionals and policy-makers	
Portland	Reduced impervious surfaces	Stormwater charges	Green roof requirement for City buildings
	Increased surface water absorption		Development bonus strategies
	Stormwater management		Grants
			City consultant
			Technical assistance

Source: Author's compilation based on Marshall, Sandra. "Green Roof Policies Worldwide." Canada Mortgage and Housing Corporation, 2006.

Cities in Canada

Toronto's Environmental Plan, as explained by Fowler and Hartmann, is an example of what a government can do to achieve sustainable living patterns. Cities have the power to develop policies and to purchase goods and services. Toronto's Environmental Plan, written in the year 2000, recommends that the City use its policy-making and spending powers to promote environmentally sustainable urban development, energy efficiency in the industrial sector, development of green industry, local food production, and recycling of construction and renovation waste. The Environmental Plan was created by an Environmental Task Force, which was established to help the city council deal with the city's pressing environmental issues. Task Force members recognized that the only way to ensure environmental issues were taken into account effectively was to infuse an environmental ethic throughout all decision-making processes. This involved instituting a sustainability approach in all decisions, simultaneously looking at the environment, economy, and social equity issues.[125] A goal of the Environmental Plan is to support the efficient production, transmission and use of energy from renewable resources, which will have environmental (improved air quality) and economic (saving money in reduced energy bills, etc.) benefits.[126]

One recommendation in Toronto's Environmental Plan was to encourage green roofs and rooftop gardens by addressing the potential for retrofitting City-owned buildings, incorporation of rooftop greening into new developments and determining the resulting environmental benefits.[127] The Environmental Plan also recommended 'Quick Starts', actions that the City could take in the short-term. One proposed Quick Start is the preparation of a report by the Toronto Housing Company on opportunities to establish rooftop gardens on residential buildings owned by the Company, with estimates of costs and possible sources

[125] Fowler and Hartmann, "City Environmental Policy: Connecting the Dots." 159.
[126] Ibid. 160.
[127] Toronto, "Clean, Green and Healthy: A Plan for an Environmentally Sustainable Toronto," (City of Toronto, Environmental Task Force, 2000).

of funding.[128] An additional Quick Start project is "flat-roof planting". This idea is often used in European cities, whose governments require all new flat roofs to be built to support the weight of rooftop gardening.[129]

Motivations of the City of Toronto to increase rooftop greening include reduction in stormwater runoff, reduction in the urban heat island effect, and replacement of displaced green spaces.[130] So far, the City has done a feasibility study, and supported two demonstration projects (one on the City Hall and one on a Community Center). Through the Federation of Canadian Municipalities, the City was awarded a grant to study, among other aspects, the measurable costs and benefits of green roofs and the monetary savings from green roofs. Researchers found that 8% coverage of existing rooftops with extensive green roofs throughout the City of Toronto could generate over $300 million in initial cost savings in areas such as stormwater management, combined sewer overflow reduction, building energy savings, and urban heat island reductions. Operational cost savings for the City from this level of coverage were calculated at approximately $40 million per year.[131]

The City of Toronto has recently, in February 2006, approved policies and programs to support the implementation of green roof technologies.[132] These policies and programs include a municipal commitment to install green roofs on existing City-owned buildings whenever practical and cover 50 to 75 per cent of the surface of any new City-owned buildings with green roofs. A pilot program will be initiated to encourage green roof construction. Additionally, City officials will be working with officials at Toronto Hydro and the Toronto Atmospheric Fund to develop programs that recognize the significant energy, air quality and climate change benefits of widespread green roof implementation.[133]

---

[128] Ibid. 141.
[129] Fowler and Hartmann, "City Environmental Policy: Connecting the Dots." 165.
[130] Sandra Marshall, "Green Roof Policies Worldwide," (Canada Mortgage and Housing Corporation, 2006). 11.
[131] "Toronto Leads North America with New Green Roof Policy," (Toronto: Green Roofs for Healthy Cities, 2006).
[132] Peck.
[133] "Toronto Leads North America with New Green Roof Policy."

Vancouver is also at the forefront in incorporating rooftop greening into its urban strategy. The city's objective is to reduce the amount of impervious surfaces within city limits, and green roofs fall under a sustainable stormwater management plan. Currently there is no policy directly supporting green roof development in Vancouver, but the City is exploring options for green roof implementation. "Stormwater Source Controls Design Guidelines" have helped the Greater Vancouver Regional District (GVRD) examine costs and benefits of different regulatory options for stormwater management. While the Guidelines do not prescribe a method for stormwater management, green roofs are among the options. The Guidelines are meant to help municipalities in the GVRD decide what would be appropriate. The City of Vancouver is creating a green building strategy to change bylaws and code requirements for all development, implementing a 'green' baseline, with green roofs as a part of this strategy. The City does not include incentives or bonuses as part of their tools for implementing green roofs; rather, secondary tools such as negotiations for amenity through rezoning or development cost charges might be used. The City also is considering introducing building management elements, green roof maintenance and fire prevention in the policy.[134]

Waterloo, Ontario does not have a specific policy encouraging green roof construction, but the City may institute a stormwater utility fee for industrial, commercial and institutional sectors. In this case, buildings with green roofs would pay a reduced fee. Also, there are restrictions on impervious surfaces in some residential areas, which is another way to reduce stormwater runoff. The City of Waterloo conducted a feasibility study to identify municipal buildings suitable for green roofs and released a report to guide decision-makers by identifying the best locations for green roofs and outlining the benefits. The result of this study was the installation of a demonstration green roof on City Hall. The demonstration roof improved the community's awareness of green roofs and scientific monitoring is helping to demonstrate the effectiveness of green roofs in reducing stormwater runoff and improving air quality. The project has been

[134] Marshall, "Green Roof Policies Worldwide." 16-17.

successful because of the involvement of all city departments, city council and the community in the planning process.[135] Also, media recognition has been essential to gaining community and council support. The City of Waterloo has created a steering committee to move forward with creating green roof policy and to consider incentives, marketing and educational initiatives in addition to requirements for green roof installations.[136]

Cities in the US

Chicago has received support for rooftop greening from its mayor, Richard Daley. The City has developed a "Building Green/Green Roof Policy" that applies to construction projects receiving public assistance or those that are to be reviewed by the Department of Planning and Development. Developers can get a density bonus in the form of a floor area premium for building a green roof but, in order to qualify, at least 50% of the roof surface must be covered by vegetation. The City also passed an "Energy Conservation Code" in 2001 requiring all new retrofit roofs to meet a minimum standard for solar reflectance in response to the extreme urban heat island effect in Chicago. Green roofs are one way to lower the roof reflectivity.[137] Another initiative that helped encourage the private sector to participate in establishing green roofs was seminars to dispel myths and fears about green roofs. Moreover, the City surveyed building professionals to determine appropriate incentives to encourage green roofs, the results of which were property tax credits, density bonuses and income tax credits.[138] There is no requirement for green roof building in the private sector. Finally, although there is no formal regulation for green roof installations on new and retrofit roofs and despite prohibitive costs, the number of green roofs is predicted to grow in

[135] Ibid. 19-22.
[136] Waterloo, "Green Roof Feasibility Study and City Wide Implementation Plan," (City of Waterloo, 2004).
[137] An alternative way to reduce the reflectivity is to install light-colored roof surfaces.
[138] Vuk Vujovic and Douglas J. Ogurek, *Shouting from the Rooftops! Chicago's Green Champions Share Techniques for Growing More Green Roofs on More Buildings* (www.greenroofs.com, 2005 [cited February 2006]).

Chicago.[139] As of May 2005, the City had 120 green roofs totaling between 1.5 million and 2 million square feet of rooftop vegetation.[140]

New York has a problem with rainstorms overflowing the sewage system, resulting in over 40 billion gallons of untreated wastewater entering the city waterways. This significant issue has led to the creation of a Green Roof Policy task force with representatives from government agencies to discuss green roof policy creation and project advancements. An organization called Earth Pledge is initiating the task force and promoting green roof technologies by holding workshops for various stakeholder groups. Earth Pledge has also created the 'Green Roof Toolbox' as an online resource for design and building professionals, policymakers and the public, in addition to an initiative entitled “Greening Gotham” to raise support for and awareness about rooftop greening.[141] So far, no policies have been adopted, but the City Council is examining green building policies and legislation that would require LEED Silver certification for publicly funded buildings.[142]

Portland was the first city in the U.S. to pass legislation supporting green roofs. This came out of the Clean Water Act and was a strategy to reduce impervious surfaces and increase surface water absorption, rather than spending time and money studying the costs and benefits. Green roofs are only required on City facilities, which must cover at least 70% of the roof surface. Portland uses development bonus strategies such as floor area ratio bonuses and reduced stormwater management charges, which for commercial, institutional and industrial buildings is $6.06 US per 1,000 sq. ft. of impervious surface per month. Portland also has a split stormwater fee based on water consumption, sanitary discharge and treatment and stormwater management. Green roofs are considered a best management practice, allowing people to earn one of the highest discounts. For public buildings, project managers must consult the City's

[139] Marshall, "Green Roof Policies Worldwide." 24-29.
[140] Vujovic and Ogurek, *Shouting from the Rooftops! Chicago’s Green Champions Share Techniques for Growing More Green Roofs on More Buildings* ([cited).
[141] *Earth Pledge: Green Roofs Initiative* (2006 [cited March 30 2006]); available from http://www.earthpledge.org/GreenRoof.html.
[142] Marshall, "Green Roof Policies Worldwide." 32-35.

internal green building consultant, but the City cannot require green roofs on private projects. Despite this, the City provides technical assistance to private building owners, developers and architects. In addition, the City provides grants for demonstration projects (funded by a stormwater fee), monitors green roofs and conducts tours to increase public knowledge about green roofs.[143]

Cities in Europe

Many cities in Europe have developed sustainability indicators and targets, with sustainability as the primary organizing concept for future planning.[144] European cities have used creative approaches to mitigate the loss of nature resulting from development and construction in their urban environments. One example of a creative approach is the city of Linz, Austria, which often requires building plans to compensate for green space lost by construction. Since the 1980's the city has subsidized the installation of green roofs by 35%, and today there are about 300 green roofs throughout the city. The government has recognized that green roofs harbor a high degree of biodiversity and are important to minimize negative environmental effects of development.[145]

Basel-City, Switzerland funded green roofs for a two-year period in the mid-1990's to stimulate interest, and then green roofs were included in building regulation. The regulation states that all new and renovated flat roofs must be greened to provide species habitats. A study was conducted on the benefits of green roofs with respect to biodiversity, which showed that green roofs can protect endangered species of invertebrates. The city's efforts have been successful first because of subsidies, which led to 85,000 m^2 of roofs being greened, about 15% of all flat roofs. Also, media attention helped promote rooftop greening, highlighting the city's contest for best looking roof. In addition, since all stakeholders were involved from the beginning, it was easier to ensure

[143] Ibid. 37-40.
[144] Timothy Beatley, "Sustainable European Cities: A Survey of Local Practice and Some Lessons for the U.S.," (Cambridge, MA: Lincoln Institute of Land Policy, 1998). 4.
[145] Ibid. 43.

that everyone's questions and concerns were met and there was no resistance to the programs and policies.[146]

Munster, Germany promotes green roofs through tools and incentives. The city has instituted a stormwater fee based on the amount of impervious surface on the property; a green roof can reduce the fee by 80-90 percent, based on its capacity to retain water. A stormwater fee is a large administrative task because the amount of impervious surface on each property must be determined and after green roof installation, it must be verified by public works staff. The city also administers a state-supported fund to give grants of 15 euros/m^2 of green roof. The stormwater fee, in addition to the incentive program, has been helpful to encourage green roof installations in Munster.[147]

Stuttgart, Germany encourages rooftop greening through a financial incentive program that can provide up to 50% of the costs of new green roofs. It greens publicly-owned buildings and regulates green roofs in local development plans. In addition, free consultations are provided by the city and a 'how to' brochure has been created.[148]

See Appendix A for examples of environmental policies from Asia.

