Urban Agriculture: The Potential for South-East False Creek

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

Master of Science (Planning)

in

THE FACULTY OF GRADUATE STUDIES

(School of Community & Regional Planning)

We accept this thesis as conforming to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

April 1998

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Abstract

Despite evidence that our present food and agriculture system is both unjust and unsustainable, decision-makers and agricultural policy units continue to push for greater production through increased applications of chemical fertilisers, pesticides and, more recently, the use of genetically modified organisms. This approach ignores ecological constraints as well as the risks to individual and community health.

Agriculture, once a thriving urban activity, is now considered inappropriate in the city. This decline, brought about by technological changes and shifting perceptions of open-space, has been exacerbated by planners who have introduced restrictive regulations and policies that discourage sustainable urban food production.

The potential of growing food in cities to address many urban problems is largely overlooked and ignored by planners in the West. In developing countries, urban agriculture plays a significant role in supplementing household incomes and nutrition, as well as dealing with urban waste management. I argue that despite a very different context in Canada, there is potential for urban agriculture to deal with urban wastes, bolster local economies, create jobs and increase local food security. This approach would be in tune with current theories of ecological economics, bioregionalism, and the
healthy and sustainable communities movement which call for increased local self-reliance as a strategy for social and environmental change.

The proposed model sustainable community at South-East False Creek offers the opportunity to explore some radical approaches to food production in a dense, urban community. This would entail moving beyond community and backyard gardening to intensive production techniques and recycling solid and liquid wastes at a community level. I show that it would be possible to produce the fruit and vegetable needs of the expected five thousand residents on the 43 acre site. This is demonstrated by calculating the space available to grow a variety of foods, the potential yields of different growing methods and the dietary needs of the inhabitants.

Making sustainable urban agriculture a reality on this site, however, depends on overcoming many problems and requires revised attitudes as well as innovative planning and design. It will need encouragement from planners and local government in the form of innovative land-use allocation, economic incentives and the modification of restrictive by-laws and regulations. Most important, perhaps, is an on-going educational process whereby the modern perception of urban agriculture as inappropriate can be overcome.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>ii</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>iv</td>
</tr>
<tr>
<td>List of Tables and Figures</td>
<td>vii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>viii</td>
</tr>
<tr>
<td><strong>CHAPTER 1: INTRODUCTION</strong></td>
<td></td>
</tr>
<tr>
<td>Problem statement</td>
<td>1</td>
</tr>
<tr>
<td>Definition of Urban Agriculture</td>
<td>5</td>
</tr>
<tr>
<td>Purpose of the Thesis</td>
<td>5</td>
</tr>
<tr>
<td>Structure of the Thesis and Methods Used</td>
<td>6</td>
</tr>
<tr>
<td>Thesis Contribution.</td>
<td>8</td>
</tr>
<tr>
<td>Proviso</td>
<td>8</td>
</tr>
<tr>
<td><strong>CHAPTER 2: UNSUSTAINABLE AGRICULTURE AND UNSUSTAINABLE CITIES</strong></td>
<td>12</td>
</tr>
<tr>
<td>The Meaning of Sustainability and Sustainable Development</td>
<td>13</td>
</tr>
<tr>
<td>Our Unsustainable Food System - Problems and Solutions</td>
<td>20</td>
</tr>
<tr>
<td>Ecological problems</td>
<td>21</td>
</tr>
<tr>
<td>Economic Problems</td>
<td>34</td>
</tr>
<tr>
<td>Social Problems</td>
<td>41</td>
</tr>
<tr>
<td>Unsustainable cities</td>
<td>49</td>
</tr>
<tr>
<td>Summary</td>
<td>52</td>
</tr>
<tr>
<td><strong>CHAPTER 3: THE DECLINE AND RISE OF URBAN AGRICULTURE.</strong></td>
<td>56</td>
</tr>
<tr>
<td>Urban Agriculture in Antiquity</td>
<td>56</td>
</tr>
<tr>
<td>From Domination to Compassion - City vs. Country</td>
<td>60</td>
</tr>
<tr>
<td>New Visions of Self-Reliance</td>
<td>65</td>
</tr>
</tbody>
</table>
List of Tables and Figures

TABLE 1 - PER CAPITA ECOLOGICAL FOOTPRINT OF CANADIAN’S FOOD CONSUMPTION 27
TABLE 2 - SUMMARY OF SPACES AVAILABLE TO GROW FOOD 132
TABLE 3 - AVAILABILITY OF MAJOR NUTRIENTS IN HUMAN EXCRETA 134
TABLE 4 - PER CAPITA ANNUAL CONSUMPTION OF COMMON FOODS 135
TABLE 5 - YIELDS OF FISH SPECIES IN INTENSIVE AND NON-INTENSIVE CULTURE 144
TABLE 6 - A CONTINUUM OF APPROACHES TO URBAN AGRICULTURE 162

FIGURE 1 - THE THREE SPHERES OF SUSTAINABILITY 18
FIGURE 2 - THE BENEFITS OF URBAN AGRICULTURE 54
FIGURE 3 - HOWARD’S PROVISION FOR FOOD PRODUCTION 62
FIGURE 4 - FOOD FROM WASTE: OPTIONS FOR RECYCLING AND REUSING THE MUNICIPAL WASTE STREAM 94
FIGURE 5 - GREENHOUSE-BASED SOLAR AQUATIC TREATMENT SYSTEM - ERRINGTON, VANCOUVER ISLAND, BC 99
FIGURE 6 - GREY-WATER RECYCLING SYSTEM AT C.K CHOI BUILDING, UNIVERSITY OF BRITISH COLUMBIA 102
FIGURE 7 - LOCATION OF THE SITE AT SOUTH-EAST FALSE CREEK 120
FIGURE 8 - CREEKSIDELANDING CONCEPT PLAN 126
FIGURE 9 - GROWING AREAS REQUIRED TO PRODUCE VARIOUS FOODS FOR COMMUNITY CONSUMPTION 137
FIGURE 10 - COMPARISON OF GROWING AREA REQUIREMENTS FOR DIFFERENT GROWING METHODS. 142
Acknowledgements

A great deal of thanks is due to many people for the help and encouragement they have given me during the writing of this thesis. Thanks to my research committee members - Bill Rees and Moura Quayle who asked the right questions at the right time. My fellow students especially Mark Holland and Nick Heap, who engaged in fascinating conversation which kept me motivated. Thanks also to Herb Barbolet, Michael Levenston for pointing me in the right direction for source material and to Yoshikoko Wada who was very generous with BC statistics and discussion of his thesis. Thanks to my mum and dad for teaching me how to grow plants and care for the soil and to my wife Cailin and daughter Eanna for making it all worthwhile.
Chapter 1: Introduction

Problem statement

There is a large body of evidence pointing to the unsustainability of our current food system. Despite the massive gains in productivity made by modern farming techniques, millions of people still go hungry or undernourished. Few can deny that something is very wrong with the way the food system operates and yet there is divergent disagreement on the solution to this problem as populations explode and agricultural productivity races to keep pace. Many of the so-called technological optimists believe that human ingenuity will devise technology and approaches that negate the ecological constraints of an increasing population and a finite (indeed shrinking) agricultural land base. They say that we need not worry about scaling back resource consumption because we will always find substitutes for those that we run out of. Julian Simon (1981), for example, believes that the constraints on food production will be overcome by human ingenuity and technological innovation. Nevertheless, many of the world’s leaders acknowledge a genuine problem in the ability of the world’s agricultural system to properly feed a growing population, stating at the World Food Summit:

[w]e consider it intolerable that more than 800 million people throughout the world, and particularly in developing countries, do not have enough food to meet their basic nutritional needs. This situation is unacceptable. Food supplies have increased substantially, but constraints on access to food and continuing inadequacy of household and national incomes to purchase food, instability of supply and demand, as well as natural and man-made disasters, prevent basic food needs from being fulfilled. The problems of hunger and food insecurity have global dimensions and are likely to persist, and even increase dramatically in some regions, unless
urgent, determined and concerted action are taken, given the anticipated increase in the world's population and the stress on natural resources.”
(World Food Summit, 1996)

Despite widespread agreement over the problem at the World Food Summit, there was no consensus over how to fight this calamity of hunger and food shortages. According to Mark Ritchie (1997), president of the Institute for Agriculture and Trade:

Most governments still think of hunger as a production shortfall problem, and therefore their final recommendations are mostly old-fashioned ideas about how to boost production (using more biotechnology, pesticides, artificial fertilisers irrigation, etc.), greater freedom for the transnational food corporations, and faster de-regulation (liberalisation) of food trade. In contrast, the NGO's stated in many different venues and situations that these exact same elements - chemical and energy-intensive industrialised farming, the lack of regulation of transnationals, and de-regulated or liberalized trade - are the causes of many of the current problems. The NGO's called for the reform of domestic and international policies to reduce the industrialization of farming, to regulate inappropriate behaviour of transnationals, and to base food trade on the principles of food security, not neo-liberal trade theory.

The standard response is to increase levels of production from a declining land base using higher levels of technology and chemical inputs despite acknowledgment that it is food access and inadequate incomes that cause hunger and starvation. Mainstream optimism for this approach is not, of course, founded on nothing. It is partially based on the apparent success of the Green Revolution which according to Nobel Laureate Norman E. Borlaug (1997), saved countries like India from starvation. Shiva (1997) pointed out the myths in this analysis:

The first myth is that India was not able to feed herself till the Green Revolution was launched. The second myth is that American scientists like Borlaug were dedicated only to preventing starvation and not to
promoting the use of chemicals. The third myth is that the increase in wheat and rice production through mono-cultures is an increase in overall food production and nutritional availability. The fourth myth is that the Green Revolution is an efficient way to provide food in a country with a large population and low resource availability. The fifth myth is that India’s grain reserves are exclusively the result of the Green Revolution, and will continue to exist in preparation for possible future disasters.

Not only is the Green Revolution partly myth but is has been achieved at a huge entropic cost. The gains in food production (i.e. increased crop and animal yields) have been due to increased levels of fertiliser applications; increased irrigation; intensive, inhumane animal production systems; putting ecologically sensitive and marginal land under the plough; and vastly increased levels of energy-use and mechanization. The impacts of this “synthetic farming” have been enormous. We have seen environmental degradation of devastating magnitude, diet related health problems escalate, allergies and autoimmune diseases increase, farm jobs all but evaporate, and rural-urban migration become characteristic of most of the twentieth century. Monocultural practices have driven the extinction of wildlife and increased the prevalence of pests and diseases. This in turn has led to the increased use of pesticides which destroy more habitat thereby creating positive feedback loops which threaten the integrity of the biosphere.

The focus of modern industrial agriculture and agricultural policy-making, rather than to ensure adequate nutrition and ecologically-safe farming methods, has been to maximize production and profit (McCrae et al. 1990). In both these principle aims agribusiness has been enormously successful, but these are very limited aims and successes. Federal and
provincial food and nutrition policy has been inadequate to protect citizens from the problems of the food system in the face of an advertising onslaught managed by a powerful oligopoly of food companies. We are deliberately fed subtle, misleading messages that unconsciously promote unhealthy and environmentally damaging eating habits.

An alternative path would be to make a transition to a more sustainable agriculture and a greater sharing of already adequate food supplies. Making the transition to a sustainable agriculture involves many steps including: less resource intensive and less polluting farming practices; increased biodiversity; reduced use of pesticides and; more integrated, diverse production systems (McCrae et al. 1990; Kneen, 1989; Altieri 1989). Many agree that increased self-reliance on all scales is desirable and their seems to be potential in re-centering a certain amount of food production within urban areas.

Urban agriculture has been shown to be very effective in combating hunger and poverty in the developing world (Smit et al., 1996). However, it is less clear what the potential contribution of urban agriculture could be to sustainability in the industrialized, Northern hemisphere generally and in Vancouver specifically. With the City of Vancouver pressing ahead with the planning of a model sustainable community at South-East False Creek the time seems ripe to investigate this potential and determine how we might plan for urban agriculture on the site.
**Definition of Urban Agriculture**

Urban agriculture is the term used to describe the production of agricultural products, including food, medicinal herbs, ornamental plants and fuel-wood, in the urban and peri-urban environment. It may include a diverse array of different production techniques, approaches and products and may be a for-profit enterprise, an important contribution to a family’s food needs, or simply an enjoyable pastime. This report concentrates on food because of its primary importance to health, well-being and the environment.

**Purpose of the Thesis**

The proposed development of a model sustainable community around South-East False Creek in Vancouver provides the opportunity to examine the potential of urban agriculture with specific reference to an example of large scale urban development that many hope will a model of sustainability for the whole region and the rest of Canada.

The primary objective of this thesis will therefore be to answer the questions - what contribution can urban agriculture make to food security and community sustainability? How can these benefits be demonstrated in Vancouver through planning for South East False Creek?

Related to this question are a number of sub-questions:

- How is the current approach to agriculture and the entire food system unsustainable?
• Could localizing food production generally (and growing food in dense city environments specifically) make our food system more sustainable?

• If it could, how can municipal planning departments best encourage and plan for urban agriculture?

• What should urban agriculture look like for the proposed model sustainable community of SE False Creek? i.e. what types of urban agriculture should be encouraged and where should these be located?

• How can we create the necessary conditions for urban agriculture to flourish on the site and to make a real contribution to sustainable development?