Summary of environmental policies

Montréal can learn much from other cities regarding appropriate methods to address local environmental issues. The most common reasons cities are encouraging rooftop greening include concerns for storm water runoff, the urban heat island effect and lack of urban green spaces. Common measures for advancing rooftop greening include visible demonstration projects, supporting cost-benefit and feasibility studies, in addition to raising community awareness. Typical outcomes of cities pursuing rooftop greening as a municipal strategy include assembling taskforces to develop policies and offering incentives for rooftop greening such as density bonuses and grants.

[146] Marshall, "Green Roof Policies Worldwide." 44-47.
[147] Ibid. 48-50.
[148] Ibid. 61-65.

In Canada, only Toronto has developed a policy to address rooftop greening. Vancouver and Waterloo are supporting rooftop greening by instituting stormwater charges to encourage reduction in impervious surfaces, and various cities are implementing rooftop greening demonstration projects on municipal buildings. Several cities in the US have been encouraging rooftop greening in the form of green roofs to reduce impervious surfaces, stormwater runoff and the urban heat island effect. Chicago has had success encouraging rooftop greening with a series of incentives such as property tax credits, density bonuses and income tax credits; strong support from the mayor has been essential.

European cities are at the forefront of environmental policies encouraging rooftop greening. In many cities, the impetus for such policies comes from the desire to restore biodiversity that has been lost because of development. Some cities have tried mandatory policies, while others have used incentive programs. Cities in Asia (see Appendix A) are driven to encourage rooftop greening because of urban development that has reduced green space at ground-level and are relaxing development requirements, introducing educational promotion programs and requiring portions of government building roofs to be greened.

City-wide rooftop greening can be a municipal strategy to address urban environmental problems. Described above are environmental policies used by cities around the world to encourage rooftop greening. In addition, cities can implement food security and urban agriculture policies that incorporate rooftops as spaces for food production, as discussed below.

Food security policy

> Food is unique among human needs because it is connected to the land, to health, and has social, economic, and political implications connected to the location of the source of the food.[149]

This statement exemplifies why many municipalities have introduced food security policies, although policies related to the environment and urban

[149] Pothukuchi and Kaufman, "The Food System: A Stranger to the Planning Field." 118.

agriculture can also work to address community food security. Pothukuchi and Kaufman outline methods planners can use to strengthen their communities' food system. Some of these methods include assessing the impact of current planning on the food system, which can be done by formulating land use and zoning policies to support urban food production and economic development policies. Also, food security goals can be integrated into community goals.[150]

To address food security issues, some municipalities have created Food Policy Councils. These Councils are public entities with strong stakeholder participation dedicated to analyzing food-security issues and coordinating the actions of diverse public agencies within a given jurisdiction.[151]

Examples of food security policies from elsewhere

There are some examples of cities introducing food security policies and programs that are related to rooftop greening, although a lack of coherent government support for urban food production is common. Generally, food security policies are marked with fragmented support from municipalities and a lack of coordination from municipal departments.[152] Despite this, there are many local government departments that can have impacts on a community's food security, such as Economic Development, Housing and Urban Development, Public Health, Parks and Recreation, Public Works and Planning. Therefore, there are many opportunities to shape local policies and programs to advance community food security.[153] Here the focus is on food security policy as it might be advanced by rooftop greening.

[150] Ibid. 119-120.
[151] Bourque, "Policy Options for Urban Agriculture". 128.
[152] Fairholm, "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations." 13.
[153] Dawn Biehler et al., "Getting Food on the Table: An Action Guide to Local Food Policy," (Venice: Community Food Security Coalition & California Sustainable Agriculture Working Group, 1999). 1-25.

Cities in Canada

Canada does not have a nation-wide food policy, although there has been much talk recently of creating one.[154] For now, municipalities are taking steps toward food security by creating food policy councils.

Toronto's city council created the Toronto Food Policy Council as a subcommittee of the Board of Health because it recognized the role that food plays in health. The Council's mission encompasses two goals: "to end hunger and the need for a food distribution system based on charity" and "to promote food production and distribution systems which are equitable, nutritionally excellent, and environmentally sound."[155] These two ambitious goals led to holistic approaches in projects, such as promoting economic development through increasing sustainable food production in the city. Such projects create healthy food, provide jobs and income to those in need and help protect the environment.

The Council has initiatives to use food policy for the improvement of public health, including partnering with a roofers' association to form the Rooftop Garden Resource Group, which helps people create rooftop gardens.[156] Another example is linking regional agricultural producers with local restaurants and retailers interested in purchasing food locally. In addition, the Food Policy Council has done a feasibility study for the construction of a greenhouse to compost food wastes, allowing for the recycling of heat, nutrients and carbon dioxide.[157] The food policy council has also been instrumental in helping draft important passages on food security in Toronto's 2003 Official Plan.

The food policy council has two full-time staff members who are employed by the Board of Health, as well as a modest budget. Members of the council include representatives of city council, conventional and organic farms, co-ops,

---

[154] "What Are We Eating? - Towards a Canadian Food Policy," in *(McGill Institute for the Study of Canada Annual Conference)* (Montreal: 2006).
[155] *Food Policy Councils: Program Profiles* (2003 [cited February 21 2006]); available from http://www.worldhungeryear.org/fslc/.
[156] Ibid.([cited).
[157] "La Région Se Mobilise Pour Mieux *Nourrir Montréal*," (Montréal: Conférence régionale des élus de Montréal, 2005). 6.

large food corporations, multicultural groups, anti-hunger advocacy groups, the faith community, and community development groups.[158]

Vancouver created a Food Policy Council as part of the City's Food Action Plan established in 2003 in response to concerns related to the city's food system, and in recognition of the opportunity for Vancouver to become a leader in the development of sustainable food policies and practices. Issues of interest to the Council include community gardens, farmers markets, community kitchens, emergency food distribution and the local food economy.[159] The primary goal of the Food Policy Council is to examine the operation of a local food system and provide ideas and policy recommendations for how it can be improved.[160] The Vancouver Food Policy Council (VFPC) is comprised of individuals from all sectors of the local food system, including food production, processing, access, distribution, consumption and waste management. The Council is built upon collaboration between citizens and government officials who work together on food policy initiatives.[161] In addition, the City of Vancouver has several organizations working to improve resident's food security. One such organization is City Farmer, a nonprofit working to promote environmentally responsible urban agriculture. City Farmer provides service and information to the community and the world about urban agriculture, waste reduction and sustainability. The organization also runs several community gardens and holds workshops for community members about various issues related to urban agriculture.[162]

Cities in the US

Hartford, Connecticut created the Hartford Advisory Commission on Food Policy. After conducting a study on childhood hunger that resulted in troubling findings, the mayor created a Hunger Task Force. This turned into a food policy

[158] *Food Policy Councils: Program Profiles* ([cited).
[159] VancouverAgreement, *Food Security: Accessing Healthy Food* ([cited April 23 2006]); available from http://www.vancouveragreement.ca/FoodSecurity.htm.
[160] VFPC, *Vancouver Food Policy Council* ([cited April 23 2006]); available from http://www.city.vancouver.bc.ca/commsvcs/socialplanning/initiatives/foodpolicy/council.htm.
[161] Ibid.([cited).
[162] CityFarmer, *Urban Agriculture Notes* ([cited April 24 2006]); available from http://www.cityfarmer.org/.

advisory committee. The purpose of the Hartford Commission is "to integrate all agencies of the city to improve the availability of safe and nutritious food at reasonable prices for all residents, particularly those in need." [163] The Commission has the strength simultaneously of an independent coalition and a city government entity, allowing it to advise government and work with non-profit organizations, businesses and city agencies to monitor, coordinate, and advocate for food system programs and functions. The Commission's lead organization is the Hartford Food System, a private non-profit, while members come from various fields and some represent the general public. Limited funding prevents the Commission from creating a full-time staff position and despite support from city officials, policy advancements are often difficult because of the lack of cooperation between government departments.[164]

Knoxville, Tennessee was the first U.S. city to create a municipal food policy council. The Council has the power to make and recommend proposals to the local government but not to enforce or control policies. Knoxville's Council consists of volunteer members appointed by the mayor, who are not intended to represent particular parts of the food system but rather to share their experience and commitment. This is a unique form of food policy council because usually council members are asked to be representatives of a certain group or population. One of the Council's accomplishments is the establishment of a relationship with the City Planning Commission that has allowed the Food Policy Council to encourage food issues to be addressed in planning reports and new developments. The Council is also working to raise awareness in the community by conducting workshops, hearings and forums to address issues and problems within the local food system. Media coverage has also increased the public awareness of food issues.[165]

[163] Biehler et al., "Getting Food on the Table: An Action Guide to Local Food Policy." 27.
[164] Ibid. 27-30.
[165] Ibid. 40-42.

Summary of food security policies

Many North American cities have introduced food policy councils to address issues of food security. Cities establish food policy councils for various reasons, some of which include ending hunger, promoting local food production, introducing a sustainable food system and improving food availability in urban areas. This is an interesting way to encourage municipal governments to address problems facing the community regarding food security because councils are generally connected to the community, yet can influence the government. Toronto is an exemplary city regarding food policy, in that it has some innovative projects to support local food production, including on rooftops.

Urban agriculture policy

Policy issues addressing urban agriculture are generally directly tied to food security, the urban environment and economic efficiency. For food security, policies relate to such issues as the access of poor citizens to land (or other spaces) and water. To improve the urban environment, policies focus on the decentralized recycling of organic wastes and waste water, integration of urban agriculture in urban zoning and city development plans, and improved producer-consumer links. For improved economic efficiency of commercial urban agriculture, attention is paid to the use of recycled waste and water, access to markets, participation of stakeholders in land use planning, and improved access to public and private land.[166]

Despite only slight economic benefits from urban agriculture, there are many benefits from growing food in cities (as explained in the literature review). In addition to the direct environmental benefits, there are also indirect benefits such as citizen environmental consciousness growing out of direct contact with the soil and with natural plant cycles and establishing a connection between people and their bioregion, something that is often lost in urban areas.[167] Finally, the social benefits of bringing community members together to grow food are so

[166] de Zeeuw, "The Integration of Agriculture in Urban Policies". 165.
[167] Fowler and Hartmann, "City Environmental Policy: Connecting the Dots." 166.

great that they cannot be met by typical social policy.[168] Rooftop gardening is a form of urban agriculture that could similarly be included in urban policies and programs.