• What policies, programs, regulations and design elements should be incorporated into the planning process?

Structure of the Thesis and Methods Used

Chapter two begins with an analysis of the current problems with our food supplies and why the current food and agricultural system is unsustainable. The relationship between the broader problem of unsustainable cities and the food system is examined. This is done with reference to a selection of literature pertaining to the food system, environmental trends and urban problems. The potential contribution and probable benefits of urban agriculture are presented and discussed. The next chapter (three) explores the reasons for the decline of urban agriculture and how this decline is related to the rise of city planning and changing urban attitudes. The remainder of the chapter
outlines the theoretical motivation for self-reliance, community control and the localisation of agriculture. Chapter 4 examines some of the problems and constraints with achieving the benefits promised by urban agriculture and, by examining successful policies and programs elsewhere, I suggest how we might go forward with food production at South-East False Creek. Chapter 5 describes the case study of South-East False Creek. The motivation and history of the project are outlined from an examination of city planning documents and the City-authorized development consultant’s study is described. The potential and limitations of the consultants preferred development scenario are explored. The chapter concludes with a calculation of how much food could theoretically be grown on the site by looking at the potential yields of vegetables and fish using different production methods. Chapter 6 deals with specific strategies that planners should use to pursue urban agriculture at South-East False Creek and makes recommendations for the planning process. Chapter 7 concludes the thesis with recommendations for policy and further study.

I have used a number of sources. These have included books and articles on urban agriculture, food security, health issues, and planning theory. Government statistics on farm production and crop yields have been gleaned from both paper and internet documents as well as secondary sources. Information related specifically to South-East False Creek and Vancouver was gained through a student internship with the City of Vancouver Planning Department (Central Area Division).
Thesis Contribution.

There has been a recent explosion of literature on the subject of urban agriculture. Most of this, however, has focused on the contribution of urban agriculture to alleviate poverty and hunger in the urban areas of developing nations.¹ The literature dealing with industrialized nations is often very general and rarely focuses on the specifics of how urban agriculture relates to the practice of planning.² This thesis, as well as detailing the potential benefits of urban agriculture goes a step further than most of the literature. It attempts to quantify these benefits for a real proposed community and also provides a framework for how a planning department should go about planning food production for this site. Urban agriculture may seem an odd topic for a planning thesis because agriculture, as a land use in the city, has all but disappeared. However, I show that there are many ways that urban agriculture can be integrated into existing and potential planning programs and help provide solutions to some of the most pressing urban planning problems.

Proviso

Many current planning problems have been accurately described by Rittel and Webber (as problems of "organized complexity" or "Wicked" problems (as cited in Mason and

¹ See for example Smit et al. 1997; IDRC, 1993
² For exceptions see Sommers and Smit, 1994

Urban Agriculture: The Potential for South-East False Creek 8
Mitroff, 1981). Following on from this work, Mason and Mitroff say that wicked problems have these characteristics:

1. Interconnectedness - Strong connections link each problem to other problems. As a result, these connections sometimes circle back to form feedback loops. “Solutions” aimed at the problem seem inevitably to have important opportunity costs and side effects. How they work out depends on events beyond the scope of any one problem.

2. Complicatedness - Wicked problems have numerous important elements with relationships among them, including important feedback loops through which a change tends to multiply itself or perhaps even cancel itself out. Generally, there are many leverage points where analysis and intervention might focus, as well as an many possible approaches and plausible programs of action. There is also a likelihood that different programs should be combined to deal with a given problem.

3. Uncertainty - Wicked problems exist in a dynamic and largely uncertain environment, which creates a need to accept risk, perhaps incalculable risk. Contingency planning and also the flexibility to respond to unimagined and perhaps unimaginable contingencies are both necessary.

4. Ambiguity - The problem can be seen in quite different ways, depending on the viewers personal characteristics, loyalties, past experiences, and even on accidental circumstances of involvement. There is no single" correct view" of the problem.

5. Conflict - Because of competing claims, there is often a need to trade off “goods” against "bads" within the same value system. Conflicts of interest among the persons or organizations with different or even antagonistic value systems are to be expected.
How things will work out may depend on interaction among powerful interests that are unlikely to enter into fully co-operative arrangements.

6. Societal Constraints - Social, organizational, and political constraints and capabilities, as well as technical ones, are central both to the feasibility and the desirability of solutions (Mason & Mitroff, 1981).

These characteristics mean that:

1. Any policy-making situation is comprised of many problems and issues

2. These problems and issues tend to be highly inter-related. Consequently, the solution to one problem requires a solution to all the other problems. At the same time, each solution creates additional dimensions to be incorporated in the solution to other problems.

The challenge of sustainable communities and the contribution that urban agriculture might make to achieving them is highly complex and, we could say, a “wicked” problem. All of Mitroff and Mason’s criteria for “wicked” problems are satisfied by the problems of where, how and why to implement urban agriculture at South-East False Creek. No obvious solution or answer to these problems will turn up from a single person engaging in research for a thesis.

What can I expect, therefore, when embarking on such an enterprise? Firstly, the thesis should satisfy the most basic criterion that it be a contribution to knowledge i.e. it should
bring something new to the debate about planning and sustainability generally, and urban agriculture specifically. This, I believe, it does by showing the general potential of urban agriculture through focusing on a specific community which is currently undergoing the planning process.

A second criterion might be that it should aid decision-making by furthering the understanding of the issues: The actual decision about whether urban agriculture will be implemented on any significant scale at South-East False Creek, and what it will look like, will be made by a number of different actors including City Council, individual residents, the planning department and firms who want to operate urban agriculture as a business venture. They will be constrained by, and may receive recommendations from, planning staff who in turn will seek input from professional consultants, and stakeholder groups including members of the general public. Whether this input is meaningful and fair will largely determine whether or not urban agriculture and a host of other innovative ideas are implemented or whether a slightly modified business-as-usual approach is taken. Either way, I hope this document will make a contribution to an understanding of the issues involved and potential benefits of urban agriculture. I have long been an advocate of urban agriculture and practiced food growing in my own backyard and allotments. However, I have attempted to maintain a critical stance and keep an open mind about whether urban agriculture could be a realistic alternative to our current highly mechanized and as Brewster Kneen puts it “distanced” agriculture.
Chapter 2: Unsustainable agriculture and unsustainable cities

This chapter examines why our current food and agricultural system is unsustainable and shows how the adoption of urban agriculture might address some of the myriad problems.

The evidence that the human population is exceeding the limits of the natural world is overwhelming and well documented. The Worldwatch Institute's annual *State of the World* report clearly demonstrates that we are increasingly eroding the natural capital base that provides the vital resources that sustain us and maintains the life-support systems that allow life to flourish. Nowhere is this crisis more obvious than in the field of agriculture and the ability of the planet to feed its people. On a global scale there is mass hunger and malnutrition. Farmers are finding it increasingly difficult to keep production apace with an ever expanding human population. Global fish catches have plateaued, wheat reserves have fallen to all time lows, aquifers are being overdrawn for irrigation. Greenhouse gas emissions continue to soar with unknown consequences for the future of food production (Brown et al. 1990; 1997).

There are other more local problems facing cities today which are also relevant to urban agriculture.
• Traffic congestion and air pollution.
• Vandalism of public places and littering of derelict lots or industrial land.
• Urban blight, industrial decay
• Poverty and unemployment
• Neglected public spaces
• Lack of community - few geographically-based social activities to rally around and places to meet people in a co-operative environment.

All of these indicators point to the unsustainability of our current direction. They are issues that planners have to face on a daily basis and to which they are no easy or obvious solutions. At this point it is necessary to look a little deeper into the meaning of sustainability so that we may better understand the contribution that urban agriculture may make in planning cities for a more sustainable future.

The Meaning of Sustainability and Sustainable Development

The thesis examines the role that urban agriculture might play in achieving sustainable communities. It seems appropriate, therefore, to examine the meaning of the term “sustainable” in order to arrive at a working definition that can be used in this study.
Sustainability, in ecological terms, means living within the limits of the natural world. Essentially this means that we cannot undermine the resource base (both living and non-living) on which we currently rely and will rely in the future. Whereas environmentalists and conservationists are almost unanimous in their agreement that we have reached and exceeded the limits of the natural world, governments blunder on with growth-oriented development showing that there is certainly no consensus as to extent of the problem or what should be done about it.

The terms sustainability and sustainable development have been adopted and co-opted by a spectrum of groups with very different interests who manipulate the meaning for their own ends. The initial impetus driving the sustainability agenda prior to the Bruntland Report was the extent of current and anticipated human suffering resulting from the degradation of the natural environment. The Club of Rome's *Limits to Growth* *(Meadows et al. 1972)* sounded a warning bell to politicians that our current economic path would eventually lead to disaster. If future trends in population growth and economic growth continue unabated into the next century, the report predicted economic collapse sometime in the next one hundred years as resources become exhausted.

The *Bruntland Report* *(WCED, 1987)* specifically introduced the concept of "sustainable development". The report suggested, both implicitly and explicitly, that it was only
through sustainable economic development (i.e. continued economic growth), especially in the developing countries of the peasant periphery, that ecological sustainability could be achieved. The report envisioned a five to ten fold increase in world industrial output in order to achieve sustainability. However, the authors pointed out that this development needed to be of a different quality to that which had preceded it. The future, it said, has to be an era of material and energy efficiency. The term “sustainable development” introduced a host of confusion into the sustainability debate. To conservative economists it meant sustained economic growth but to radical environmentalists it suggested development that had to be ecologically sustainable.

These opposing views can be explained by the very different world-views (paradigms) of their proponents. As Duncan Taylor (1992) says we are still “disagreeing on the basics.” The confusion over the term sustainable development, says Taylor, lies in the conflict between two competing and very different world-views - the expansionist world-view and the ecological world-view. The expansionist world-view maintains that sustainability can only be achieved by continued growth of the economy that will eventually trickle-down to the poor so that they can competently and efficiently manage their own resources and provide for human need. Nature is a resource that exists to satisfy the needs of humanity and it can be effectively managed using science, technology and market pricing. This is essentially the view expressed by the Bruntland Report. The ecological world-view, on the other hand, sees nature as inherently valuable and worthy of conservation for its own sake. Continued economic growth is
seen as impossible in a world of finite resources and within the limits of photosynthetic production without a corresponding degradation of the resource base.

These two conflicting world-views give rise to two different understandings of sustainability (and how to achieve it) which David Orr (1992) refers to as technological sustainability and ecological sustainability.

In the most general terms, the difference is whether a society can become sustainable within the modern paradigm through better technologies and more accurate prices, or whether sustainability requires the transition to a post-modern world that transcends...individualism, anthropocentrism, patriarchy, mechanization, economism, consumerism, nationalism and militarism ... Technological sustainability is about stabilizing planetary vital signs. Ecological sustainability is the task of finding alternatives to the practices that got us in trouble in the first place.

This question of “reform or transformation” is taken up by Bill Rees. Rees (1995) points out the danger in the technological approach to sustainability showing, along with Daly and Cobb (1989) and others, that the question of sustainability is not amenable to monetary analysis alone and can only be approached through measures of physical stocks and flows. The danger inherent in a purely monetary analysis lies in the fact that the price of renewable resources does not accurately reflect scarcity in any real way. Rees and his colleagues have therefore begun to use an area-based indicator of sustainability which they have named the “Ecological Footprint” (Rees and Wackernagel, 1996).

iii For a fuller distinction between the ecological and expansionist world-views see Rees, William. 1995.

Urban Agriculture: The Potential for South-East False Creek 16
This discussion highlights the immense threat to conventional economic wisdom raised during debate about the transition to ecological sustainability. The challenge facing a society that wants to make this transition is enormous. We live in a culture that still worships the creed of mechanistic, reductionist science despite the discoveries of quantum physics, relativity, thermodynamics, and complex systems theory. Planning in the twentieth century is therefore founded on the tenets of an outmoded science relying as it does on the prediction and control of complex, systems (both social and natural) which are inherently unpredictable, complex and chaotic (Holling C.S 1969; 1985; Heap, N. 1997; Kay & Schneider, 1995). Most politicians, economists and planners have yet to embrace these discoveries of twentieth century science in any meaningful way.

Sensible precautions about the use of resources and the generation of waste flounder at every turn in the face of arguments from the corporate apologists that this strategy will lead to lost jobs and prosperity. At the time of this writing, the delegates to the Kyoto conference on Global Warming seem reluctant to make even modest gestures to reducing greenhouse gas emissions, amid the din of a powerful corporate lobby that says any reduction in energy use will threaten the viability of the economy. We cannot afford sustainability, it is said, until the economy grows to a sufficient size that allows us that luxury. Within the current political climate therefore, the need is for solutions that provide both economic stability and ecological conservation and restoration.
But there is another side to the sustainability debate. In an age where virtually every important planning task has been professionalized and bureaucratized we have created a citizenry that has little meaningful input into the policy and decision-making process. The social problems of today very often mask the ecological imperatives that face us. High crime rates, poverty, malnutrition, inadequate health-care, community fragmentation. These are just some of the issues that dominate the political debate while the environment takes a back seat. The need then is to develop solutions that address these very real problems of social instability while at the same time addressing the ecological imperatives and economic necessities already mentioned.

Sustainability then, is a term that embraces three distinct but interdependent spheres of activity - social, ecological and economic. Action is required on all three fronts. So let us examine these components of sustainability and the necessary requirements that need to be fulfilled for all three?