Generally, individuals, community groups, or local NGOs have taken the lead in creating productive spaces for agriculture within cities.[169] But in order to support the expansion and institutionalization of urban agriculture movements, local and national policies must be changed. This requires some combination of local and national government agencies supporting the efforts of city farmers. There are several methods of creating policy change to support urban agriculture, as suggested by Martin Bourque; comparable methods could be used to support rooftop urban agriculture. Cities can enact legislation to implement the following:

- "financial support, in terms of budgetary line-items that a city or agency can approve to pay for necessary urban agriculture activities;
- financial incentives, such as tax breaks, fee waivers, zoning variances or permits and preferential contracts and credit programs for farmers;
- non-financial incentives, including public recognition and media opportunities, which can be good motivation for corporate sponsors;
- new programs, to create new activities and divisions in existing agencies to get more services for city farmers; and
- changes in zoning and other codes that can open new areas of the city to urban agriculture activities."[170]

Bourque highlights several areas of policy action that municipalities can undertake to encourage and facilitate urban agriculture. One example is to coordinate efforts between municipal solid waste managers and gardeners to make use of compost and other amendments produced by cities which are often thought of as garbage. Second is to create markets for locally-grown produce that are regulated by the municipal government. Finally, an area of policy action could be regular testing of all produce for lead and heavy metals to ensure a safe food supply.[171]

[168] Ibid. 165-167.
[169] Bourque, "Policy Options for Urban Agriculture". 119.
[170] Ibid. 129-131.
[171] Ibid. 137-139.

There are many policy instruments cities can use to support urban agriculture. For one, municipalities can integrate urban agriculture into urban land use policy. To do this, they would have to remove legal restrictions that impede urban agriculture as a legitimate urban activity.[172] Another measure is to integrate urban agriculture into urban development planning. Towards this goal, municipalities would need to, for example, revise zoning bylaws and integrate urban agriculture in zoning plans. In the same vein, cities could promote rooftop urban agriculture as an acceptable use of roof space.

To further highlight the link between urban agriculture and food security policy, Hank de Zeeuw emphasizes that urban food production needs to be integrated into food security and health policies. This can be done by improving the access of urban farmers to agricultural research, technical assistance and credit services. Urban agriculture also needs to be integrated into urban environmental policy. Cities can improve their environments by promoting the safe re-use of urban organic wastes and wastewater by urban farmers and they can promote ecological farming methods.[173]

It is impossible to ignore the social and community aspects of urban agriculture. Therefore, for successful policies, urban agriculture must be included in urban regeneration projects and Local Agenda 21 activities. Agenda 21 is a program of the United Nations (UN) related to sustainable development. It is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the UN, governments, and others in every area in which humans have an impact on the environment.[174] Urban food production can be linked with educational and community development activities; it can also facilitate direct marketing and local exchange systems to connect local producers and consumers.

Urban agriculture is directly linked to many urban issues. It is up to municipal officials to create an enabling policy environment for the development

[172] de Zeeuw, "The Integration of Agriculture in Urban Policies". 165.
[173] Ibid. 172-173.
[174] UN, *Agenda 21* (UN Department of Economic and Social Affairs, Division of Sustainable Development, 1992 [cited March 30 2006]); available from http://www.un.org/esa/sustdev/documents/agenda21/index.htm.

of urban agriculture. To do this, cities can establish inter-agency committees on agriculture that will allow various departments to share ideas and interests.[175] The benefits of urban agriculture cannot be seen as separate from issues such as food security, environmental responsibility, economic efficiency and community health.

Examples of urban agriculture policies from elsewhere

There are examples of cities around the world introducing policies and programs related to urban agriculture, although urban agriculture is often considered appropriate only for cities in 'developing' countries. Unfortunately, the potential for local food production in and around cities in industrialized countries is rarely considered. Scholars have shown that policy to support the development of wide-spread urban agriculture is even rarer.[176] Generally, North American cities make space for urban agriculture in the form of community gardens. Community gardens can play a vital role in local food security initiatives by providing an accessible common ground for vegetable growing and social cohesion. This form of urban agriculture is experiencing a revival in cities across Canada.[177]

Cities in Canada

Toronto has both community-run and municipally-run gardens throughout the city. There are over 1,000 community gardens, plus 20 municipal allotment gardens, with a total of approximately 4,500 plots.[178] Since 1986, FoodShare, a non-profit community organization, has implemented a Community Garden Network to help community groups and individuals start and sustain community

[175] de Zeeuw, "The Integration of Agriculture in Urban Policies". 174-175.
[176] Tjeerd Deelstra, Donald Boyd, and Maaike van den Biggelaar, "Multifunctional Land Use: An Opportunity for Promoting Urban Agriculture in Europe," *Urban Agriculture Magazine* 4 (2001).
[177] Fairholm, "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations." 15.
[178] FoodShare, *Community Gardening Program* ([cited March 30 2006]); available from www.foodshare.net.

gardens. The organization does not run the gardens, but rather seeks to educate groups and individuals on the aspects of community garden implementation.[179]

Québec City does not have a specific policy related to urban agriculture, but the city recently created a Round Table on Agriculture that hosted a conference on November 2, 2004 about the state of urban agriculture in Québec. No policies have been implemented, but the goal of the conference was to make recommendations. Some recommendations that came out of this conference for the city to consider include:[180]

- Expand incentive programs for the development and maintenance of agriculture;
- Develop programs to recuperate and put into use abandoned and unploughed lands;
- Adopt a municipal policy for the protection of a permanent agricultural zone; and
- Promote local products and local producers.

Another important proposal that came out of this conference is that the city should promote urban planning that integrates agriculture.[181]

Cities in the US

Providence, Rhode Island created an Urban Agriculture Policy Task Force in 2004 to "ensure broad-based, multi-agency support for the long-term viability of urban agriculture in Providence."[182] The task force was created along with a grant that the Southside Community Land Trust received from the US Department of Agriculture for a project called the Providence Urban Agriculture Initiative. The goal of this project is to increase urban agricultural production by fostering backyard and container gardens, youth gardens, community gardens, and market gardens, in addition to education, outreach, a garden supplies buying club, and a city-wide Urban Agriculture Policy Task Force.[183]

---

[179] Ibid.([cited).
[180] *L'agriculture, Une Force À Cultiver: Les Actes Du Colloque Sur L'internet* [Communiqué] (Ville de Québec, 2005 [cited February 21 2006]); available from http://www.ville.quebec.qc.ca/fr/information/communique/amenagement_territoire_habitation/2491.shtml.
[181] "La Région Se Mobilise Pour Mieux *Nourrir Montréal*." 6.
[182] Kate Hitmar, "The Return of Victory Gardens: Southside Community Land Trust Launches the Providence Urban Agriculture Initiative," (2004).
[183] USDA, "Veneman Awards $4.6 Million in Grants for Community Food Projects," (2004).

Community garden and mural. Philadelphia, PA. Photo: Rotem Ayalon. 2005.

Philadelphia, Pennsylvania is home to the Pennsylvania Horticultural Society (PHS) that has developed a Green City Strategy calling for significant improvements to the city's open spaces. It also addresses the city's problem with vacant land by promoting a citywide vacant land greening and management system. Believing that community gardens are a vital form of open space and important to a neighborhood's quality of life, PHS has provided technical assistance and project support to city gardening groups since its inception in 1974. In fact, community gardens are the foundation of the organization, which later expanded its projects to include the revitalization of parks, vacant land, and other public spaces.[184]

The US is home to the American Community Gardening Association (ACGA), which was founded in 1979 to help gardening programs share their limited resources and benefit from each other's experience and expertise. The ACGA is a nonprofit membership organization of professionals, volunteers and supporters of community greening in urban and rural communities. ACGA and its member organizations work to promote and support all aspects of community food and ornamental gardening, urban forestry, preservation and management of open space, and integrated planning and management of developing urban and rural lands.[185]

Cities in Europe

Urban agriculture is not promoted in Europe; Deelstra, Boyd and Biggelaar explain this phenomenon by describing the great separation between urban and rural Europe, with over 80% of the population living in cities. Post-war European

[184] PHS, *Pennsylvania Horticultural Society: Philadelphia Green* (2006 [cited March 30 2006]); available from http://www.pennsylvaniahorticulturalsociety.org/.
[185] ACGA, *American Community Garden Association* (2004 [cited March 30 2006]); available from http://www.communitygarden.org/index.php.

agricultural policy has concentrated on agriculture as a food generator, to avoid hunger and to ensure social stability. The economic rationale behind the policy was, according to policy-makers, that costs could be reduced and output maximized if agriculture was practiced by as few people as necessary. Urban agriculture did not meet these policy goals because it was considered too small-scale. Social and environmental benefits of urban agriculture were ignored.[186] Although successful in meeting its main economic aim, such policies have led to monoculture, in terms of both agriculture and ecology, as land use planning separated functions in order to maximize scale and efficiency. This one-dimensional focus of agriculture in Europe is being challenged by people who are realizing the enormous cost of the Agricultural Policy and by consumers who are concerned about food quality, the effects of pesticides and other chemicals used in food production on health and the wider environment, genetically modified crops and animal welfare issues.[187]

An example of this change in thinking about urban agriculture is the Federation of City Farms and Community Gardens (FCFG), in the UK. FCFCG is the representative body for city farms, community gardens and similar community-led organizations in the UK. There are 59 city farms, nearly 1,000 community gardens, 75 school farms and a number of community-managed allotments in the UK. FCFCG promotes and represents its members at a national, regional and local level, in addition to providing a wide range of services, advice and support for city farms and community gardens.[188]

Please refer to Appendix B for a summary of urban agriculture policies in the 'developing world'.

---

[186] Deelstra, Boyd, and Biggelaar, "Multifunctional Land Use: An Opportunity for Promoting Urban Agriculture in Europe."

[187] (Pederson and Robertson, 2001) quoted in: Ibid. Note: This research is based on issues in the Netherlands. It may not be true for all countries in Europe.

[188] FCFCG, *Federation of City Farms and Community Gardens* (2005 [cited March 30 2006]); available from http://www.farmgarden.org.uk/.

Summary of urban agriculture policies

There are not many examples of cities in industrialized countries incorporating an urban policy strategy for agriculture. Most North American cities have embraced community gardening, either municipally-run or community-organized, as the common form of urban agriculture. European cities have historically kept agricultural practices outside city limits, but are beginning to change with the influence of citizens wanting more connection to the source of their food.

Despite the small number of examples, common reasons for existing municipal support for urban agriculture include:

- Desire to increase incentives for the development and maintenance of urban agriculture;
- Preservation of the long-term viability of urban agriculture;
- Improving education and outreach;
- Improving the city's open space;
- Concerns for food quality;
- Environmental issues such as pesticide use on food crops.

Montréal's policy context

In order to make recommendations of policies, programs or projects for the City of Montréal that would encourage rooftop greening, it is essential to understand the city's specific context. Although much can be learned by studying initiatives from around the world, projects or policies that are successful in one city cannot easily be transported to another without local adaptations. Here, I examine Montréal's environmental, food security and urban agriculture policies to help identify strategies for the city to support rooftop greening.

The City of Montréal has shown interest in rooftop greening as an urban strategy. A municipal committee has been created to discuss the creation of a green roof policy.[189] Mentions of green roofs as a technology that can be useful to reduce the negative environmental impact of the built environment can be seen in the Montréal Master Plan.[190] In addition, the City has created a Strategic Plan for Sustainable Development that addresses rooftop greening as it relates to energy efficiency, GHG emission reduction, biodiversity and green space.[191]

Montréal environmental policy context

Currently in Montréal there are no municipal policies for rooftop greening, but the Plateau-Mont-Royal borough is considering requiring new municipal buildings to have green roofs.[192] Despite the lack of policies, there have been several initiatives to raise awareness and begin greening rooftops. The Québec Energy Efficiency Fund offers a $1/sq ft incentive for green roof installations with funding from the gas utility company, Gaz Métropolitain. This is the first subsidy of its kind in Canada. Motivations for rooftop greening in Montréal include energy efficiency, urban agriculture, stormwater runoff, the heat island effect and air quality.

---

[189] Lauzon.
[190] "Plan D'urbanisme," ed. Division de la planification urbaine Mise en valeur du territoire et du patrimoine (Montréal: Ville de Montreal, 2004).
[191] "Premier Plan Stratégique De Développement Durable De La Collectivité Montréalaise," ed. Service des infrastructures Direction de l'environnement, transport et environnement, de la Ville de Montréal (Montréal: Ville de Montréal, 2005).
[192] Marshall, "Green Roof Policies Worldwide." 6.

Montréal's Master Plan lists objectives related to green roofs. Objective 12 is to "*Promote quality architecture and consolidate the built environment in harmony with the surrounding character*." In this objective, the Master Plan states that "the notion of architectural quality must also extend to techniques for constructing, operating and maintaining innovative buildings that are healthier for their users and more respectful of the environment."[193] In response to this objective, Action 12.1 is to "*Promote quality architecture that is ecologically sound and respectful of Montréal's character*." This action highlights that, from a sustainable development perspective, "architectural quality also means innovative construction methods that favor environmentally friendly materials and the optimal use of resources." This action also states that the "Ville de Montréal intends to play a leading role in architectural quality."

Implementation measures under Action 12.1 in the Montréal Master Plan are as follows:[194]

- "Provide the City with mechanisms for ensuring architectural quality, particularly for municipal construction projects: urban design guidelines, an architectural competition policy, awards for excellence, etc.;
- Ensure that all municipal buildings and all development projects constructed in partnership with the City meet performance standards for environmental sensitivity and energy efficiency during their construction, operation and maintenance;
- Develop and implement incentives to encourage the integration of energy-efficient methods and environmentally-sensitive architectural innovations, such as green roofs, in new construction or renovation projects."

These measures show the City's interest in reducing the negative environmental impact of the built environment and recognizes that rooftop greening is one way to do that.

Section 2.7 in the Master Plan is entitled "A healthy environment," with three objectives. Objective 17 under this section is to "*Ensure the optimal management of resources in an urban context*," explaining that the City supports

[193] "Plan D'urbanisme."131.
[194] Ibid. 133.

measures to "reduce paved areas" and "decrease the impact of heat islands." In Action 17.1, "*Support healthier urban development*," the Ville de Montréal states that it "will encourage a reduction in the total area of paved surfaces and take action to counter the effects of heat islands, which are found in greater concentrations in industrial and commercial areas." As part of this action, the City recognizes that several measures may be considered, such as "tree planting and partially or completely 'greening' the roofs of commercial, industrial and public buildings." The Master Plan recognizes the many benefits that can be gained from adding vegetation to the city, such as a reduction in the amount of storm water runoff, absorption of pollutants and heat, and energy efficiency, not just the added beauty that will be gained.

Implementation measures under Action 17.1 include:[195]

- "Encourage rooftop greening for commercial, industrial, institutional and municipal buildings;
- Develop and implement incentives to implement energy efficiency standards and apply innovative techniques such as green roofs for new construction and existing buildings (see Action 12.1)."

This shows that the City of Montréal supports rooftop greening. The appropriate next step is to create a specific plan for how it will encourage rooftop greening and a deadline or plan for the development of incentives.

The Ville de Montréal has also undertaken the development of a Plan stratégique de développement durable (Strategic Plan for Sustainable Development). Some priorities of the Strategic Plan are to improve the air quality and reduce greenhouse gas emissions, with objectives of reducing emissions generated by industries, commercial institutions and other institutions in the Montréal territory; and to reduce atmospheric emissions generated by Montréal households. The report emphasizes that in the building sector, a large portion of the emissions are caused by heating and cooling.[196] Another priority of the Strategic Plan is to assure the quality of residential neighborhoods, with the

[195] Ibid.
[196] "Premier Plan Stratégique De Développement Durable De La Collectivité Montréalaise." 16.

objectives of increasing the chances for contact with nature and reducing sources of noise pollution.

Additional priorities and their related objectives outlined in the Strategic Plan for Sustainable Development that relate to rooftop greening include:[197]

- *To manage resources responsibly*.
  - Objectives include supporting measures of reducing energy consumption and improving the quality of used water;

- *To improve the protection of biodiversity, natural spaces and green spaces because the City has problems with stormwater runoff and atmospheric pollution*.
  - Objectives include increasing the area of green space in Montréal;

- *To adopt sustainable development practices in business enterprises, institutions and commercial buildings*.
  - Objectives include favoring the adoption of a system for environmental management in businesses, institutions and commercial buildings; favoring the practices and decision-making processes that correspond to the principles of sustainable development.

Specific actions listed in the Strategic Plan for Sustainable Development that relate to rooftop greening include:[198]

- Action 1.2: *Elaborate a city-wide strategy about GHGs*.
  Create a plan of action for reducing the GHGs generated by municipal activities starting in January 2006.

- Action 1.10: *Implement 'Quartiers 21' projects*.
  Implement at least three pilot projects to demonstrate sustainable development at the local level.

- Action 1.19: *Put in place measures to have more efficient energy use*.
  Implement at least four projects in municipal buildings for energy efficiency.

- Action 2.2: "*Find funding for a green fund*."
  Support sustainable development initiatives.

[197] Ibid. 21-24.
[198] Ibid. 38-91.

Additionally, the City has committed to the Partners for Climate Protection (PCP) program. PCP is a network of more than 126 Canadian municipal governments who have committed to reducing greenhouse gases and acting on climate change.[199] The program is a partnership between the Federation of Canadian Municipalities (FCM) and ICLEI - Local Governments for Sustainability. PCP is based on a five milestone framework used to guide municipalities to reduce greenhouse gas emissions.

The five milestones are:

- Creating a greenhouse gas emissions inventory and forecast;
- Setting an emissions reductions plan;
- Developing a local action plan;
- Implementing the local action plan or a set of activities; and
- Monitoring progress and reporting results.

While many municipal governments start by completing a greenhouse gas inventory, others have moved immediately to actions aimed at reducing greenhouse gas emissions. Montréal has yet to begin this process.

Other plans, programs and policies related to the quality of life in Montréal include: 'Le projet de Politique du patrimoine' (Heritage Policy), 'La stratégie municipale en matière d'habitation' (Municipal strategy on housing) and 'La stratégie d'inclusion du logement abordable' (Inclusion strategy for affordable housing).[200]

As described above, the combination of Montréal's Master Plan and the Strategic Plan for Sustainable Development show that Montréal is introducing environmental and social sustainability in its policies. This is encouraging, but more needs to be done, specifically in the area of rooftop greening.

[199] *Partners for Climate Protection* (Federation of Canadian Municipalities, [cited); available from http://kn.fcm.ca/ev.php.
[200] "Premier Plan Stratégique De Développement Durable De La Collectivité Montréalaise."18.

Montréal projects toward rooftop greening

The Montréal community has demonstration projects to show the benefits of rooftop greening (see literature review for more information). The City has given some support to these initiatives, but has not been the leader.

Montréal has also made an effort to increase the public and private sectors' awareness about rooftop greening. Recently, the Urban Ecology Center hosted a conference about green roofs and urban environmental policies.[201] The City of Montréal hosted a green roof symposium in November 2004, and followed up by creating a Green Roof Committee to investigate ways to promote green roofs. According to Daniel Lauzon, a landscape architect employed by the City's parks and green space department and head of the 'Comité Inter-Service' (Inter-departmental Committee), the City hopes to establish a position on green roofs during 2006.[202] The goal of the Committee is to confirm the City's objectives regarding extensive green roofs. For example, if urban heat islands are deemed a major problem, they will suggest identifying where in the city they are a problem and ways to reduce the heat islands. Mr. Lauzon highlighted that green roofs are only one method cities can use to reduce the heat island effect. Based on the work of the Committee, the City will issue a statement to guide the development of policies and a process of approval for green roof construction.[203] According to Mr. Lauzon, whatever the City implements, it will need the administrative capacity to support any new policies and/or programs. For this reason, the City is carefully examining and studying all issues before anything is adopted. Members of the Inter-departmental Committee include: the Buildings, Fire, Planning, Affordable housing (Habitation) and Parks departments, in addition to various Borough representatives, the Sustainable Development committee, and the City's plant nursery.

Awareness about green roofs is growing in Montréal. The Energy Efficiency Fund incentive encouraged the approval of three projects in the first

[201] "Turning Green: Roofs, Neighborhoods, Cities." March 10, 2006. www.ecologieurbain.net. [cited 30 March 2006.
[202] Lauzon. Personal communication.
[203] Lauzon emphasized that the Committee's mandate is focused on extensive green roofs only; he and the City see rooftop gardens in a separate category than green roofs because of their additional social benefits.

three years, with a total of four so far (Cirque du Soleil headquarters, a new addition at the École Polytechnique at Université de Montréal, and a retrofit at the Faculté d'aménagement at U de M, and the Québec headquarters of the RCMP in Saint-Henri). In addition, the Urban Ecology Center is helping to solve certain technical issues and bring different stakeholders together to educate them about green roofs.[204]

Montréal food security policy context

Food insecurity is a reality in Montréal. As explained by the Public Health department, more than 16.2% of the population lives in a situation of food insecurity, either not having the means to purchase healthy and nutritious food every day or residing in a neighborhood without public markets or supermarkets that offer a variety of quality foods at affordable prices.[205] In 2001, about 30% of the population was considered low income; among the people touched by poverty are: single-parent families, immigrants, women and single people.[206] In 2003, 45% of youth between the ages of 12 and 17 were not consuming the five minimal daily portions of fruits and vegetables recommended by the Canadian dietary guide and in 1999, about 1 in 4 youth between the ages of 6 and 16 was overweight.[207]

Montréal is beginning to formulate policies to address issues of food insecurity. Recently, in December 2005, under the guidance of the Conférence régionale des élus de Montréal (CRÉ), organizations concerned with questions of food security decided to unite their efforts by forming *Nourrir Montréal*, a council supporting quality nourishment for all.[208] The mission of this new council is to improve the food security on the island of Montréal by looking at issues related to health, social equity, the economy and the environment. The actions of *Nourrir Montréal* will unfold under three main goals: to respect people's right to nourishment, to develop a dietary culture and to improve the food system.