Figure 1 - The three spheres of sustainability
Ecological sustainability requires that we:

1. Maintain and improve the integrity, productivity and fertility of ecological life-support systems indefinitely.

2. Maintain constant stocks of natural capital (including the soil) and live off the interest of these stocks.

   This means drastically reducing our throughput of material and energy to avoid global ecological catastrophes such as climate change and crashing fish populations.

3. Maintain the genetic and biological diversity of species

4. Reduce the amount of waste produced so that it can safely be assimilated by the remaining stocks of natural capital

Economic Sustainability requires that we:

1. Create meaningful employment for all the labour force and provide an adequate standard of living for all citizens

2. Balance the fiscal books in the long term

Social Sustainability requires that we:

1. Have democratic participatory governance systems that all citizens feel a part of

2. That we learn from traditional and local ecological knowledge
3. That the benefits and costs of moving towards sustainability are shared and understood by everyone and that a process of social learning takes place.

4. That our social institutions are robust but adaptive to changing circumstances.

5. That the trend of increasing income disparity is reversed.

The task of planning therefore becomes developing solutions that can address all three areas of sustainability simultaneously. Otherwise gains in one area may be undermined by losses in another. It is now time to look at how the food system currently operates and why it is unsustainable both as a related component of the overall economy and in its own right.

**Our Unsustainable Food System - Problems and Solutions**

The focus of modern industrial agriculture and agricultural policy-making has been to maximize production and profit. This has been achieved through a combination of farm and business concentration, mechanisation, irrigation, control of pests and disease through the ubiquitous application of chemicals, the addition of fossil-fuel based fertilisers and more recently using biotechnology. In both these principle aims agribusiness has been enormously successful. However, this seeming success has been to
the detriment of farm sector employment and ecological integrity - in other words to sustainability and food security.

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (World Food Summit, 1996a).

Human and animal health in industrialized nations have in some ways also suffered despite the fact that we have more to eat than at any point in history. Let’s look at these problems, which for clarity will be grouped under the three headings of ecological, economic and social problems, although in reality many are interdependent.

**Ecological problems**

**Increasing Population and Increasing Hunger - The Problem of Food Security.**

According to Lester Brown of the Worldwatch Institute, 1981 was a turning point for agriculture (Brown et al., 1990). In that year, for the first time since agriculture began, the amount of land planted to crops on the planet actually fell, meaning that the amount of land reclaimed was exceeded by the amount of land degraded or converted to non-agricultural use. Grain output per person fell nearly seven percent between 1984 and 1989 and fell another seven percent between 1990 and 1996. The world’s farmers are finding it increasingly difficult to keep up with a growing global population. Not only is
productivity falling but prices are also rising. After reaching an all time low of $117 per ton, wheat prices rose 48% to an estimated $173 per ton in 1989. It seems that environmental degradation is finally showing up in declining productivity and increased costs (Brown et al., 1990, 1997). The promise of limitless production keeping pace with an ever expanding human population and increased affluence is no longer tenable. This is partly because in the race to produce ever greater yields we are destroying the productive capacity of the soil.

Brown points to similar worrying trends in the global fishery. Having risen from 19 million tons in 1950 to 88 million tons in 1988 the total amount of fish caught has now plateaued but the number of human mouths to feed continues to increase. Perhaps more worrying still is the amount of current production that is based on the unsustainable use of land and water. Much of the world’s grain is produced on land that simply cannot support the intensity of agriculture to which it is subjected. Eventually this leads to massive soil erosion and declining productivity. Intense irrigation is also overdrawling aquifers which will eventually dry up. Not only is there severe and on-going soil erosion and soil degradation but also contamination of water bodies with agricultural run-off, salinization of soils due to over irrigation, and the more recent, but poorly understood impact of climate change on the world agricultural system.

However, the emphasis on increased production through more intensive use of fossil fuel and fertilisers is still the mainstream focus of agricultural policy-making aimed at
alleviating hunger and malnutrition. The Rome declaration on food security states that “[t]he 5.8 billion people in the world today have, on average, 15 percent more food per person than the global population of 4 billion people had 20 years ago.” Despite this fact, 800 million people are still inadequately nourished. Our leaders do not seem to be getting the message that focusing on more production is not working. Mark Ritchie, observed at the World Food Summit that most governments still think of hunger as a production shortfall problem, and therefore their final recommendations are mostly old-fashioned ideas about how to boost production.” (Ritchie, 1997).

The “success” of this approach has meant that for a few decades we have managed to increase food production exponentially as populations have exploded. Despite this, the distribution of that extra food has been far from equally distributed with only those who can afford to pay generally seeing the benefits of increased production. Population growth and increased yields go hand in hand in a dangerous dance on the edge of hunger, starvation and ecological catastrophe. Until recently the gains in production outpaced population growth. But it is clear that this trend is reversing. This is due to over fishing, the addition of 90 million more mouths to feed every year, the demand for higher protein diets accompanying increased wealth, and declining gains in agricultural production (Brown, 1995; Brown et al. 1997). The latter is the result of the urbanization of agricultural land, limitation of water for irrigation, the inability of crops to use any more fertiliser, and the diminished fertility of the soil.
In the United States, 91 percent of the estimated 27.1 million metric tonnes of cereal, legume and vegetable protein suitable for human use is fed to livestock to produce the 5.3 million metric tons of animal protein that is consumed annually. Thus, for every 5kg of vegetable and fish protein fed to livestock in addition to the large forage intake, we obtain 1 kg of animal protein (Pimentel et al., 1975). David Pimentel (1997) has pointed out that "[i]f all the grain currently fed to livestock in the United States were consumed directly by people, the number of people who could be fed would be nearly 800 million ..." Eating a diet that is predominantly vegetarian is a major saving of resources.

The above scenario presents a difficult conundrum for agriculturists and planners. If the gains in production do not keep up with population growth then massive hunger on an unimaginable scale will result. However, if we follow the route we have taken up to now of increasing fossil fuel use and fertiliser application, increased production will itself lead to greater degradation of soil productivity and other impacts on environmental and human health. These problems will themselves threaten the long term viability of our food system.

This raises the question of whether the huge population explosion means that we are tied to an unsustainable agriculture whether we like it or not - simply to keep food production at a level high enough to feed the growing number of hungry mouths? However, proponents of organic farming suggest that this system of agriculture can produce yields
comparable with conventional methods without the use of harmful agro-toxins and with much less energy (Altieri, 1989, p. 181).

There is also the immense waste produced by cities that is currently contaminating water bodies. This waste has the potential to increase soil fertility but it is generated so far from the point of food production that applying it to the soil is problematic. The potential solution that this thesis examines is to vastly expand the production of food within cities where food consumption, and therefore waste generation, take place. Exactly how this might be achieved is explored in subsequent chapters. For now I want to concentrate on just how unsustainable our current patterns of food production and consumption are.

**THE ECOLOGICAL FOOTPRINT OF FOOD CONSUMPTION**

One criteria for measuring “sustainability” is the integrity of natural capital (for our purposes the soil). Another is the amount of pollution and waste generated. Because sustainability depends on a number of different factors it is very hard to measure sustainability except by monitoring many different indicators but how do we calculate the overall impact of these factors and work out if we are moving in the right direction or not? One answer is to calculate the “Ecological Footprint” of our present consumption. The “Ecological Footprint” concept was developed by Bill Rees and Mathis Wackernagel at UBC’s School of Community and Regional Planning. It is an attempt to measure the
overall ecological impact of human consumption and is therefore an ideal tool with which to gauge sustainability. Correctly identifying land as the true scarce resource, the ecological footprint is calculated by estimating the equivalent area of ecologically productive land used to produce the materials and energy, and assimilate the waste, for the products we consume. Therefore, the ecological footprint of individuals, neighbourhoods, cities, nations or, even the human population of the planet itself, can be calculated. For the purpose of this thesis it is useful to be able to calculate the ecological footprint attributed to food consumption in the City of Vancouver. This is basically the amount of ecologically productive land needed to produce the materials and energy, and assimilate the wastes; used to grow, transport, fertilize, package, store and display the food that we consume. Eventually ecological footprint analysis could provide a useful way to compare the ecological efficiency of different methods of production by comparing the equivalent land areas utilized by each method to produce the same quantity of food.

According to Rees and Wackernagel the average Canadian uses 4.27 hectares of ecologically productive land in order to sustain their total consumption. Of this, 1.30 hectares (30%) is dedicated to food production. Table 1 shows how this figure is broken down.
Table 1 - Per Capita Ecological Footprint of Canadian's Food Consumption

The table shows the equivalent area of ecologically productive land used to produce our food and assimilate the wastes. This includes the amount of land needed to absorb the CO$_2$ produced from energy used in the food sector as well as the ecologically productive land used to grow crops and feed livestock (A small amount of food is also derived from forests). Source: Rees & Wackernagel, 1996.

The total ecological footprint of Vancouver’s food consumption is (assuming our consumption patterns are similar to those of the rest of Canada):

1.3 hectares  \times  514,000  =  668,200 hectares

The City of Vancouver covers a land area of 11,340 hectares, so the ecological footprint of Vancouver’s food consumption is $668,200 \div 11,340 = 59$ times the city’s land area.

This, remember, is just the land area required to support our present food consumption and does not include the marine area required to produce the fish we eat or the land required to assimilate the atmospheric pollution generated from the transportation trips required to distribute and purchase the food. The marine ecological footprint for each
individuals food consumption is about 0.5 ha which would add another 257,000 ha to Vancouver’s Food Footprint.\textsuperscript{iv}

Vancouver is importing the ecological productivity of other regions to supply its bloated diet. This type of analysis reveals the debt which cities owe to their global hinterlands and gives the lie to the notion that cities could ever be completely self-sufficient. It also seriously undermines the argument for conventional economic growth which, as we are seeing in China, itself leads to higher protein diets which use more resources (Brown, 1995).

Urban agriculture can reduce our “Ecological Footprint” by growing food more proximally to its point of consumption. This will reduce the amount of transportation, storage, and packaging required to deliver food to people. We can therefore reduce the size of our “Ecological Footprint” by adopting urban agriculture as a land use in the city.

\textit{Reducing Transportation-Related Pollution}

Reducing vehicular traffic is a major goal of GVRD’s Livable Region Strategy and excessive number of truck and car trips is, of course, a major contributor to many environmental and health problems as well as the driving force behind urban sprawl. If our food was produced more proximally, especially that with a short shelf-life, then the

\textsuperscript{iv}Personal communication with Dr. William Rees. Feb. 17 1998
frequency and length of trips of both distributional and shopping trips could be reduced. This would reduce energy-use and pollution. An urban food production policy could lessen the need for car-based shopping trips by encouraging backyard growing, community gardens and local commercial food production and initiating local produce markets that are within walking/cycling distance. Locally produced food can reduce the number of trips required to distribute the food to suppliers and further reduce pollution.

Packaging and storage requirements will be lessened because there will be less time for deterioration and reduced handling. Food may even be cheaper if it can be channeled more directly from the producer to the consumer.

It is important that community/allotment gardens be within a reasonable distance from where people live otherwise the automobile problem may be exacerbated by individuals driving to tend their gardens.

**Reducing the use of petroleum-based energy in farming practice.**

As can be seen from the ecological footprint information, a large proportion of our ecological footprint is derived from the use of fossil fuels on farms and in transporting that food to markets. If we compare North American use of energy with that of India, our overuse of energy seems irresponsible and unnecessary. North American farmers do produce a yield three times greater than that of India but to do so requires the use of 15 times more fossil fuel energy. The difference is, of course, machinery. Indian corn was
produced using 615 person-hours per hectare whereas North American wheat used only seven (Pimentel et al., 1975). The Western world has rapidly substituted human labour with fossil-fuel powered machinery.

Urban agriculture can have a significant impact on agricultural fuel consumption by returning to a more labour intensive form of food production. This will drastically reduce the need for agricultural machinery and will increase employment in the farm sector.

Reducing Water Consumption

Although Vancouver's water supply is plentiful, a growing population is placing more pressure on the system's ability to cope with demand and we are seeing regular summer shortages. We could probably cope with this increased demand by building additional water reservoirs but there are, of course, significant environmental costs involved with building reservoir supplies (such as degraded fish habitat). It seems sensible therefore to limit the use of potable water for garden irrigation as much as possible by encouraging efficient irrigation, water re-use, and water retention techniques. If care is not taken, urban agriculture may increase the demand for water in urban areas. However, urban agriculture can contribute towards water saving by re-using treated grey-water, using rain barrels to collect and store water, mulching and cover-cropping so as to reduce surface evaporation.
Utilizing Waste-Water/Sewage Flows From Buildings

The waste-water output stream from residential buildings represents another potential resource that could be utilised in urban food production. Not only does this constitute a huge waste of valuable irrigation water, but sewage also contains valuable nutrients that could be used for plant fertilization and aquaculture. Techniques exist that could efficiently and safely use this resource. Our preference is usually to shift this problem as far away as possible. Recognizing the potential of this resource and using it locally is a major challenge that needs to be met if we are to make the transition to sustainability.

Utilizing Waste Heat From Buildings

Vancouver's temperate climate is not ideal for year-round vegetable production. However, there is a huge amount of waste heat coming from the roofs and heating ducts of most residential and commercial buildings. This is a potential resource and could extend the growing season if we could devise ways of using this heat before it escapes into the atmosphere and is lost forever. This could be done by using rooftop gardens or rooftop greenhouses.