[204] Marshall, "Green Roof Policies Worldwide." 7.
[205] "La Région Se Mobilise Pour Mieux *Nourrir Montréal*."
[206] Ibid.
[207] Ibid. Whether this is from lack of access to healthy food or lack of knowledge about healthy eating habits is unclear.
[208] Ibid.

According to *Nourrir Montréal*, "in order to improve the food system, concerted actions need to take place in different sectors, including: agriculture, social development, transport, urban planning, environmental protection, health and economic development." Currently, Montréal is home to about 1,000 organizations that offer activities favoring the dietary support and autonomy of people and families. Some of these organizations include: collective kitchens, collective or community gardens, collective transportation to supermarkets and public markets, community meals and restaurants, meals-on-wheels, food banks, breakfast clubs, etc…[209]

The Montréal Public Health Department (Direction de la santé publique) considers that food security has been achieved when: "the whole population has access at all times and with all dignity, to a food supply that is sufficient and nutritious, at a reasonable and acceptable price from a social and cultural point of view; individuals have adequate purchasing power; and individuals have access to simple and reliable information that matches their skills and permits enlightened food choices."[210] Promoting rooftop gardening and urban agriculture in general can contribute to improving Montréal residents' food security.

Montréal urban agriculture policy context

Montréal has a long history of urban agriculture. As described earlier, the City has supported over 70 community gardens throughout the island. Community organizations, such as Action Communiterre, also manage a series of collective gardens. Organizations such as Équiterre and some borough Éco-quartiers help facilitate community-supported agriculture initiatives to link farmers near the city with urban residents; this encourages urban residents to purchase locally-grown foods while helping local farmers find local consumers. The municipal government has responded to citizens' requests for more

[209] Ibid. 5.
[210] Équiterre, "Système Alimentaire Et Sécurité Alimentaire: Comprendre Et Agir." 9.

gardening space by becoming involved in administering community gardens and also by offering technical support and a variety of services.[211]

Montreal's community gardens are administered by the Department of Culture, Sports, Leisure and Social Development (DCSLDS) in cooperation with other municipal departments and voluntary gardening organizations. The city provides the land, the equipment, and the materials necessary for the program to function efficiently, in addition to repairing equipment, providing water, collecting garden refuse, and offering the services of horticultural animators or counselors.[212]

Land for gardening is precious on the island of Montréal so the city makes every possible effort to protect gardens from commercial speculation by designating the territories occupied by community gardens as park zones. Despite the effort to protect gardens from development, some gardens are situated on city-owned land that is eventually destined for the construction of apartment buildings. Others occupy land owned by either the federal or provincial governments or by religious institutions.[213]

Since 1990, the City of Montréal has had three major goals guiding its policies regarding existing and future green spaces:

> 1. "To revamp existing parks, improving their accessibility and the equipment in them;
> 2. To increase the number of parks and green spaces by protecting them from commercial development, improving on their natural elements, and developing the potential of public spaces such as alleyways and school yards to become 'green' sites; and
> 3. To develop a 'green network' by recuperating unused spaces, such as abandoned railway tracks, in order to establish contiguity between city parks, the banks of water courses, and other green city areas."[214]

Action 11.3 of the Master Plan is to "*Preserve and improve Montréal's green network*." The City recognizes the importance of protecting private green spaces

[211] Daniel Reid, "Montréal's Community Gardening Program," (Montréal: Ville de Montréal, 2005). 3.
[212] Ibid.
[213] Ibid. 4.
[214] Ibid. 8.

for their exceptional contribution to the ensemble of Montréal's green network. The Plan reinforces the importance of parks and green spaces as special places enabling relaxation, leisure and contact with nature. It also underlines the major contributions of nature parks, metropolitan parks and large urban parks to the quality of Montréal's living environments. Implementation measures include ensuring the greening of living environments through:

- "An increase in the planting of trees on public and private land, particularly in areas lacking in this regard and those that are extensively paved;

- Regulatory measures favouring green spaces and the planting of trees as part of new real estate developments, in front yards, backyards, courtyards, rooftops, etc.;

- Support for green alley initiatives."[215]

One of the few mentions of agriculture in Montréal's Master Plan is Action 11.4. The City's goal is to "*Preserve and enhance the rural character and agricultural activities in certain areas of the West Island*."[216] This is a good step forward, showing that the City is thinking about keeping agriculturally-productive land available in close proximity.

The City also has a 'Policy on the protection and enhancement of natural habitats' that has three key objectives:

1. "Maximize biodiversity and increase aggregate hectarage of protected natural habitats in Montréal;

2. Ensure the sustainability of natural habitats in existing City parks, and promote the consolidation and viability of park ecosystems;

3. Foster enhanced integration of ecosystems and natural landscapes in built-up areas."[217]

[215] "Plan D'urbanisme."
[216] Ibid.
[217] "Policy on the Protection and Enhancement of Natural Habitats," (City of Montréal, 2004).

Summary of Montréal's policy context

Although no specific policies have been created regarding rooftop greening, the City addresses environmental issues in the Master Plan, the Strategic Plan for Sustainable Development and other policies. Actions and objectives related to rooftop greening are outlined in these policies but are lacking implementation measures with specifics on how new projects will be supported. Initiatives to address food security formally and strategically are advancing quickly, and Montréal's community garden program is one of the most extensive in North America, supported by city policies and programs. All of these factors contribute to setting the stage for Montréal to incorporate rooftop greening into the city fabric.

Conclusions – Policies

Cities throughout the world are recognizing that environmental and social issues are directly linked and by introducing policies and programs, municipalities can resolve some of these problems. Rooftop greening is one way to address urban environmental problems. North American cities such as Toronto, Chicago and Portland are advanced in their municipal environmental policies regarding rooftop greening. Social problems, such as food insecurity, can be resolved with a concerted municipal effort; several North American cities have introduced food policy councils to address food security, in addition to instituting policies supporting local food production. Policies supporting urban agriculture are strategies cities can take to facilitate local food production while also addressing environmental issues. Several North American cities have incorporated community gardens into a municipal strategy.

Montréal is on the path to developing policies supporting rooftop greening. These kinds of policies can enhance environmental quality, food security and access to urban agriculture. In terms of environmental policy, the City's main documents, such as the Master Plan and the Plan for Sustainable Development, show a desire to improve urban environmental conditions. Local community organizations and a food policy council that is being developed are indications

that food security issues are important and need to be addressed efficiently. The City has a long history of supporting urban agriculture in the form of community gardens; expanding the activities to rooftops could help address environmental problems and food insecurity simultaneously.

Potential for rooftop greening in Montréal

Based on the research I have conducted, I have identified **main issues** that still need to be addressed to expand rooftop greening throughout the city. These issues include: public awareness, cost, technical considerations, horticultural matters, municipal support and identifying buildings with appropriate roof space.

The City of Montréal could be successful in expanding rooftop greening if it works with various organizations. Support can come in terms of monetary assistance, technical expertise or even providing rooftop space for future projects. **Possible partners** the City of Montréal should collaborate with to push forward policies and programs include the following (and more):

- Community
  - organizations already involved in rooftop greening,
  - environmental organizations,
  - community centers,
  - community and collective gardening organizations,
  - local food banks and meals-on-wheels organizations,
  - Nourrir Montréal;
- Institutions
  - Local universities,
  - CEGEPs,
  - the Montréal school board,
  - hospitals,
  - senior-citizens homes,
  - Montréal Botanical Garden;
- Governmental
  - municipal boroughs,
  - research institutions, such as the National Research Council,
  - federal and provincial governmental departments (for example: environment, infrastructure, energy, education, housing, health).

As covered in previous sections of this report, not all buildings in Montréal are suitable to support rooftop greening structures because of building age, structural capacity and roof access. For these reasons, the City and other organizations need to strategically target appropriate buildings for future rooftop greening projects. Sample requirements of **buildings to target** include:

- concrete or steel structures,
- flat roofs,
- located in proximity of downtown residential neighborhoods,
- accessible roof or rooftop terrace,
- accessible on evenings or weekends.

5] Recommendations

> We can build the sustainable city by thinking of it as a process of a thousand tiny empowerments, each of which begins with apparently small interventions, but these interventions serve as catalysts which develop the momentum for a broader social transformation.[218]

Based on my research of rooftop greening in other cities and of barriers specific to Montréal, clearly municipal involvement is essential if there are to be widespread greening initiatives that have an impact on the urban environment, food security and the urban community. Wayne Roberts of the Toronto Food Policy Council has written that "planners exist because nobody just 'tends their own garden'; people need incentives and regulations to work for the public interest." [219] Additionally, the most common suggestion given by Montréal residents at a focus group study was to encourage municipal action promoting rooftop greening. Participants demonstrated that they would be more inclined to green their roofs if they knew the supporting city rules and regulations. Participants also said that if city employees had more resources and knowledge about the topic, the expansion of rooftop gardening throughout the city would be more successful.[220]

Sandra Marshall, in a green roof manual for municipal policy makers, outlines six phases on the path to green roof policy development. The phases are as follows:[221]

1. Introduction and awareness
2. Community engagement
3. Action plan development and implementation
4. Technical research
5. Program and policy development
6. Continuous improvement

---

[218] Leonie Sandercock, "The Sustainable City and the Role of the City-Building Professions," in *The Human Sustainable City: Challenges and Perspectives from the Habitat Agenda*, ed. Girard et al. (Aldershot: Ashgate, 2003). 384.
[219] Roberts, "The Way to a City's Heart Is through Its Stomach: Putting Food Security on the Urban Planning Menu."
[220] Bottone et al., "Perceptions Related to Rooftop Gardening in Montreal."
[221] Marshall, "Green Roofs: A Resource Manual for Municipal Policy Makers."

Montréal may be in too early of a stage to develop policies for rooftop greening, but the city is on the right track. Marshall has identified that Montréal's progress to date with policy development has reached phase 4 and the very initial stages of phase 5. This research supports Marshall's assessment; some technical research is being done by the Urban Ecology Center and a municipal committee has been organized to make recommendations to city council about possible policies regarding green roofs.

In this section, I give recommendations for how the City of Montréal can encourage more rooftop greening in the form of policies, programs and projects. I base my recommendations on successful initiatives by other cities, my assessment of what could work in Montréal and on suggestions by the people I interviewed.

I recommend both monetary and non-monetary initiatives to encourage rooftop greening, although I recognize that much can be done without major financial contributions by the City. Additionally, the municipal government would likely prefer non-monetary options. Montréal's government already has many financial commitments and is limited by its budget; therefore, non-monetary incentives would be best for Montréal's case. Also, based on my understanding of Montréal and Québec's policy context, it is not typically the practice to institute mandatory policies.[222] Other cities (e.g. Portland, Oregon and cities in Germany) have instituted stormwater charges to enforce reducing the amount of impermeable surfaces on a property. But if a mandatory policy is instituted, the municipality needs to invest in enforcement and following-up on the policy. This introduces many new costs to the City and would not be practical at this stage in Montréal.

The following are broad recommendations for the City of Montréal and other actors to overcome barriers to rooftop greening. Details about each recommendation follow below.

[222] Lauzon. and Fotopulos.

- Increase awareness
- Minimize financial barriers
- Minimize technical issues
- Minimize horticultural challenges
- Increase administrative support
- Decrease site-specific barriers

Measures that could be used to **increase awareness** entail *education*, *demonstration projects*, and *further research,* including *quantitative analyses*. In terms of education, the City, in conjunction with local organizations, can conduct a public education campaign about the benefits and various types of rooftop greening. By holding workshops and information sessions, city officials, administrators, architects, builders and building owners can be made aware of the benefits of rooftop greening, the differences between the various types, and sources of funding. Additionally, municipal advisors could be identified who could counsel individuals, architects, contractors or builders in their design, decision-making and approval processes. To increase the public's awareness, the City could hold a city-wide contest for the most beautiful or innovative rooftop greening project.

As a symbol of the municipality's support for rooftop greening, the City could provide funding or access to a roof for a visible rooftop greening project on a municipal building that is well publicized and accessible by the community.[223] A project - a demonstration community rooftop garden - could be implemented by the Community Gardens Program in downtown Montréal. Moreover, the City could implement a demonstration project to exhibit sustainable development at the local level through the 'Quartiers 21' projects.[224] Finally, in terms of research, the City could involve various actors such as the Montréal Botanical Gardens, universities and various municipal departments in studying and publicizing the benefits of rooftop greening.

[223] This could also be a sample of the City's goal to increase energy efficiency, outlined in the Strategic Plan for Sustainable Development.
[224] "Premier Plan Stratégique De Développement Durable De La Collectivité Montréalaise."

In terms of quantitative analyses, the City could commission a cost-benefit analysis (similar to the one done for the City of Toronto)[225] about potential economic savings to the City of Montréal provided by rooftop greening. The study could focus on impacts such as stormwater runoff reduction, decrease in urban heat island effect, energy savings and increasing green spaces. One goal of this study could be to quantify the contribution of urban food production to the urban environment, such as providing clean air and water as well as food security. For example, estimates show that one city tree saves $40,000 over a lifetime of conditioning air, trapping industrial dust, pumping out fresh oxygen, etc.[226] Additionally, the City could commission a social benefits study of rooftop greening to assess the benefits of increasing gardening and community spaces.

Measures that could be taken to **minimize financial barriers** to rooftop greening include various initiatives to *support greening on private buildings*, *support greening on institutional buildings*, *help the community sector* and *support tourism*. To reduce financial barriers for private buildings, developers and building owners need to be targeted. The City could provide developers with density bonuses in exchange for rooftop greening; this type of measure is not very costly and helps both the building owner and the city. The municipality could also consider reducing water rates for private buildings with green roofs or rooftop gardens. A green reserve fund could be created to support loans for developers to build rooftop gardens or green roofs. In order to establish this, requirements should be made for developers to include park or green space in all developments over a certain size; in lieu of meeting the requirements, developers could contribute to the green reserve fund. Additionally, the City could institute a pilot grant program for retrofitting existing roofs. This should be done in order to test building owners' interest, and the kind of incentives to which they respond best. Finally, the City could create a fund to refurbish municipal buildings by

[225] "Report on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto," (Toronto: Ryerson University, 2005).
[226] Roberts, "The Way to a City's Heart Is through Its Stomach: Putting Food Security on the Urban Planning Menu." 47-48.

replacing their roofs with green roofs or rooftop gardens when the time comes to repair the roof; this will allow municipal buildings to be examples for developers.

To encourage rooftop greening on new institutional buildings, the City could collaborate with local universities and CEGEPs in terms of providing space, sharing cost and participating in research with departments of urban planning, environmental studies or engineering. Funding for institutional building construction often comes from the provincial government, so encouraging rooftop greening may require a partnership between the provincial and municipal governments. In addition, the City could provide a tax rebate to institutional buildings that provide space for rooftop greening

Finally, financial barriers to rooftop greening can be minimized by supporting tourism and helping the community sector. The City could encourage the tourism potential of rooftop greening for a greener skyline and for destination spots (such as rooftop restaurants or cafés). In terms of the community sector, the City could increase community funding for rooftop greening, meaning that establishment and maintenance does not necessarily have to be done by the City directly, but should have political and some financial support from the City.

Methods the City could use to **minimize technical issues** to rooftop greening include *conducting research* on technical aspects, *using municipal influence*, and *providing technical advice*. The City could conduct or commission a study to identify appropriate buildings (institutional, municipal, commercial, etc.) to host rooftop gardens or green roofs. Focus should be placed on buildings in the downtown areas that are structurally able to support rooftop greening. Practical research, such as collecting information from green roof owners and installers about the costs of installation and maintenance, and benefits such as energy savings would be beneficial. Additionally, as done in Toronto, a list of rooftop greening projects in Montréal should be made available to the public.[227]

Using the its influence, the City could act as an intermediary and a supporter of rooftop greening initiatives to help community organizations gain

[227] "Making Green Roofs Happen," (Toronto: City of Toronto, 2005).

access to buildings. This could be done by identifying appropriate buildings, in addition to approaching and encouraging building owners to accommodate community rooftop greening initiatives. An influential player such as the City could encourage all new municipal, institutional, commercial and industrial buildings to green their roofs. Also, to have an impact on new developments, the City could add a line to the building permit application which reads: "Will the roof be greened?" If so, city consultants on rooftop greening should be contacted.

Finally, the City could minimize technical barriers to rooftop greening by creating the position of a city consultant to give advice to architects and developers who want to green roofs of buildings. The City could also identify and designate city staff in each relevant division as the "first port of call" for inquiries relating to green roof development as done by the City of Toronto.[228] Finally, it is important for the City to clarify building requirements for rooftop greening. This would require identifying and clarifying the restrictions of the fire department and the heritage requirements. These regulations should be easily accessible by the public.

The City could encourage rooftop greening by **minimizing horticultural challenges**. This could be done by encouraging and facilitating information exchange between various sources of knowledge. For one, the Community Gardens Program could be involved and train horticultural animators to teach community members about rooftop gardening techniques. The Botanical Garden and its horticultural experts could be involved by conducting horticultural research about rooftop greening. Finally, the City could host an interdisciplinary design charette to expand on ideas and knowledge about rooftop greening.

The City could take measures to **increase administrative support** for rooftop greening. Importantly, the City needs to clarify the approval policy; transparency of the appropriate procedure is essential to encourage rooftop greening. In order to integrate rooftop greening into the City landscape, a rooftop

[228] Ibid.

greening taskforce (including green roofs and rooftop gardening) could be created, consisting of municipal officials from various departments and community organizations. To determine the source of support for rooftop greening, the City should establish a connection with the provincial government. Multiple government departments benefit from environmental, habitat preservation and energy efficiency improvements given by rooftop greening. In addition, the City could incorporate rooftop greening into its Strategic Plan for Sustainable Development.

Finally, measures could be taken to **decrease site-specific barriers** for rooftop greening. The City could act as a liaison between community groups wanting to green roofs and the owners or managers of appropriate buildings. The City could also use its influence to encourage building owners or managers in targeted neighborhoods (e.g. downtown) to provide access to community rooftop greening projects. Finally, the City could provide community groups access to municipal buildings that could structurally support rooftop greening.

The institutional structure for making many of the above recommendations could take several forms. Experience elsewhere suggests that an effective option is to create a 'body' or committee to work together on city-wide rooftop greening. This 'body' could help provide community organizations with access to resources, launch feasibility studies, work with contractors to help small organizations, etc. The City could help organize this or it could be run by a community organization. For large-scale change, there should be a coordinating organization or body to create dialogue and connect interested people and organizations. Additionally, inter-agency committees could be established on agriculture and rooftop greening that will allow various departments to share ideas and interests. In addition, they can create stakeholder platforms for dialogue and consensus building at city and neighborhood levels.[229]

[229] de Zeeuw, "The Integration of Agriculture in Urban Policies". 174-175.

Summary

The above are recommendations I have made for the City of Montréal to encourage rooftop greening by implementing policies, programs or other initiatives. In response to the main barriers regarding rooftop greening, the broad recommendations proposed in this document include: increasing awareness and minimizing financial, technical, horticultural, administrative and site-specific barriers. Many of the recommendations are feasible because they are not dependent on large financial contributions from the municipal government. These recommendations fit in quite well with Montréal's current environmental, food security and urban agricultural policy context.

Montréal is on the right path to implementing city-wide rooftop greening for the benefit of all urban residents. This research is one seed that has been added to the garden of ideas and initiatives to convert unused, empty rooftops into alive and fertile spaces. Much more research and development is needed in order to find appropriate solutions for Montréal. An area of research that is warranted is to assess the social and community benefits, not just cost and environmental benefits, of rooftop greening. The social and community benefits could encourage municipal officials to implement rooftop greening on a wide scale. Advancements in this direction can be made by doing such things as gathering people's stories to support the policies. Technical proof and data are not enough to encourage municipal policy-makers that rooftop greening is necessary. Rather, personal statements and stories about the benefits of rooftop greening to the lives of urban residents would be invaluable. As Will Rogers, President of the Trust for Public Land explains, "Stories can accomplish what no other form of communication can – they can get through to our hearts with a message […] stories have the power to speak to us about what truly matters."[230]

The following is an example of such a story. It describes the benefits of rooftop greening as experienced by a Montréal resident.

> *An elderly woman who lives alone is in a wheelchair and has not left her home in over three years because she has no family to help*

[230] Helen Whybrow, ed., *The Story Handbook: Language and Storytelling for Land Conservationists, A Center for Land and People Book* (San Francisco: The Trust for Public Land, 2002). 1.

her get down the winding staircase. But, she enjoys looking out of her third story window over the city. On one building, she notices people gather several times a week to work in a garden. She used to be a gardener and loves to tell tales of her prize-winning flowers. Although she cannot participate in gardening activities anymore, once a week she has a meal delivered to her that contains vegetables from her neighborhood rooftop garden. The people from her meals-on-wheels service have also brought her a small planter garden that she can put on her own balcony to enjoy because she cannot leave her home. What a change in her life. She now has many things to look forward to and instead of seeing only black tar from her window, she sees green plants.[231]

[231] Based on a true story of a Santropol Roulant client.

References

ACGA. *American Community Garden Association*, 2004 [cited March 30 2006]. Available from **http://www.communitygarden.org/index.php**.

ActionCommuniterre. [cited March 20 2006]. Available from **http://www.actioncommuniterre.qc.ca**.

Altieri, Judith, Lila Fraser, and Indika Samarakoon. "Recycling Rooftops." Montreal: McGill University, 2002.