Habitat Destruction

Mono-cultural farming practices and the heavy use of pesticides have created a farming environment that is often inhospitable for wildlife. The increased size of fields, to make them suitable for massive farm machinery, has meant that valuable hedgerows and other
wildlife habitat has been destroyed. Remarkably, wildlife is more often seen by major roads that in fields these days.

Urban gardens can be of immense value in creating animal, bird and insect habitat and should contain an indigenous plant component. Important habitat in the urban realm should be created by replacing the use of harmful biocides by integrated pest management, using mixed plantings, including perennials, and practicing edible landscaping rather than ornamental landscaping. Using rare cultivars and heritage seed varieties can also contribute to maintaining the diversity of genetic stock (Garnett, 1996).

**LOSS OF AGRICULTURAL LAND TO URBAN DEVELOPMENT**

Until the introduction of the agricultural Land Reserve (1972-75) the Province of British Columbia was losing 6000 hectares of agricultural land per year to non-farm uses. Despite this strong piece of legislation, 1,235 hectares were lost to non-farm uses in 1995 (Glover, 1997). In comparison, however, Washington State lost an average of 30,000 hectares per year to non farm uses between 1982-1992. The City of Vancouver, of course, has no land in the ALR, but the decreasing amount of high quality agricultural land in the Province is an important concern for local food security.

We need to preserve this land in perpetuity if a viable metropolitan-scale agriculture is going to flourish. This thesis mainly concentrates on the food-growing opportunities in
the dense city but it is recognized that much production will need to occur on the urban fringes.

Urban agriculture should be achieved without compromising the goals of compact communities identified in the *Livable Region Strategic Plan* and identified as desirable in *CityPlan*. One approach to urban agriculture is to simply zone large areas of urban land as agricultural but the current resistance to high densities means that the necessary land will not become available and at current densities this approach would undermine the ability of neighbourhoods to absorb the growing population. Urban agriculture by promoting urban sprawl would contribute to the loss of valuable agricultural land at the urban fringe.

A more promising approach is to look for ways to grow food in the underutilized and interstitial spaces of the city by overlapping uses and creatively making use of derelict space such as rooftops, vacant lots and roadside verges. Vancouver's CityPlan explicitly calls for the creation of a city of neighbourhood centres, - “[n]eighbourhood centres will help the environment by reducing the need to travel long distances from home to jobs and services.” (C.O.V., 1995). A policy on urban agriculture should contribute toward the implementation of this laudable idea. This can be achieved by allowing people access to community gardens in their neighbourhoods and by improving the availability of good quality, fresh produce at a neighbourhood level. Producing as much food as
possible within the community will reduce the reliance on the automobile and so lessen its adverse impact on a dense city of neighbourhood centres.

**Economic Problems**

*Efficiency*

The main drive of modern agriculture is to be more efficient. It has already been noted that modern agriculture has been enormously successful in increasing production. But as Geno and Geno (1976) point out that this "increase in production was only achieved through reliance on capital inputs, most often replacing human labour...[t]aking into account all inputs used for production the rise in productivity has been small or negative."

If we examine agricultural output in terms of energy we find that modern agriculture is grossly inefficient. Modern agribusiness basically grows food using petroleum. Every stage of the food production process, from tilling the field to display in the supermarket, requires large quantities of petroleum-based energy. "We now use 20BTU's of fuel energy to produce 1 BTU of food energy. By comparison in 1910 that ration was 1:1 (Ross, 1980)." In British Columbia, farmers use 20 million litres of gasoline and 35.4 million litres of diesel each year. This is supplemented with 51,200 tonnes of commercial petroleum-based fertilisers (BCMAFF, 19??).
Unemployment

This substitution of capital for labour has had a number of negative consequences. As already mentioned, one of the tragedies of modern farming is the drastic reduction in the farm population that has resulted from the mechanization of farming. In 1991, Canada’s farming households comprised only 3% of the population, a similar figure to that in many other Northern countries. This is compared to a peak of 31% of the population in 1931 (Rees, 1997).

Low real farm incomes

Winson (1993) points to the fact that farmers are chronically in debt as a result of increased land prices, low food prices, and the need to purchase expensive machinery. This leads in turn to low real farm incomes as most of the value gained from production goes to debt servicing.

Too much value-added

The average Canadian household spends $5,686/year on food - more than any other item except accommodation (Statistics Canada (a)). This figure represents over 12% of the average before-tax income and nearly 18% of household consumption. However, this figure obscures the fact that low-income households spend on average 30% of their income on food (Agriculture Canada, 1989). Meat and meat preparations represent the largest expenditure at 18%, dairy products - 11%, fruit & nuts - 8%, vegetables and vegetable preparations - 6.5%.
Despite these figures, agriculture and its related service industries at $11,876 million (constant 1986 dollars), represent less than 2% of the nation's GDP (Statistics Canada (b)). This apparent paradox, of food expenditure being high but the GDP of agriculture being low, is explained by the fact that most of the monetary value (and cost) of food is generated by the post-production industries of food processing, marketing, wholesaling and retailing. Although “value-added” is a popular community development concept at present, it can be misleading when applied to food. Because of food’s primary importance for health and existence we have to give consideration to nutritional value and people’s ability to feed themselves over and above any economic value. Highly processed foods may well have much “value-added” but they also usually mean lower nutritional value for much increased cost.

Exports and Imports

Canadian imports of agricultural and fishing products have been on the rise up from $9,736.4 million in 1992 to $13,370 in 1995. About 30% of the 1995 figure is fruit and vegetable imports. Exports have also been increasing, up from $14,609 millions in 1992 to $20,001 millions in 1995. In dollar terms Canada is, therefore, a net exporter of agricultural products with 20% of the 1995 figure represented by wheat exports (Statistics Canada (c)). This may only reflect a greater level of “value-added” goods rather than a true material surplus - again the dollar figures are not necessarily revealing of the material traded.
The full cost of this increased trade is not taken into account. Although it may appear good for the national balance sheet, the assumptions of competitive advantage are questionable and the impacts of trade on joblessness, income distribution and environmental quality go unaccounted for.

Who is gaining/ who is losing?

Most farmers are struggling to make a decent living never mind a huge profit. However, the late twentieth century has also seen massive concentrations of power in the hands of a very small number of farms. This concentration of power was such that “by 1981 about 25 percent of farms in this country accounted for 75 percent of gross farm sales and the top one percent of census farms [superfarms] controlled nineteen percent of aggregate gross farm sales. Processors, suppliers and retailers have also super-concentrated so that a powerful oligopoly now controls almost the entire business.” (Winson, 1993).

ECONOMIC BENEFITS OF URBAN AGRICULTURE

There are two economic approaches to urban agriculture. Either we can produce food for our families’ immediate consumption and that of a few friends or we can engage in a commercial urban agriculture that operates as a business and creates jobs. There are benefits to both approaches and of course both will probably occur.
Encouraging Local Economic Development and Job Opportunities

Urban agriculture could encourage many employment opportunities. Small scale, organic urban farming is a much more labour intensive form of agriculture than its agribusiness counterpart. In the period 1931-1992 the farm population of Canada went from 31% to 3% of the total population creating a problem of rural-urban migration that persists today. One recent study also showed that small-scale organic agriculture can produce higher returns for the farmer who relies on premium prices and household scale production (Van Sieters et al., 1997). With unemployment cruising around 9%, creating maximum employment opportunities should be one of the primary aims of any level of government.

However, we also have to remember that even those few farmers who do remain are not having an easy time of it economically. Many smaller farms are crushed by debt and real farm incomes are low. If we started to produce most of our vegetables in the city it would reduce the incomes of many Fraser Valley vegetable growers. This is a real concern when farmers are already struggling but we have to weigh the social, ecological and economic costs and benefits of urban agriculture with the impacts of business as usual. Farmers may not be to blame for the present predicament but we need to grasp opportunities to enhance the level of environmental stewardship. Farming is no longer a Ma and Pa operation with a few chickens and a dairy cow. It is a highly capitalized, highly mechanized operation where many farmers have been encouraged to become businessmen rather than stewards of the land (Kneen, 1989).
Urban agriculture will inevitably be small scale, labour intensive agriculture because it can only utilize the small spaces available in a dense city which are unsuitable for large-scale machinery. If done on a commercial level it may, therefore, be more expensive to produce the food because it will rely more on human labour. However, savings might be made because of reduced transportation and packaging costs. Urban agriculture will have the advantage of creating more jobs per unit of production than its rural counterpart. There are certain types of crop and technique that will be suited to urban agriculture more than others because they are labour intensive.

A number of beneficial spin-off industries could result from growing more food in the city. Small-scale food processing opportunities will arise and there will be an increased demand for suppliers of tools, equipment, seeds, plants, and composts.

There is also the consideration of how to distribute and sell the food. The current channels of distribution are unsuitable for urban agriculture because they steer too much of the price of food away from the producer which not only increases the price of the food but also increases the psychological distance between producer and consumer.

**Farmers markets** are an excellent way to bring producers and consumers together and they often manage to incorporate a significant educational component as well as a fun morning out. They may be volunteer-run and offer stall space to local producers who
sell the food directly to the public. Buyers can question the producers about growing methods and make informed buying choices.

**Community Supported Agriculture (CSA)** is another way to ensure the viability of urban farmers. This type of scheme is already popular in ex-urban situations. It basically involves citizens sharing in the risk of a bad harvest, or the bounty of a good one, by purchasing shares in the harvest from the farmer in advance. It can also involve a certain level of sweat equity where shareholders commit to a level of participation in farm-work during labour intensive periods such as planting, weeding or harvest. CSA is often associated with the organic farming movement and can be initiated either by the farmer or a buying group interested in partnering with a farmer. This type of arrangement means the farmer is spared speculating about whether there will be a market for the crop and can concentrate on producing high quality food.

**Community gardening** as practised by amateur gardeners on small urban allotments is popular in many North American urban areas. Although the volume of fruit and vegetables produced is usually small, there seems to be some potential to alleviate poverty by freeing up income for non-food uses. It may also improve overall levels of nutrition. To evaluate the Philadelphia Urban Gardening Project, researchers at Pennsylvania State University surveyed 144 urban gardeners to assess the benefits gained from urban gardening on community-based allotments or vacant lots. They found that "the mean economic value of the 151 assessed garden plots was $160 with a range of $2
to $1134. This is similar to the median yield value of $101 to $250 for community vegetable production reported by the National Gardening Association survey of community gardens. 49.7% of the Philadelphia urban garden plots yielded produce worth less than $100, 29.2% had a yield worth between $101 and $250, 15.1% yielded between $251 and $500, and 6% yielded produce worth greater than $500 (Blair et al., 1991)." So the economic benefits to individuals practising community gardening are potentially significant but, based on this study, urban gardening does not usually make a major contribution to family incomes.

**Social Problems**

Accompanying these environmental impacts and economic changes has been a social upheaval that has shaped the very patterns of human settlement in Canada and the rest of the industrialized world. In the competition between human and machines on the farm, humans have lost. As mechanization has increased the number of jobs in agriculture has declined dramatically.

The result has been that huge sectors of the rural population have been ousted from meaningful employment by the logic of late twentieth century capitalism and been forced to migrate to the city. Anthony Winson (1993) identifies "some time around 1950 in Canada, [as the period when] farming as a unifying activity for a substantial proportion of the population entered a period of rapid change." He goes on to explain how many of
the problems that farmers had to face at that time were due to the “cost-price squeeze”
where the combined costs of production were rising faster than the price the farmer
received when s/he sold the product and that this pattern continues right up to the present
day.

Food Charity and Hunger in Industrialized Nations (Food Access)

At the same time, the number of people relying on food charity, even in the wealthy
industrialized nations, is still increasing. In his book First World Hunger Graham Riches
(1996) highlights the growing reliance on (and inadequacy of) food charity programs in
Canada. This is mainly due, he says, to the inadequacies of social assistance payments.

The evidence is unequivocal in its condemnation of inadequate welfare-
benefits being the immediate cause of hunger. The fact is that in none of
the countries studied (Canada, US, UK, New Zealand and Australia) is it
possible to provide for an adequate, nutritious diet on the basis of social
assistance alone...The unassailable fact is that when food expenditures
have to be weighed against the increasing price of rent, utilities, clothing
and other essentials, it is the food bill which invariably suffers. Healthy
eating...is expensive. (Riches, 1997, p.168-9)

Although local food production will never be a substitute for a decent level of income, it
can contribute to the ease of access to nutritionally adequate and culturally appropriate
sources of food. As the most basic requirement of a healthy life ensuring this access
should be seen as an absolute priority.
Health and Nutrition Concerns

We are witnessing increasing incidences of environmentally and diet-related health problems such as allergies, auto-immune diseases, cancers of myriad forms and cardiovascular disease. "Humans, not surprisingly, are among the most poisoned creatures on Earth." (Steinman, 1990).

Diminishing food quality, the overuse of chemical pesticides, fertilizers and preservatives, and the introduction of biotechnology have meant that many people have become concerned with the quality of our food. David Steinman (1990) refers to this as "food anxiety" in his book Diet For A Poisoned Planet. In it, he describes a myriad of different chemical residues that pollute our food and drink. These include PCB's, pesticides, heavy metals, as well as nitrates and nitrites in our drinking water as the result of the use of synthetic fertilisers on farmland. Much of this profligate use of chemicals could be avoided if we were just willing to except smaller, less perfect-looking food.

Although not necessarily associated with food toxicity "cardiovascular disease and cancer accounted for 64% of deaths in BC in 1995." (Farm Folk/City Folk, 1997). High levels of fat in our diet is certainly a contributing factor. A National Cancer Institute Study in the US found that children are up to six times more likely to suffer from childhood leukemia when pesticides are used in the home or garden (Dauncey, 1997). Recently Britain has spent hundreds of millions of pounds and destroyed thousands of cattle where poor feeding practices (feeding cattle the rendered remains of dead and
diseased animals thereby turning herbivorous cattle into carnivores and even cannibals) have led to an outbreak of Bovine Spongiform Encephalopathy (BSE) popularly known as “mad cow disease”. BSE, which has been linked with Scrapie in sheep, is the cause of the deadly Cruzefeld Jacob’s Disease in humans.

Processed and non-local foods may also lead to increased incidence of allergies and autoimmune diseases.

“The proliferation of highly processed foods in tandem with the globalization of the food industry means that much of the food we eat in the developed world has less and less of the local physical environment attached to it...the mucosal system is given little chance to learn which local pollen, mould, and dust can be eaten without harm, and hence can also be breathed without harm.” (Cone, 1997).

Two thirds of Canadians believe nutrition is somewhat or very important (FFCF, 1997). Making organic produce more available and less expensive should be a major goal of all governments concerned with the welfare of their citizens. As has been noted above, our food supply is contaminated with a vast array of chemical residues. The incidence of cancers is epidemic. Breast cancer incidence increased 14% between 1973 and 1985. The US Surgeon General’s Report on Nutrition and Health in 1988 estimated as many as 10,000 cancer deaths annually could be caused just by chemical additives in food (Steinman, 1990). Just how many deaths are caused by pesticide residues can only be guessed at. Organic food consumption can drastically reduce our exposure to harmful chemicals because it introduces no new chemicals in the farming process, relying as it does on non-petroleum-based fertilisers such as compost or animal manure, integrated pest-management techniques rather than pesticides, and benevolent species pairings to...
ward off pests and crop diseases. We should endeavour to make urban agriculture as chemical-free as possible.

**Psychological and Physical “Distancing”**

We are increasingly separated from the sources of our food supply, both because of increasing globalization of the food system and because of an increasingly urbanized society. Most food consumers live in cities and most food producers live in rural areas. This physical and psychological “distancing” means that we are ignorant of the production methods used to produce our food and blind to the ecological ramifications of our consumption habits on the agro-ecosystem and the ecosphere at large.

City and nature have become so separated both geographically and psychologically that we now find it almost inconceivable that a large proportion of our food could be grown in cities. As Murray Bookchin points out, we now define a city partly in terms of the absence of food production:

> We are often satisfied to call any urban entity a city if ...most significantly [it is] populated by individuals whose work no longer deals directly with food cultivation. (1992, p. 4)

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"The term "distancing" is borrowed from Brewster Kneen’s excellent book *From Land to Mouth: Understanding the Food System.*
The expansion of the city and the reliance of ever fewer people on the land has meant that we have become an ecologically illiterate society that is cut off from nature.

By building cities in the way we have, we have divorced ourselves from nature. What contact is there with the seasons in a modern air-conditioned shopping mall with its built-in trees? Sadly, we have banished nature from most of our town-scapes and the resulting environment reflects only too well the assumption that we can exist entirely in isolation from the natural world...People are not only unaware of their natural roots but are becoming divorced from all aspects of the natural world upon which they ultimately depend. If this rift between mankind and nature is to be healed...[w]e need to consider ways in which people can relate more closely to nature in cities...by creating completely new opportunities for nature to exist within an urban setting (Goode, 1990).

Urban agriculture offers a great opportunity to reconnect ourselves to the natural world and to educate citizens in the vital life processes that govern the natural world.

*Lack of local control*

The advent of trading agreements such as Canada-US Free Trade Agreement (FTA), The General Agreement on Tariffs and Trade (GATT - overseen by the World Trade Organization(WTO)), The North American Free-Trade Agreement (NAFTA), and the impending Multi-Lateral Agreement on Investment (MAI), as well as the removal of trading barriers in the European Community, mean that we are increasingly reliant on other provinces and nations for our food needs. Federal and Provincial governments, and consequently the rest of us, have less autonomy in deciding what is beneficial or detrimental for our health and the environment. For example, Swenarchuk reports that “The FTA required harmonization of our pesticide standard with the American one, in
accordance with the American approach of risk-benefit analysis, which requires the balancing of the health effects of a pesticide with economic loss to producers of preventing its registration. This standard is lower than Canadian standard in the

*Pesticide Products Control Act, Regulation Section 18(d)*, which is exclusively based on health considerations." (Swenarchuk, 1993, p. 197). Also, a recent interim report by the World Trade Organization rejected the European Union’s ban on importing cattle treated with growth hormones on the grounds that the ban was “unscientific” (United Nations Food and Agriculture Organization, 1997). Clearly these trading agreements are threatening the very basis of a democratic country’s ability to make sovereign decisions about the type and quality of the food its citizens eat.

While global trade has the benefit of bringing diverse, fresh products from around the globe to our refrigerators, it also has a number of less fortunate consequences. It is now difficult to know where food comes from, let alone exert any form of control over how that this food is produced. Many countries give huge subsidies to mainstream agriculture and encourage the profligate use of water, fertilizers and petroleum inputs into the farm machine. Despite the massive ecological cost involved in the transportation, refrigeration, storage, packaging, marketing and displaying of food products, these costs go unaccounted for and we are all increasingly powerless to influence these events.

There is also the consideration of our responsibility to poorer nations. Food exports do contribute to the economies of less developed countries but they can also inflate local
food prices and diminish the availability of food for marginalized populations. As David Zirnhelt (previously Minister of Agriculture for British Columbia) has said “[o]ne of the questions is how much a province that has considerable food production capability should put pressure on the more limited resource base elsewhere.” (Zirnhelt, 1995).

The more locally food is produced the more exposure local people will have to the food growing process and the bio-physical processes involved. This will have an educational role and will hopefully encourage people to value and appreciate productive land. It will also increase the influence citizens can have over the way food is produced. Rather than arriving from far-off lands in sealed containers and then miraculously ending up on super-market shelves, the production of urban food will be transparent from the start. People will know if their vegetables have been sprayed or grown on contaminated land. There is also more likelihood that they will also understand what sort of inputs are used in the farming process and whether any harmful environmental practices are occurring.

_Fostering Citizen Co-operation and Community Development Through the Highly Cooperative Activity of Gardening._

Community gardening is an inherently cooperative enterprise where novices learn from experts and many hands can make light work of an otherwise difficult task. The community gardens in Vancouver are wonderful examples of this co-operative spirit. These groups have self-organized to steward a piece of land and do a wonderful job of maintaining both the land and the human organizations necessary to oversee a large
group of people. One study showed that community gardeners were more likely to regard their neighbours as friendly and were also more likely to get involved in neighbourhood clean-ups, beautification projects, and local barbecues. By comparing responses to questions on psycho-social well-being to those of controls the study also showed that urban gardeners find life marginally more satisfying than non-gardeners (Blair et al, 1991). There is also compelling evidence that community gardens can reduce local crime rates.

**Unsustainable cities**

A sustainable city needs a sustainable food supply and I have outlined the argument for why our current food system is far from being so. But the link between cities and the problems of the food system requires elaboration. As the world population grows by 90 million mouths per year a parallel trend is that an increasing proportion of these people will live in cities. The Bruntland Report (WCED, 1987, p. 16) states that “by the turn of the century, almost half of humanity will live in urban centres.” Even more dramatically, 75% of people in the developed North now live in towns and cities. This means that the food consumption patterns of city people and the waste-disposal practices of their municipal governments are increasingly influential.

Indeed it is the world’s industrial cities that produce most of the world’s solid and liquid waste, consume most of the world’s fossil fuels, emit the majority of ozone depleting compounds and toxic gases, and give economic incentive to the clearing of the world’s forests (UNEP, 1990, as cited in Roseland, 1992).
Cities currently import food from all over the globe and generate solid and liquid waste that is often improperly disposed of and rarely re-used. This represents a massive waste of valuable nutrients which may be as crucial to long term sustainability as energy-use. We simply cannot continue to mine the fertility of the soils and simply dump this fertility into water bodies where they become damaging pollutants. And as Rees and Wackernagel (1994) point out:

Our preliminary data for developed regions suggest that per capita primary consumption of food, wood products, fuel, and waste processing capacity co-opts on a continuous basis up to several hectares of productive ecosystem...This approach reveals that the land “consumed” by urban regions is typically at least an order of magnitude greater than that contained within the usual political boundaries or the associated build up area. However brilliant its economic star, every city is an ecological black hole drawing on the concentrated material resources and low-entropy production of a vast and scattered hinterland many times the size of itself...we say that high density settlements “appropriate” carrying capacity from all over the globe, as well as from the past and the future.

Cities then are giant organisms, gobbling up resources and discharging waste. Making a city ecologically sustainable is therefore a matter of both limiting the material and energy use and also re-using the valuable waste products of consumption so they do not become pollutants. We need to create cities that are more like ecosystems, which produce as well as consume, so that cities can exist in balance with the ecological limits of the natural world. Sustainable communities would therefore contain autotrophs as well as heterotrophs - i.e. ecological producers as well as consumers. This is one role for urban agriculture. By producing food in city, grown partially on the nutrients from human
waste we can both reduce the consumption of ecological productivity from "distant elsewhere" and minimize the amount of waste to be treated.

**IS URBAN AGRICULTURE A REALISTIC ALTERNATIVE TO ITS RURAL COUNTERPART?**

Urban agriculture will not completely replace its rural counterpart. Many of our food products, such as grains and meat are difficult to grow in large quantities in an urban environment and on the whole are best left to rural farmers. However, the potential to produce certain crops and some small livestock is immense. To indicate what is possible in times of crisis we can look at what was achieved in wartime. Hough reports that during World War Two 10% of Britain's food needs and 30% of its vegetables were grown in *Victory Gardens* in the city and "[i]n Canada, Vancouver citizens urged by the government to 'plant a wartime garden', and aided by a city decision to rent vacant land at a nominal fee, produced some 31,000 tones of fresh vegetables and fruit in 1943." (Hough, 1989, p.212). This was equivalent to $20 million worth of supermarket produce at 1979 prices (Harrowsmith, 1979; as cited in Hough, 1989, p.212). The South-East False Creek project offers a great opportunity to ascertain just how realistic is the notion of communities that are partially self-reliant in food and what these communities will look like. It is unusual for a mature city to have such a large area of land available for comprehensive development. Thus, the objective of the next chapter is to explore this potential.
Summary

This chapter has been about the negative effects of the way we currently get food from the field to the table and about the potential solutions offered by urban agriculture. Our food system, as it currently operates, contributes to severe hunger and malnutrition on a global scale, and inadequate nutrition for many people in Canada too. It also results in environmental degradation that itself threatens the food supply as well as the health of individuals and communities.

Our food system is not organized for maximum nutrition but for maximum profit and consequently contains a plethora of poisons harmful to human health. Not only this, but agriculture is responsible for contaminating our water bodies including the ground water that many people rely on for drinking water. Agriculture plays a major part in generating greenhouse gases which may ultimately be the most harmful effect on all of us if severe climate change occurs.

Unfortunately, in the current political climate, one fixated by economic growth and personal gain, only those measures that promise an improvement in life quality for the majority of people in industrialized countries are likely to be politically acceptable. This requires inventing win-win scenarios at global, national and local scales. The purpose of this thesis is determine how urban agriculture can be part of this approach. That is, how
can urban agriculture reduce ecological deterioration and improve community life
without diminishing important elements of the economy? Indeed, how can it make
improvements to the general welfare of all citizens and at what cost? Achieving
ecological sustainability means reducing the throughput of material and energy used by
the economy and decreasing the amount of waste generated. But making this possible
also entails creating jobs and dealing with social issues.

We need to develop solutions in the city to the problems of the food system and to
sustainability generally.

Urban agriculture presents a number of clear benefits to a large industrial or post-
industrial city like Vancouver. It seems to be an ideal tool for planners to work with and
can be incorporated into a number of existing programs. Figure 2 summarizes the
possible contribution of urban agriculture to sustainability.

There are some very powerful reasons to pursue urban agriculture. Urban agriculture has
the ability to play a part in achieving many aims of a healthy, sustainable city. It can
further one of the goals set out in CityPlan (C.O.V., 1995) to create compact
neighbourhoods where residents have access to most of their daily needs. It can help
achieve the goals of the Clouds of Change Report (C.O.V. 1990) to reduce atmospheric
pollution and climate change, and the goals of the Greenways (C.O.V., 1992) report that
called for Vancouver to become a “City of Gardens”. It can also make for stronger, more vital communities where cooperation is encouraged and people feel empowered to deal with their own problems.