The American Heritage® Dictionary of the English Language. Fourth ed. New York: Houghton Mifflin Company, 2000.

Armstrong, Donna. "A Survey of Community Gardens in Upstate New York: Implications for Health Promotion and Community Development." *Health and Place* 6, no. 4 (2000): 319-27.

Ayalon, Rotem. "An Assessment of the Environmental Impacts of Rooftop Gardens." Montreal: Alternatives, 2005.

Beatley, Timothy. "Sustainable European Cities: A Survey of Local Practice and Some Lessons for the U.S." Cambridge, MA: Lincoln Institute of Land Policy, 1998.

Bhatt, Vikram, and Rune Kongshaug, eds. *Making the Edible Landscape: A Study of Urban Agriculture in Montreal*. Montreal: Minimum Cost Housing Group, 2005.

Biehler, Dawn, Andy Fisher, Kai Siedenburg, Mark Winne, and Jill Zachary. "Getting Food on the Table: An Action Guide to Local Food Policy." Venice: Community Food Security Coalition & California Sustainable Agriculture Working Group, 1999.

Bottone, Joseph, Elizabeth Heller, Anne-Marie Huard, Sophie L.-Van Neste, and Jocelyn Wilson. "Perceptions Related to Rooftop Gardening in Montreal." Montreal: McGill University School of Environment, 2005.

Bourke, Julia. Personal interview, February 9 2006.

Bourque, Martin. "Policy Options for Urban Agriculture." Paper presented at the Growing Cities Growing Food: Urban Agriculture on the Policy Agenda, Havana, Cuba, October 1999.

Burros, Marian. "Food-Borne Illness from Produce on the Rise." *New York Times*, November 23 2003.

Carlsson-Kanyama, Annika. "Climate Change and Dietary Choices — How Can Emissions of Greenhouse Gases from Food Consumption Be Reduced?" *Food Policy* 23, no. 3/4 (1998): 277-93.

CityFarmer. *Urban Agriculture Notes* [cited April 24 2006]. Available from **http://www.cityfarmer.org/**.

CMHC. "Greenbacks from Green Roofs: Forging a New Industry in Canada." In *Research Highlight Technical Series 01-101*. Ottawa: Canada Mortgage and Housing Corporation.

de Zeeuw, Hank, Sabine Guendel and Hermann Waibel. "The Integration of Agriculture in Urban Policies." Paper presented at the Growing Cities, Growing Food - Urban Agriculture on the Policy Agenda, Havana, Cuba, October 1999.

Deelstra, Tjeerd, Donald Boyd, and Maaike van den Biggelaar. "Multifunctional Land Use: An Opportunity for Promoting Urban Agriculture in Europe." *Urban Agriculture Magazine* 4 (2001).

Earth Pledge: Green Roofs Initiative, 2006 [cited March 30 2006]. Available from **http://www.earthpledge.org/GreenRoof.html**.

EPA. *Heat Island Effect* U.S. Environmental Protection Agency, 2004 [cited 2006 March 22]. Available from **http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ActionsLocalHeatIslandEffect.html**.

Equiterre. *2006 Season of Community Supported Agriculture*, 2006 [cited March 20 2006]. Available from **http://www.equiterre.org/agriculture/paniersBios/listeFermes.php**.

Équiterre. "Système Alimentaire Et Sécurité Alimentaire: Comprendre Et Agir." Montréal: Direction de la Santé publique de Montréal, 2005.

Fairholm, Jacinda. "Urban Agriculture and Food Security Initiatives in Canada: A Survey of Canadian Non-Governmental Organizations." In *Cities Feeding People*: LifeCycles, 1998.

FCFCG. *Federation of City Farms and Community Gardens*, 2005 [cited March 30 2006]. Available from **http://www.farmgarden.org.uk/**.

Field Measurements of Thermal Parameters of Rooftop Gardens in a Multi-Storey Carpark and a Commercial Building Singapore National Parks Board, Date not published [cited June 2005].

Flavelle, Dana. "Monsanto Wins Landmark Case; Supreme Court Rules against Farmer." *Toronto Star*, May 22 2004.

Food Policy Councils: Program Profiles, 2003 [cited February 21 2006]. Available from **http://www.worldhungeryear.org/fslc/**.

FoodShare. *Community Gardening Program* [cited March 30 2006]. Available from **www.foodshare.net**.

Fotopulos, Helen. Personal communication, January 31 2006.

Fowler, Edmund P., and Franz Hartmann. "City Environmental Policy: Connecting the Dots." In *Urban Policy Issues: Canadian Perspectives*, edited by Edmund P. Fowler and David Siegel, 155-71. Toronto: Oxford University Press, 2002.

Fowler, Edmund P., and David Siegel. *Urban Policy Issues: Canadian Perspectives*. 2nd ed. Toronto: Oxford University Press, 2002.

"Green Roofs a La Montrealaise: A Demonstration Project." Urban Ecology Center, 2004.

Green Roofs Initiative Earth Pledge Foundation, 2005 [cited December 12 2005]. Available from **http://www.earthpledge.org/GreenRoof.html**.

Halweil, Brian. *Eat Here: Reclaiming Homegrown Pleasures in a Global Supermarket*. 1st ed. New York: W.W. Norton, 2004.

Hautecoeur, Ismael. Personal interview, February 21 2006.

Heller, Martin, and Gregory Keoleian. "Life Cycle-Based Sustainability Indicators for Assessment of the Us Food System." Center for Sustainable Systems, 2000.

Henning, John. "Cities Feeding People: An Overview." Paper presented at the Cities Feeding People: A Growth Industry, IDRC Development Forum, Ottawa, May 21 1997.

Hill, Alex. Personal interview, February 22 2006.
———. *International Rooftop Garden Projects* Rooftop Garden Project, 2005 [cited December 12 2005]. Available from **http://english.rooftopgardens.ca/files/intl_description.pdf**.
Hitmar, Kate. "The Return of Victory Gardens: Southside Community Land Trust Launches the Providence Urban Agriculture Initiative." 2004.
Howard, Ebenezer, and Frederic James Osborn. *Garden Cities of to-Morrow*. London: Swan Sonnenschein, 1902.
Jepermaculture. *Research on Local, Healthy and Affordable Foods*, 2005 [cited March 20 2006]. Available from **http://jepermaculture.forumactif.com/index.htm**.
L'agriculture, Une Force À Cultiver: Les Actes Du Colloque Sur L'internet [Communiqué]. Ville de Québec, 2005 [cited February 21 2006]. Available from **http://www.ville.quebec.qc.ca/fr/information/communique/amenagement_territoire_habitation/2491.shtml**.
"La Région Se Mobilise Pour Mieux *Nourrir Montréal*." Montréal: Conférence régionale des élus de Montréal, 2005.
Landreville, Maude. "Toitures Vertes À La Montréalaise: Rapport De Recherche Sur L'implantation Des Toits Verts À Montréal." Montréal: Centre d'écologie urbaine, 2005.
Lappé, Frances Moore, and Anna Lappé. *Hope's Edge: The Next Diet for a Small Planet*. New York: Jeremy P. Tarcher/Putnam, 2002.
Lauzon, Daniel. Informal interview, February 2 2006.
Liu, K. "Research Quantifies Benefits of Rooftop Gardens." *Construction Innovation* 7, no. 1 (2002).
Liu, K. "Engineering Performance of Rooftop Gardens through Field Evaluations." Paper presented at the RCI 18th International Convention and Trade Show, Tampa, Florida, March 13-18 2003.
———. "Sustainable Building Envelope – Garden Roof System Performance." Paper presented at the RCI Building Envelope Symposium, New Orleans, Louisiana, November 4-5 2004.
Liu, K.K.Y. "Energy Efficiency and Environmental Benefits of Rooftop Gardens." *Construction Canada* 44, no. 2 (2002): 20-23.
Liu, Karen, and Bas Baskaran. "Green Roof Infrastructure – Technology Demonstration, Monitoring and Market Expansion Project." In *Part 1: Field Monitoring and Technical Analysis*: National Research Council, Institute for Research in Construction, May 2002 – June 2003.
"Making Green Roofs Happen." Toronto: City of Toronto, 2005.
Marshall, Sandra. "Green Roof Policies Worldwide." Canada Mortgage and Housing Corporation, 2006.
———. "Green Roofs: A Resource Manual for Municipal Policy Makers." Canada Mortgage and Housing Corporation, 2006.
Mazmanian, Daniel A., and Michael E. Kraft. *Toward Sustainable Communities: Transition and Transformations in Environmental Policy, American and Comparative Environmental Policy*. Cambridge, Mass.; London: MIT Press, 1999.

Mitlin, Diana. "Chronic Poverty in Urban Areas." *Environment & Urbanization* 17, no. 2 (2005): 3-10.
Murray, Danielle. "Oil and Food: A Rising Security Challenge." Earth Policy Institute, 2005.
Nerenberg, Jacob. Personal interview, January 19 2006.
Ngan, Goya. "Green Roof Policies: Tools for Encouraging Sustainable Design." 2004.
Nowak, Michelle. "Urban Agriculture on the Rooftop." Cornell University, 2004.
Palomo Del Barrio, Elena. "Analysis of the Green Roofs Cooling Potential in Buildings." *Energy and Buildings* 27 (1998): 179-93.
Partners for Climate Protection Federation of Canadian Municipalities. Available from **http://kn.fcm.ca/ev.php**.
Peck, Steven. Telephone communication, February 17 2006.
Pednéault, André. Informal interview, October 6 2005.
PHS. *Pennsylvania Horticultural Society: Philadelphia Green*, 2006 [cited March 30 2006]. Available from **http://www.pennsylvaniahorticulturalsociety.org/**.
"Plan D'urbanisme." edited by Division de la planification urbaine Mise en valeur du territoire et du patrimoine. Montréal: Ville de Montreal, 2004.
"Policy on the Protection and Enhancement of Natural Habitats." City of Montréal, 2004.
Porsche, Ulrich and Manfred Köhler. "Life Cycle Costs of Green Roofs: A Comparison of Germany, USA, and Brazil." Paper presented at the Rio 3 – World Climate and Energy Event, Rio de Janeiro, Brazil, 1-5 December 2003.
Pothukuchi, K., and Jerome L. Kaufman. "The Food System: A Stranger to the Planning Field." *Journal of the American Planning Association* 66, no. 2 (2000).
"Premier Plan Stratégique De Développement Durable De La Collectivité Montréalaise." edited by Service des infrastructures Direction de l'environnement, transport et environnement, de la Ville de Montréal. Montréal: Ville de Montréal, 2005.
Rabinowicz, Jane. Personal interview, February 13 2006.
———. "Urban Food Security and the Potential for Urban Agriculture." (2002): 24.
Reid, Daniel. Personal interview, October 15 2005.
———. "Montréal's Community Gardening Program." Montréal: Ville de Montréal, 2005.
"Report on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto." Toronto: Ryerson University, 2005.
Roberts, Wayne. "The Way to a City's Heart Is through Its Stomach: Putting Food Security on the Urban Planning Menu." Toronto: Toronto Food Policy Council, 2001.
Roseland, Mark. *Toward Sustainable Communities: Resources for Citizens and Their Governments*. Revised ed. Gabriola Island, BC: New Society Publishers, 2005.
Sandercock, Leonie. "The Sustainable City and the Role of the City-Building Professions." In *The Human Sustainable City: Challenges and Perspectives from the Habitat Agenda*, edited by Girard et al. Aldershot: Ashgate, 2003.
SAT. *Society for Arts and Technology* [cited March 28 2006]. Available from **http://www.sat.qc.ca/**.
"Special Issue for the World Summit on Sustainable Development." In *Urban Agriculture Magazine*. Johannesburg: Resource Center for Urban Agriculture (RUAF), 2002.
Stiegman, Martha. Informal interview, February 2 2006.

Tomalty, Ray, Anna Hercz, and Peter Spurr. "Research Report: Municipal Planning for Affordable Housing." CMHC, 2002.
Toronto. "Clean, Green and Healthy: A Plan for an Environmentally Sustainable Toronto." City of Toronto, Environmental Task Force, 2000.
"Toronto Leads North America with New Green Roof Policy." Toronto: Green Roofs for Healthy Cities, 2006.
UN. *Agenda 21* UN Department of Economic and Social Affairs, Division of Sustainable Development, 1992 [cited March 30 2006]. Available from **http://www.un.org/esa/sustdev/documents/agenda21/index.htm**.
USDA. "Veneman Awards $4.6 Million in Grants for Community Food Projects." 2004.
VancouverAgreement. *Food Security: Accessing Healthy Food* [cited April 23 2006]. Available from **http://www.vancouveragreement.ca/FoodSecurity.htm**.
VFPC. *Vancouver Food Policy Council* [cited April 23 2006]. Available from **http://www.city.vancouver.bc.ca/commsvcs/socialplanning/initiatives/foodpolicy/council.htm**.
Vujovic, Vuk, and Douglas J. Ogurek. *Shouting from the Rooftops! Chicago's Green Champions Share Techniques for Growing More Green Roofs on More Buildings* **www.greenroofs.com**, 2005 [cited February 2006].
Waterloo. "Green Roof Feasibility Study and City Wide Implementation Plan." City of Waterloo, 2004.
"What Are We Eating? - Towards a Canadian Food Policy." In *(McGill Institute for the Study of Canada Annual Conference)*. Montreal, 2006.
Whelan, Robert K., and Pierre Joncas. "Montreal Demergers: An Update." *Inroads* Winter, no. 16 (2005).
Whybrow, Helen, ed. *The Story Handbook: Language and Storytelling for Land Conservationists, A Center for Land and People Book*. San Francisco: The Trust for Public Land, 2002.

Appendix

Table 2: List of Interviews

Contact	Organization	Title	Phone	Email	Date of interview
Andre Pedneault	Montreal Community Gardens	Horticultural Animator	514.868.4183		6-Oct-05
Daniel Reid	Montreal Community Gardens	Horticultural Animator		danielreid@cam.org	15-Oct-05
Stephanie Dunn	Eco-Initiatives	Former Director		stefanie.dunn@mail.mcgill.ca	22-Nov-05
Ray Tomalty	McGill University	Consultant and professor		tomalty@corps.ca	17-Jan-06
Jacob Nerenberg	Urban Ecology Center	Green Roofs project coordinator		jacobnerenberg@yahoo.ca	19-Jan-06
Helen Fotopulos	City of Montreal	Mairess, Plateau-Mont-Royal		hfotopulos@ville.montreal.qc.ca	31-Jan-06
Martha Stiegman	Action Communiterre	Board member		msteig@openface.ca	2-Feb-06
Daniel Lauzon	City of Montreal	Landscape architect	514.872.1467		2-Feb-06
Julia Bourke	Fiset Miller Bourke, McGill U.	Green architect and professor		julia.bourke@mcgill.ca	9-Feb-06
Jane Rabinowicz	Santropol Roulant	Director		jane@santropolroulant.org	13-Feb-06
Steven Peck	Green Roofs for Healthy Cities	President	416.971.4494	speck@greenroofs.org	17-Feb-06
Ismael Hautecoeur	Rooftop Garden Project	Project Manager		ismael@alternatives.ca	21-Feb-06
Alex Hill	Rooftop Garden Project	Project Manager		alex@alternatives.ca	22-Feb-06

Table 3: Barriers to rooftop greening, as given by interviewees

Barriers	Respondent's Organization	Reasons for Barrier
Financial	City of Montreal	Retrofitting of old buildings is expensive
	City of Montreal	Lack of government funding for environmental initiatives
		Energy costs in winter (heating) are greater than in summer (A/C).
		Green roofs are only one way to address Montreal environmental problems.
	Mtl. Community Gardens	Difficult to determine which City department would fund rooftop greening
	Green Roofs Project	The City does not calculate stormwater runoff.
	Green Architect	Difficult to assign a monetary value on quality of life benefits from green roofs
	Rooftop Garden Project	Funds for gardening are hard to find - it is not the top priority of municipalities.
	Rooftop Garden Project	Difficult to know the exact cost of rooftop garden per square meter.
Education / Awareness	City of Montreal	Lack of education leads to resistance to new initiatives
		Lack of awareness has caused resistance by the fire department.
	Action Communiterre	Lack of awareness by city officials slows down new projects
	City of Montreal	More technical research needs to be done before more progress is made.
	Santropol Roulant	New technique and style of community organizing is difficult.
	Rooftop Garden Project	People don't understand the purpose of rooftop gardening.
		Because it is a new concept, there are many organizational challenges.
	Rooftop Garden Project	People don't understand the purpose of rooftop gardening.
Technical	Mtl. Community Gardens	Weight of a garden is an issue for the roof structure.
		A garden would need a rooftop water source.
		Access to roof is difficult, especially to make community gardens
	Action Communiterre	Old buildings need structural reinforcement.
	Rooftop Garden Project	Access to roofs, building a terrasse on a roof is difficult.
	City of Montreal	Wooden buildings need structural reinforcement (technical and cost barrier).
	Green Roofs Project	Access to the roof of residential buildings is difficult.
	Rooftop Garden Project	About 30% of the City's buildings are obsolete, too old to support rooftop gardens.
		Weight of a garden, materials, access to water, aesthetics, etc.

Table 3, continued: Barriers to rooftop greening, as given by interviewees

Barriers	Respondent's Organization	Reasons for Barrier
Horticultural	Montreal Community Gardens	Extra exposure to the elements (wind, sun, heat) on roofs.
		Different gardening techniques on a roof than at grade.
	Action Communiterre	Organic hydroponics (light weight, soil-less gardening) is difficult.
	Rooftop Garden Project	Productivity and technique of lightweight soil-less rooftop gardening is difficult.
	City of Montreal	Weeding, irrigation (gardens require more maintenance than green roofs).
	City of Montreal	A community garden requires a manager - who would that be?
	Rooftop Garden Project	People's lifestyles don't often fit with requirements of maintaining a garden.
Administrative	Green Roofs Project	No policies or regulations makes it difficult to implement green roofs.
		Safety and heritage protection regulations are prohibitory
	Action Communiterre	Bureaucratic regulations, such as safety and heritage, act as 'red tape'
	Green Architect	Disconnect between Provincial and Municipal government environmental responsibility
	Green Roofs for Healthy Cities	Different city departments need to collaborate in order to enact green roof policies
Location	Mtl. Community Gardens	Rooftop gardening only makes sense in areas lacking land space.
	Santropol Roulant	Difficult to find access to buildings with feasible roof space for gardening.
	Rooftop Garden Project	Difficult to gain access to buildings.

Appendix A: Urban environmental policies from Asia.

Cities in Asia

Tokyo suffers from severe urban heat island effect because of its expansive impervious surfaces and urban machinery; the average annual temperature in Tokyo has increased by 3ºC in the last century, a rise four times higher than what might be explained by global warming.[232] A program in Tokyo's Shibuya ward requires green roof installation on 20% of all new flat roof surfaces of government buildings and 10% of all new flat roofs on private buildings. The success of the program has created a demand for green roofs in addition to encouraging more supporting legislation.[233]

Singapore encourages rooftop greening by allowing portions of the building used for greenery (such as sky terraces, balconies, public pavilions, and covered communal areas) to be excluded from gross floor area calculations. This means that builders can build larger buildings if they add these features. Widespread outreach has been done by the city in the form of research and education to better inform the public and builders of the benefits of skyrise greenery. Relaxing development requirements and educational promotion programs are key features of Singapore's success and could be examples for Canadian municipalities.[234]

[232] (Tracey, 2004). Japanese Meteorological Agency. Cited in: Goya Ngan, "Green Roof Policies: Tools for Encouraging Sustainable Design," (2004).
[233] (Sichello, 2004). Cited in: Ibid. 5.
[234] Marshall, "Green Roof Policies Worldwide." 59-60.

Appendix B: Urban agriculture policies - Examples from cities in the 'developing world'

In 'developing countries,' urban agriculture is considered a necessity by many people. It is practiced to supplement household food supplies, unlike in developed countries where it is often practiced as a leisure activity.[235] Municipalities in North America can learn a lot from cities in the 'developing world.'

Havana, Cuba is an example of how supportive government policies can be effective in encouraging urban agriculture. Government programs are successful because they change in response to the needs of producers and consumers. Some things the government has done to facilitate urban agriculture include giving urban farmers access to unused land and issuing land grants for vacant spaces that favor food production.[236] In the city's land use policy, urban agriculture is specifically mentioned and zoned as an 'agricultural corridor' around the urbanized area.[237] The city has opened farmer's markets and legalized the sale of produce directly from producers to consumers, which has led to an increase in production incentive for urban dwellers. In addition, the government encourages gardeners by providing a strong support system of extension agents and horticultural groups that give assistance and advice to urban food producers. These actions and commitment by the Cuban government have contributed to making food production a secure activity.[238]

The municipal government of Harare, Zimbabwe, along with the Ministry of Local Government, began a process of stakeholder consultation and policy development to stimulate urban agriculture in 2000.[239] This is a complicated task that requires a multi-stakeholder approach. In Harare, urban planners have taken a leading role to coordinate the process of policy development and the city

[235] "Special Issue for the World Summit on Sustainable Development." 14.
[236] Bhatt and Kongshaug, eds., *Making the Edible Landscape: A Study of Urban Agriculture in Montreal.* 16.
[237] "Special Issue for the World Summit on Sustainable Development."
[238] Bhatt and Kongshaug, eds., *Making the Edible Landscape: A Study of Urban Agriculture in Montreal.* 17.
[239] "Special Issue for the World Summit on Sustainable Development." 14.

has acknowledged the importance of urban food production, allowing residents to grow food on fallow areas of the city.[240]

Urban agriculture in Dar es Salaam, Tanzania has received support and attention at various policy levels and is now accepted as a land use in the city. The city's commitment can be seen in The Strategic Urban Development Plan, which has designated special land-use zones for agriculture.[241]

[240] Ibid.
[241] Ibid. 17.