Figure 2 - The benefits of urban agriculture (adapted from Smit et al., 1996)

Making food production a local, urban issue is one of the keys to exerting some form of control over how food is produced and educating people about the ecological ramifications of business as usual. It is therefore vital to the issue of sustainability. By producing food very close to the point of consumption, and using sustainable gardening and farming techniques, urban agriculture offers a partial solution to many of the...
problems and pressing urban issues with which planners have to deal noted. However, our enthusiasm over these potential benefits needs to be tempered by a consideration of some real and potential problems with urban agriculture that need to be addressed in Vancouver as a whole and at South-East False Creek.
Chapter 3: The Decline and Rise of Urban Agriculture.

In this chapter I discuss why agriculture, which was once a vital component of city life, has come to be seen as a purely rural pursuit and as inappropriate in the city. This is done in the context of current planning theory. It is my attempt at synthesizing a theory of planning that can embrace urban agriculture and pave the way to a new approach that can reconcile the conflicting demands of economics, health and equality brought about by the imperative of sustainability. I discuss the role of agriculture in the earliest cities and how agriculture shifted from being an integral component of city life to a purely rural occupation exiled from the urban realm.

Urban Agriculture in Antiquity

In the earliest known cities agriculture was a part of the fabric of everyday life. In Catal Huyuk (in present day Turkey) for example grain cultivation and the rearing of domestic goats was a part of everyday life (Nelson, 1996). Wild food supplies were supplemented with domesticated sheep, cows and goats and cultivated grains and legumes (Jacobs, 1969, p. 24).

Significantly, early cities were not only economically dependent on the land, but they often included space for food cultivation within the urban perimeter. Technochtitlan, for example, contained many of the floating gardens that the Aztecs created in Lake Texcoco by anchoring mud with
osier reinforcements, adding trees whose roots fixed the entire ensemble to the lake bottom. (Bookchin, 1974).

The city of the middle ages also provided many of the food needs of its inhabitants:

Until the medieval towns became overcrowded towards the end of the Middle Ages, gardening and dairying were a normal part of family life. Plots were reserved for growing food and each family retained some pigs, chickens and a cow or two which could be pastured on common land (Bookchin, 1974).

Even in nineteenth century Paris, most of the city’s vegetable requirements were grown under glass cloches and fertilized using massive quantities of horse manure (Smit et al., 1996). The marais cultivation system occupied 1,400 hectares of the city which at the time covered an area of 7,800 hectares (Katz, 1986). Jane Jacobs (1969) even goes as far as to say that the skills necessary for the development of agriculture (animal husbandry, and seed selection and propagation), and therefore for the transition from a hunter-gatherer culture to an agrarian culture, were discovered in cities founded on trade and then transported to the countryside.

Current theory in many fields - economics, history, anthropology - assumes that cities are built upon a rural economic base. If my observations and reasoning are correct, the reverse is true: that is, rural economies, including agricultural work, are directly built upon city economies and city work.

Cities, Jacobs says, came before agriculture and were, in fact, the crucibles of agricultural invention, a role that they have maintained until relatively recently. This is a highly contentious hypothesis not shared by many other scholars, but even if Jacobs is...
wrong, agriculture was clearly an important land-use in cities prior to the twentieth century. This, of course, was necessary because food stuffs, most of which are easily perishable, needed to be produced near to where they were consumed for the simple reason that transportation and storage were difficult or impossible over long distances and times. This is still true today in many cities of the developing world and explains why, for example, there are 400,000 dairy cows in Karachi, Pakistan (Lewcock, 1996, p. 256).

For most industrialised nations the twentieth century has seen a very different pattern of food production and consumption unfold, made possible by the advent of artificially cheap, efficient transportation and food storage techniques such as refrigeration. Apart from during the second world war, when massive amounts of food were grown in Victory Gardens, food production has become an increasingly rural pursuit and seen as an inappropriate activity in the city. Reflecting this predominant view planners and regulators have created bylaws and regulations that inhibit the possibility of local food production through exclusive zoning regulations that disallow greenhouses, animal rearing and even bee-keeping, and prevent the local re-cycling of nutrient-rich human wastes. This was, in part, a rational response based on an historical trend in planning which started with early health reform in industrial Britain. It spoke to genuine concerns over health issues and the pressures of expanding urban populations divorced from the land by the brutal acts of enclosure of the 1800’s. Food production, especially the keeping of animals, was seen as a threat to health and hygiene. The result of disallowing
farm animals in the city meant that the tradition of mixed agriculture where crops and livestock are integrated in an efficient, symbiotic relationship with the land was no longer possible.

The banishing of food production from the city was coupled with a changed perception of the meaning and function of open space in the city. The nineteenth century saw the building of public parks as refuges from the stresses of city life and work, and as places to explore and enjoy, rather than harness, the undisturbed qualities of nature (Laurie, 1979). Under the influence of nineteenth century landscape-painting, the enticement of poet-conservationists such as Emerson and Thoreau, and the persuasions of landscape architects such as Olmstead, a number of highly naturalized parks were created in urban areas. These open-space legacies are the product of a particularly nineteenth-century view of nature and society. They reflect, in essence, a very middle class perspective that promoted the creation of parks for health and relaxation, the moral instruction of the working classes, the aesthetic improvement of the city, the ensuing increase in property values as well as to satisfy an increasing interest in natural processes and organisms (Laurie, 1979).

Our outlook is now a little wider. We have come to see that there are important ecological issues that need to be addressed by the functions of public open space. We have also learned that artificial landscapes can be very energy hungry and time intensive,
especially if designed for merely aesthetic purposes. The barren landscapes of grass and ornamental bushes require a constant input of maintenance and chemicals to keep them healthy (Hough, 1989).

However, it is not only planners and landscape architects who have precipitated the decline of urban farming. These professionals have only reflected the predominant view that urban agriculture is inefficient and inappropriate. This inefficiency is compared to the economics of large scale agriculture which means that food can be produced in greater quantities, with less human effort, for a lower price. By substituting machines for human labour great gains in productivity and reductions in price have been made. This is an undeniable advantage but it has come at an enormous cost, as I have mentioned, in terms of meaningful work, ecological damage, social upheaval, and psychological and physical "distancing". The view that urban agriculture is somehow inappropriate is rooted in a long history of tension between the city and the countryside which we shall now explore further.

From Domination to Compassion - City vs. Country

A radical agriculture, geared to the needs of a post-industrial society, must begin in the cities as well as the farms. Then we can finally come together (Merrill 1976).
The tension between the city and the country has been one of the pivotal intellectual points for social theory. Marx felt that the “whole economical history of society is summed up” in the development of the antithesis between town and country (Bookchin, 1974). Since the very early cities urban culture has lived uneasily with its rural counterpart. How do we balance the cosmopolitan needs of a growing city (its high culture, voracious appetite and tendency to swallow up nearby farmland) with those of the countryside with its very different culture and values and its need to maintain viable populations?

Problems like this dominated the thinking of such figures as Lewis Mumford who said that “except for a few congested centres, the town of the Middle Ages was not merely in the country but of the country: food was grown within the walls as well as on terraces. Or in the orchard’s and fields outside.” Ebenezer Howard’s famous goal was to create a unification of the city and the countryside that combined the advantages of both country and city living with none of the disadvantages (Hall, 1992). As we can see from a part of Howard’s famous diagram there was much inclusion in the idea for the production of all the food needs of the garden city.

Over time the values and culture of the city gained predominance over the values and culture of agrarian society. Despite this, both city and country lived in an intimate balance with one another for centuries. It seems that only with the arrival of the
industrial revolution, coupled with the 19th century *Acts of Enclosure*, that an almost parasitic relationship developed.

**Figure 3 - Howard's Provision for Food Production (from Garden Cities of Tomorrow)**

**THE RISE OF CITY PLANNING**

The rise of modern city planning has its roots in the industrial revolution and the increasingly crowded conditions of nineteenth century Britain. Rapidly growing urban populations, poor quality drinking water, lack of sanitary sewers and poor quality health...
care led to the unprecedented outbreak of disease and pestilence and shockingly high infant mortality rates. Solutions to these problems in the form of a series of health reforms and building standard controls were the precursors of what we today know as city planning (Hall, 1992). Along with planned actions to regulate building densities and transport sewage to outlying locations, planning was enormously successful in achieving its original aims of improving infant mortality rates and reducing the incidence of transmittable disease.

However, necessary as they were at the time, these measures have had a number of negative consequences. Piping sewage to locations outside the city perimeter only served to shift the locale of the problem of sewage treatment further afield. Instead of polluting city streets, it now pollutes water bodies and threatens the integrity of aquatic habitat far from the source of the waste. Reducing housing and population densities has resulted in urban sprawl and it is now proving difficult to wean people off the suburban dream. Perhaps most crucially, the professionalization of planning that soon accompanied these measures has resulted in the complete disempowerment of individuals and communities to engage in meaningful activity - to plan their own destinies and exercise local control over planning issues.

Although linked to birth the of planning through intent and philosophy, the banishment of food production from the city happened over a period of time and coincided with the
ability to import huge quantities of food over long distances. Gradually the relationship that developed between city and country was one of dominance - the city came to dominate the country in a way never before seen. Of course this trend steadily worsened as urban populations escalated and threatened the very land on which many of their economies were built. Murray Bookchin, an ecological-anarchist and social ecologist puts a new slant on this traditional view of the city as engulfing the country. Bookchin's (1992) sense of what a city should be is in marked contrast to what our modern day urban areas have become.

The truth is that the city and the country are under siege today - a siege that threatens humanity's very place in the natural environment. Both are being subverted by urbanization, a process that threatens to destroy their identities and their vast wealth of tradition and variety. Urbanization is engulfing not only the countryside; it is also engulfing the city. It is devouring not only town and village life based on the values, culture and institutions nourished by agrarian relationships. It is devouring city life based on the values, culture and institutions nourished by civic relationships.

Reinforcing the views of the Frankfurt School (Horkheimer and Adorno, 1979), Bookchin (1980) sees this dominating form of urbanization and the urge to dominate nature itself, as a reflection of the dominant hierarchies that pervade human relationships.

The basic conception that humanity must dominate and exploit nature stems from the domination and exploitation of man by man. ...I would argue that environmentalists have not posed the strategic problems of establishing a new and lasting equilibrium with nature.
So the central questions become how can we reverse this tendency to dominate and control, and how can we restore the balance between the city and the country so that both can once again flourish and complement each other? To do this we cannot just invent utopian villages and new towns although a certain amount of decentralisation is probably necessary. But the problems already exist in our cities so we need to reintroduce a vital nature into our existing urban centres that can restore the balance between society and nature that we have so profoundly upset. This has to be more than the passive environments of nineteenth century park-space. The most pressing area that we need to work on is the land and the activity of producing food. This is not just because food is the most essential and most "intimate commodity" as Anthony Winson (1993) puts it, but because it is symbolic of our ties to nature. By producing food in a way that respects and preserves the land we will go along way towards healing our relationship with nature and other human beings too. Food is vital. As Tim Lang (1997) says:

In our daily lives, we meet for meals. We cement our loves and domestic life over meals. We care through food. We exploit and give pleasure through food. We also hate through food. We argue over meals. We oppress each other over food. We fight with and over food. We express loyalty through food.

**New Visions of Self-Reliance**

Emerging from the social and ecological crises of the industrio-technological world-view is an alternative paradigm or world-view that challenges the notions of centralization, large-scale efficiency and unbounded growth. The relatively new disciplines of
ecological economics, bioregionalism, and the healthy and sustainable communities movement are essential parts of a new understanding and approach to human activity and our relationship to the natural world. Re-centering agriculture within local regions is part of the competing paradigm that has developed alongside these theories.

ECOLOGICAL ECONOMICS

Although acting locally is essential to the solution of the problems outlined in the previous chapter, we also require a redefinition of the field of economics and action at a larger scale. Under the current cloud of growth-mania and gigantism we require a progressive theory that will replace the atomistic consumer with a citizen that can make choices beyond a simplistic cost-benefit scenario. While governments provide massive ecological subsidies to unsustainable practices (and farming is a prime example) it will be difficult for community-based, sustainable alternatives to compete. Altering this imbalance requires an internalizing of the environmental costs associated with production so that prices begin to reflect the full ecological and social costs that result.

Introducing the discipline of ecology into economics reconfigures our thinking about the relationship of the economy with the natural world. Ecological economists refute the neo-classical notion that the economy is separate from the natural world which exists to provide an infinite flow of resources and unlimited sink for assimilating wastes. Realising that human beings will remain in a state of “obligate dependence” on the natural world, and that economic production is in fact consumption of the natural

Urban Agriculture: The Potential for South-East False Creek 66
productivity of the biosphere, forces us to question the basic assumptions that drive the economy at present. In what Herman Daly (1991) calls “a world full of ... human beings and their furniture”, one in which humans “use directly and indirectly, about 40 per cent of the net primary product of land-based photosynthesis” and where Western nations are already consuming more than their fair share of ecological goods and services, the only ethical direction is to restrict that consumption so that developing nations will have the ecological space to provide for their basic needs. Trade and economic growth only serve to shift and exacerbate the limitations of carrying capacity (Rees and Wackernagel 1994). This is a powerful argument against both unfettered growth and global trade and for a redistribution of material wealth both within and between nations. It is also a call for concentrating on local self-reliance where populations exist within the natural carrying capacity of the region or at the very least the country.

**BIOREGIONALISM**

The bioregional vision is one in which human beings are reconnected to and gain intimate knowledge of the natural world. It is a vision where “place” becomes specific to local conditions, and nature becomes our teacher through protracted observation. Bioregionalism is also about moulding human institutions to the appropriate scale that allows citizens to be active participants in civic as well as rural life. It is about knowing and living within the limits (or carrying capacity) of the local region which is defined not through arbitrary political boundaries and census tracts but by tangible ecological, topographical and cultural patterns which have less distinct but nevertheless real
boundaries. Bioregionalism is a distillation of ideas both old and new. ‘[It] is a term first coined in 1974 by Nova Scotian Alan Van Newkirk...’ (Aberley, 1987). Traditional, localized knowledge and respect for the Earth are melded with modern mapping techniques and the new ecology. The resulting synthesis which finds its praxis in ecological planning, differs only modestly from the more technology trusting, regional approach of Lewis Mumford, Howard Odum and the Regional Planning Association of America. But what is a bioregion? The arbitrary, artificial boundaries of districts, provinces and nations set by contemporary society seem, as Gene Marshall (1993) maintains, “wholly inappropriate [and] most of them are personally meaningless to us.”

The solution that bioregionalism offers involves a redefinition of territorial boundaries on the basis of physical, ecological and cultural characteristics. Kirkpatrick Sale (1985), one of the pioneers of the movement, describes bioregions as naturally defined regions:

[D]istinguishable from other regions by particular attributes of flora, fauna, water, climate, soils, land forms, and by the human settlements and cultures those attributes have given rise to.

One of the characteristics of a bioregion is that it should have the capacity for self-reliance. That is, the region should be capable of providing for most of the essential needs of its inhabitants without relying heavily on global trade. In the Pacific Northwest the Cascadia bioregion spans two countries, four states and two provinces. It has been defined as stretching from Montana, Oregon and Washington in the South, through British Columbia and Alberta, to Alaska in the North. Nested within this huge region are smaller bioregional units such as the Georgia Basin and the Fraser River basin. Again,
within these regions we can identify smaller biophysically distinct areas. It is this
concept of appropriate scale that is key to bioregionalism. With problems like climate
change, acid rain, and toxicity of the oceans occurring globally, the question that arises
is: where can we act to be most effective? Kirkpatrick Sale (1985) helps answer this by
introducing the concept of human scale:

The only way that people will apply “right behaviour” and behave in a
responsible way is if they have been persuaded to see the problem
concretely and to understand their connections to it directly - and this can
only be done at a limited scale...For if there is any scale at which citizens
can see themselves as being the cause of environmental effect, it is at the
regional level.

This idea of scale can also be examined in relation to the concept of home, another key
concept of bioregionalism. Home can mean many different things to us: home can be
the house that we occupy now or did when we were children; it can be the
neighbourhood or community that we live in or even the county, province or country that
we feel we belong to. We can even say that the Earth itself is our home. On all these
scales of territory we may have a sense of belonging and each is important because they
chart our geographical circles of responsibility (Marshall, 1993). In an age of rapidly
expanding global trade, tourism and communications, the task of bioregionalism has
become to “wed dynamic human populations to distinct physical territories defined by
continuities of land and life.”(Aberley, 1993). The bioregional vision then is one that of
sustainable, self-reliant regions, populated by communities that respect the delicate
balance of the eco-systems that support them.
HEALTHY AND SUSTAINABLE COMMUNITIES

Behind this movement is the evolution of the concept of “health” from a focus on the mere absence of disease that now includes the capability of a human system (an individual or community) to define and create its own relationship to the environment.” (Boothroyd and Eberle, 1990). The healthy communities movement is about individuals and communities taking responsibility for the health of themselves and the community. “It is not a matter of a community participating in technocratically guided national or municipal planning, but of whole communities planning for themselves.” (Boothroyd and Eberle, 1990).

Implicit in the Healthy Communities approach is an understanding that sustainability encompasses human development; i.e. social aspects, as well as the more conventional economic and ecological aspects. According to Trevor Hancock (1996) this has profound implications for organization and governance:

For communities, a shift from economic development to human development will bring significant changes in design and operation. This is because human development centres on seeing development as an integration of health/social well-being, environmental protection/ecosystem health and economic activity.

Hancock sees that health should be the overarching organizing principle of a community and the state of “health” will emerge as the natural result of the three balanced spheres of activity - community conviviality, environmental viability and economic adequacy.
maintains that extending the definition of health has radical implications for the structure and functioning of local government including re-evaluating the purpose of government, the approach to government, the level at which government occurs, the style and structure of government, and the democratic process.

This recognition that social, ecological and environmental issues are highly inter-related is the assumption around which I have based much of this thesis. Food which crosses the boundaries of social, ecological and economic activity, is so profoundly linked with health, both on an individual, physical level and at the level of community well-being. Urban food production is therefore, I suggest, an ideal tool for planning holistically. If we are to follow the healthy communities model in the planning of South-East False Creek, it will mean that the residents will take charge of implementing food gardens and fruit trees. This, desirable as it is, requires a supportive City Council and planning department but also requires the interest and commitment of members of this future community.

**Urban Agriculture as Part of the Transformation of Agriculture**

The above comments have been a very brief tour through some complex theories. It was not my intention to delve deeply into the literature but merely to illustrate the theoretical
antecedents and rationale for localizing the very basic necessity of food production. I hope the role that urban agriculture can play in achieving healthy and sustainable communities will now be clearer.

The transformation of agriculture and the food system to a condition of sustainability will require more than just the localizing of food production. We will never be able to grow all of our food in cities and there will probably always be some reliance on imports. Sustainable agriculture will also require the adoption of techniques that conserve and replenish the fertility of the soil. Organic farming is a necessary component of such a system and it is gaining popularity worldwide as people realize the health and environmental consequences of a diet based on petroleum, chemicals and genetically modified organisms.

Urban agriculture, as well as being only a small step towards sustainable agriculture, is an even smaller step towards resolving the conflict between humanity and the ecosystem. However, it is my thesis that it represents an important step in the right direction towards these goals for the reasons stated in this and the previous chapter. The next chapter will show how urban agriculture is a practical tool that can be used by planners to solve some of the very pressing urban problems outlined in chapter one.

It is my view that farming in the city presents the opportunity to heal some of the historic wounds inflicted on both the city and the countryside by the on-going battle of identity.
that has been fought between city and country. It can also help to re-establish a sense of citizenship. Tending the land, especially in a dense city environment where large machinery is impossible to use, is a highly co-operative activity. It can develop a sense of belonging, not only to a geographical locale but a belonging to (and awareness of) the vital resources and processes that make up the productive power of economy.
Chapter 4: Possible Approaches to Urban Agriculture

The preceding two chapters have indicated why we need to consider an alternative to current agricultural practice. I have explored some of the problems of the food system and why it is unsustainable as well as some of the principles on which sustainable agriculture would be based. The problems of food insecurity brought about by expanding populations and shrinking agricultural land-base, the one way flow of nutrients from the soil to the sewage plant, the vast quantities of fossil fuel energy expended to produce and deliver our food, and the health risks associated with food produced using toxic chemicals - all these issues are forcing us to investigate new approaches to food production.

I examined how we abandoned the once flourishing practice of urban food production and some of the deep seated reasons behind this. It remains to be clearly demonstrated how to implement local food production (specifically growing food in cities) so as to diminish the negative ecological impact of agriculture and enhance job creation, health and nutrition, and community development. This chapter will show more concretely how urban agriculture can contribute to the goals of creating a healthy, sustainable community and how we can overcome some of the barriers to implementation.
Urban Agriculture in Developing Countries.

The response in many developing countries to the problems outlined in the preceding chapters has been to grow food wherever and whenever the opportunity arises. In their book written for the Habitat II conference, Smit et al. (1996) give numerous examples showing the extent of urban agriculture in poorer nations. For a rapidly increasing urban population, cut off from farming opportunities in rural areas, this means using the available space in urban environments. People are growing food and fuel just about everywhere as a response to hunger, malnutrition and to provide a supplement to inadequate incomes. On the whole this has not been a planned exercise and in some cases local authorities have actively tried to stop urban agriculture from been practised (Smit et al. 1996). Despite this, the authors estimate that roughly 200 million people worldwide are involved in urban agriculture and 800 million derive at least some of their nutritional requirements from food produced in the urban environment. Since the 1970's the trend has been towards increasing urban food production as the social and economic conditions of mega-regions deteriorate (Mougeot, 1994). City farmers in Accra, Ghana now supply residents with 90% of their vegetable needs - and Singapore farmers provide 25 % of vegetables and 80% of poultry requirements (Nelson, 1996). Calcutta uses sewage-fed lagoons to raise 20% of its fish needs and Hong Kong raises 40% of its demand for fish (Smit et al. 1996, p.109). Despite these successes, Mougeot points out that “[w]orldwide, most [urban agriculture] still remains largely unrecognized, unassisted, or discriminated against, if not outlawed or harassed, even in years of food shortage. However, several governments are
creating agencies to manage [urban agriculture] and some governmental and other organizations are actively encouraging the activity." (Mongeot, 1994)

Urban Agriculture in Industrial Nations

Obviously, the situation in Western, industrialized nations is very different. We have an adequate supply of food at present although as Graham Riches (1996) has shown it is by no means universally accessible. However, for reasons stated earlier, the food security that we enjoy is not guaranteed to last as global populations expand and soil fertility declines. Now is the time to develop local systems of food production that will ensure continued food security far beyond the next century. There are also the pressing ecological concerns of sustainable development that are forcing us to reconsider the way in which food is produced for cities.

Urban agriculture has the potential to address many of the concerns of sustainability. These include: environmental concerns over soil loss; air and water pollution; excessive resource consumption and habitat destruction; economic concerns such as high unemployment and unequal distribution of resources; and social concerns such as health, food access for low-income citizens, and the empowerment of local communities to make choices about food production and consumption. There are, however, a number of potential problems associated with urban agriculture that need to be overcome.
Constraints and Opportunities Associated with Urban Agriculture

LAND AVAILABILITY

Competition for land in most cities is fierce. Canada, has suffered less than its southern neighbour from the abandonment of inner-city areas and therefore the amount of vacant land available for food production is small. It may seem that growing food, because it does not generate a large income stream for the amount of land used, is an inappropriate use of much sought-after land. Opponents may ridicule urban agriculture as not being economically viable. In one sense this is a fair criticism and in a purely market-led society it is unlikely that urban agriculture would exist for precisely the above reason. The market, however, is flawed and planners often intervene in the workings of the market to promote the values of environmental and social good. As I have argued, the environmental and social costs of our food system as currently organized, are inadequately accounted for. The numerous benefits of producing food in cities make this interference in the market-place worthwhile and could include zoning land specifically for agriculture use.

There are four reasons why city land might become available for use by urban farmers:

1. We should remember that not all uses in the city are determined by purely financial means. Parks exist because we have made a conscious choice not to develop these green spaces for the sake of our health and relaxation.
2. There are also some spaces that are simply not suitable for building and some of these may be suitable for urban agriculture. These may include rights-of-way such as along the Arbutus Rail-line, excessively steep areas, and rooftops.

3. Temporarily vacant land, such as vacant city lots awaiting development, may offer an opportunity for short term food production although a year’s lease would be an absolute minimum duration of tenancy. Ideally food production requires longer periods than this to become established and to improve soil fertility.

4. A fourth possibility, that is rarely explored, is zoning land for the purpose of food production. This would add a level of permanence to the activity of food production and diminish land speculation that can drive land prices beyond the reach of urban farmers.

A list of spaces where we might grow food in the urban environment.

Backyards

Rooftops of residential, commercial or industrial buildings

Community Gardens in Parks, Vacant Lots (private or city-owned), or School Grounds.

Container Gardens on rooftops, balconies, decks, windowsills or hanging on walls

Roadside verges in quieter neighbourhoods

Floating barges

Urban commercial greenhouses

Land zoned specifically for agriculture
Community Gardens

The City of Vancouver has 580 community garden plots and Greater Vancouver has a total of about 2000 plots in 21 operating community gardens (Connolly, 1997). Other cities provide for a much greater involvement in community gardens - Berlin, for example, has more than 80,000 gardeners who lease plots on land where buildings were destroyed in World War II (Nelson, 1996). Metropolitan Montreal has 6,278 garden plots which are attended by some 10,000 residents, 1.5% of the city’s adult population (Ville de Montreal, 1994). The success of the Montreal example seems to stem partly from the fact that the municipality hires three animateurs whose job is to actively promote community gardening and provide advice, education and site identification. Montreal has a zoning designation for community gardens which gives a much-needed sense of security to those involved in this activity (TFPC, 1997). In New York a municipal agency called “Green Thumb” makes more than 1000 vacant lots available to community groups and urban gardeners (Smit et al. 1996).

Rooftop Gardens

Monica Kuhn (1997) reports that:

In some parts of Germany, new industrial buildings must have green roofs by law; in Swiss cities, regulations now require new construction to relocate the area of green space covered up by the building's footprint to the rooftop - and even existing buildings, some hundreds of years old, must convert 20% of their roof space to pasture! This has spawned a whole new industry which specializes in lightweight growing mediums, filter cloths, roofing membranes, plant stock, and how-to books and kits; nurseries, designers, consultants, and contractors have been forced to relearn and re-adjust in order to compete in the new market, with the result that they now have more and varied work.
In theory just about any plant can be grown on a rooftop garden including small fruit trees. Rooftop gardens can take advantage of the heat output of a building which can extend the growing season by as much as three weeks and it is common in winter for the soil of a rooftop garden to be 5 to 10 degrees Celsius higher than soil in the surrounding landscape. This additional heat input makes it possible to grow palms, figs and vines in temperate areas (Scrivens, 1980; as cited in Brownlie, 1990). Rooftop soil also improves building insulation and reduces heating costs. The presence of vegetation on rooftops can improve the local micro-climate and reduces the heat-island effect. The roof acts like a sponge and the absorption of rainfall reduces the pressure on the storm-water and sewer system. Roof gardens can be places where residents, who would otherwise never meet, congregate for social activities and rally around the common interest of gardening. Soil can also extend the life of a flat roof by protecting the waterproof membrane although careful consideration has to be given to the materials and construction methods used.

There are a number of factors that need to be taken into account when deciding if an existing roof is adequate for installing a rooftop garden or designing a new building. These are:

(i) the type of membrane used for waterproofing purposes. Roofing membranes are nowadays of high quality and tend to be far more durable than those of two decades ago. “If of suitable quality and laid as a three layer system, should prove capable of lasting 50-60 years for asphalt and 20 years for bitumen (Brownlie, 1990).

(ii) the load-bearing capacity of the roof - a conventional soil profile at a depth of one metre will impose the considerable load of 2 tonnes/m². According to Brownlie “[r]oofs of
commercial buildings are generally built with the same load-bearing capacity as that of other floors in the building and may thus require little, if any, additional structural support for a roof garden. Roofs of residential buildings, however, have a relatively low load-bearing capacity” (Brownlie, 1990). When planning a roof garden it should be noted that the load the garden will impose depends mainly on the thickness of soil but also whether any large trees or rainwater storage barrels will be used (large point loading) and whether any live loads in the form of heavy machinery or people will be present. Generally live loads can be expected to be around 1.5 KN/m² giving a total load of around 5KN/m². Where weight is a serious problem that cannot be easily overcome, hydroponic systems can be used or we can make use of extremely light growing mediums. It is also possible to use the snow-load capacity of the roof which isn’t needed during the growing season.

(iii) **irrigation method and drainage** - an adequate means of watering the garden needs to be in place especially considering that the thinner soils and higher winds on a roof garden will mean rapid drying. This could be either a rainwater collection and storage system, could use municipally supplied water, or better still from a sustainability perspective, would be to re-use waste-water from the building.

(iv) **wind protection** - roof gardens need protection from the wind especially if they are on higher buildings. This is necessary to prevent rapid drying of the soil, trap warm air in the garden to facilitate growth and to prevent plant damage.
A number of rooftop gardens already exist in Vancouver but few seem to be used for growing any food. The ability to grow food producing crops in these spaces may well be impeded by the requirement that adequate vegetation is planted by the developer *prior* to completion.

How would we encourage a rooftop greenhouse business operation? We need to consider how to transform this attractive idea into a reality. Obviously there are certain costs involved in rooftop production compared with a ground-level operation. These include:

1. The cost of structural adjustments/enhancements to the building.
2. The limited size of the area involved (this may be inadequate to run a competitive business)
3. The inconvenience of accessing a rooftop facility eight or more storeys above the ground.

These disadvantages would add costs to the business but could be offset by

1. Close proximity to point of sale.
2. Reduced heating costs due the re-use of buildings heat
3. Government interference into the cost of using rooftop space i.e. A requirement that all rooftops be used to grow food and/or a zero (low) property tax for rooftop space used to grow food.

*Vertical Gardens*

Because space is limited in the city we need to devise ways of using vertical space more efficiently to produce food. Just as buildings get taller in areas of expensive land so too must...
food growing areas. As long as the requirements for sunlight, nutrients and access for harvesting can be met, plants can be stacked vertically to create greater yields from the same land area. Growing food on vertical walls, trellises, and in vertically stacked containers could be a significant contribution to food production if the techniques necessary can be acquired.

This type of approach is crucial for urban agriculture and is currently being demonstrated by the "Living Wall Project" which has a vertical container garden at the Vancouver Aquarium.

**Fruit Trees in Parks**

Vancouver Park’s Board Street Tree Department is responsible for the planting and maintenance of the city’s 1,400 km of streets with over 100,000 street trees currently growing on them. Each year a further 4,000 street trees are planted, one third of which are replacements for trees that are lost to disease, old age, development or storm damage.

Redbud, Crabapple, Cherry and Plum are all on the list of recommended street trees for Vancouver but generally the non-fruiting cultivars are used. There is the potential, if the will exists, to plant cultivars that could produce an abundance of food for bird, animal and human populations. The current policy, however, is to plant non fruit-bearing trees. The problem of unharvested fruit rotting on sidewalks or in parks is a real one and innovative approaches to stewardship by local residents are needed to ensure that pruning is undertaken correctly and harvesting is done at the right time. A block or neighbourhood group could negotiate a contract with the city whereby it would agree to manage the trees for a number of years. In return the
group would derive the benefits of the fruit harvested from the trees including the right to sell any surplus not required by the group. At Village Homes in the City of Davis, California, the residents now produce and sell enough fruit from their street trees to be able to pay for the maintenance of their remaining public open space. Some cities also grow fruit trees in their parks - Stockholm, Prague, and Bangalore grow up to 25% fruit trees in their urban parks (Garnett, 1996).

Fishponds

The raising of fish for food consumption is an approach that needs to be examined carefully for acceptability and environmental benefits and problems. Fish have few of the nuisance problems associated with raising other creatures in the city. They do not smell, grunt, bite or attract flies. Fish could provide a vital protein component into the diet of the residents. As shown already, some species can be raised very intensively. There is adequate space to establish aquaculture ponds that could produce much of the fish required by the residents at South-East False Creek if this were done very intensively. False Creek itself should probably not be used for this purpose as it is poorly flushed by the tides making the fish susceptible to disease and leading to the contamination of the water. Rather the ponds should be land-based and self-contained. The idea of using sewage to feed these fish should be explored further as this is an idea that has been pursued very successfully in other countries such as China and India.
Space for Keeping Small Livestock

Rabbits, Chickens and goats are also possible protein sources. Of course many people will laugh or gasp with horror at the suggestion but as already mentioned animals can be an important component of an integrated mixed-farming system that effectively recycles wastes and conditions the soil. There are some real problems of perception to overcome and also the practical considerations of noise (Cocks crowing at dawn), flies and smell to deal with. The recent outbreak of so called “bird flu” in Hong Kong has probably sounded the death-knell for animal rearing in the city, at least for a while.

Many animals need a large quantity of bulky food so it would not be practical to grow the fodder for most live-stock on the site. However, animals can be fed garden and kitchen wastes and this can supplement imported commercial feed (Farallones Institute, 1979).

Lack Of Economic Incentives To Produce Food

Food is cheap - too cheap many say because the price does not properly reflect the subsidies that have been used to support commercial agriculture and the damage done to the environment by energy intensive and polluting farming practices. Until the full-costs of production and waste assimilation are accounted for, ecologically damaging products will continue to be cheaper than responsibly grown, organic products.
Growers also tend to dump certain products on the market in order to gain market share and force other growers out of business. Food pricing is a highly charged political issue. The costs of food to consumers are determined by many factors some of which are: The level of government subsidies; the costs of inputs to the production process especially land, and fossil fuels and fertilizers (affected by the price of oil); the scale of production; the success of the years harvest; the price paid for the crop by the wholesaler (Wheat board etc.); the seasonality of the crop; the costs of transportation; the price of labour in the producer country/region; the wholesalers profit margin; and the retailers profit-margin.

There is also the issue of time. Many urban professionals work long hours and have demanding jobs. Many will have little time or inclination to spend several hours a week to tend community or backyard gardens. The desire to reduce the amount of yard maintenance to a minimum can be seen in the simplification of front and backyard landscapes which are often turf, gravel and a few ornamental bushes. Urban agriculture is obviously not for everyone but judging by the number of people on community garden waiting lists in Vancouver there is certainly a great deal of interest in this activity. It seems to me that people who wish to live in a "sustainable community", as proposed for South-East False Creek, will be more likely to have interest in this activity than others. If the benefits of urban agriculture are widely publicized by the city and residents are encouraged to garden there should be no shortage of willing participants.

At the same time it will also be necessary to build urban agriculture businesses than can engage in for-profit food production. The scale of these operations will necessitate larger pieces of land
and a number of financial incentives will need to be available to encourage people to start urban commercial greenhouses that can produce food for South-East False Creek and the rest of the city.

Most urban food production is at present, not for profit. It is mostly done by people for their immediate family's food needs. There is, frankly, little economic incentive to grow your own food and growing for profit (or at least to earn a living) is problematic in urban areas because of high land prices and restrictive regulations. What is clear is that economic incentives are needed to increase the presently small but important level of urban food production.

Part of encouraging urban agriculture entails creating a regulatory and taxation regime in which the full-costs of producing food are recognized and accounted for. This is primarily a provincial and federal responsibility and means increasing taxes on resource consumption and imposing penalties for pollution associated with transportation and fertiliser use. We also need to take into account the detrimental health and ecological effects of the business-as-usual approach to food production and processing. Health problems (which represent a real cost to society) are caused by pesticide residues in food; chemical inputs at the processing level; and reduced nutritional quality as a result of transportation, processing, and the deliberate emphasis placed on appearance and durability of food as opposed to its nutritional content. There are also the unknown effects of genetic manipulation and food irradiation. Until these effects are fully accounted for, the economic balance will be tipped in favour of the agri-business sector and away from the local, small scale organic-producer. Consequently, food produced in a
sustainable manner will be over-priced and under-valued. However, while we wait for higher levels of government to catch up, municipalities can encourage food produced in a responsible way through the following means:

**Encouraging Job Creation**

If urban agriculture is to provide full-time paying jobs then we need to think seriously about how to encourage horticulture businesses at South-East False Creek. If urban horticulture is to become a major contributor to community’s food needs then we have to make land available for this purpose that will not have to compete with other higher value uses. This means zoning land specifically for that purpose.

**Capital and Credit**

As urban agriculture becomes more sophisticated, lending institutions will become aware of the financial possibilities involved. However, until this happens difficulties in obtaining sufficient capital and credit to start an urban food production business may forestall many initiatives.

Preferential property-tax rates could be given to urban food producers. For low-income citizens, the establishment of micro-credit enterprises and peer lending circles such as those springing up in developing nations could be a great catalyst for small-scale urban food production.
Making food affordable and accessible

As pointed out earlier, the large proportion of the cost of food comes from the processing, marketing, storing and retailing components of the food industry. The scales of production of agribusiness has made food more affordable for many people but this has come as the cost of health, jobs and sustainability. If we are to provide food produced in the urban environment that is cheap, healthy and nutritious then this food needs to travel more directly from producer to consumer. There are a number of ways to achieve this.

Growing some of your own food is, of course, a simple way to save money and produce extremely fresh food.

Over the last few years food box schemes have become very popular in urban areas. Food boxes schemes usually supply organic fruit and vegetables (and other organic products) direct from the farmer or wholesaler and delivered to the consumer. The costs and profit of the retailer are thus eliminated. Many of these schemes actively promote the benefits of organic farming and where possible use local produce that benefits local producers. Vancouver has its own food bag scheme.

Community Supported Agriculture - CSA’s are another growing phenomena that has great benefits for the small, organic farmer. Recognizing that small, local farmers are struggling to survive financially and at the mercy of fluctuating markets and the weather, community supported agriculture allows the community to share in some of the risks and benefits of
farming. Consumers buy shares in the years produce at the beginning of the season and share in the harvest. The system often involves members of the community working for a few hours on the farm so as to increase the awareness of farming practices.

In the urban realm this same system could work very well. Consumers could buy shares in a market garden operation and help finance some of the start-up costs of the operation and share in some of the risks of an early experiment. They would have the benefit of seeing exactly where they food was produced and what methods were used and would have the ability to persuade growers to use ecologically benign methods.

**Farmers Market’s** - The East Vancouver Farmers Market, concentrating on the selling of locally produced, organic fruit, vegetables, mushrooms and crafts, was started in the summer of 1995 in the car park of the Croatian Cultural Centre at Commercial Drive and 17th Ave. Small scale local producers from the region paid a small amount to have a stall and market their produce. The project was extremely popular with the public and consequently is now an annual event. Establishing this market was not, however, without its bureaucratic problems. For example, the Vancouver Health Department was initially against the idea because they could not control the quality of the food being sold.

Further west, beside False Creek, is the hugely successful Granville Island Market which attracts many local farmers and is a magnificent example of a food market atmosphere. Urban farmers at South-East False Creek could certainly sell some of their produce at this location but
more local farmer's market, which catered specifically to the needs of urban producers would be beneficial. Urban farmers need a leg-up to make food production viable and this is one of the roles that a simple, weekly farmers market could play. There are also thriving farmers markets in Nelson, Mission, Southern Vancouver Island has several successful projects and there are plans for a South Vancouver Farmers Market underway.

Farmers markets are an excellent opportunity to encourage small, local, organic producers. They have an important community building capacity and can stimulate the local economy by providing opportunities for urban gardeners and crafts people, keeping wealth within the community rather than seeing it pour out to distant corporations. One of the most attractive qualities of these markets is the vitality they add to the public realm. The hustle and bustle of a market environment creates an exciting, dynamic place to be. Let us be clear though. If farmers markets are to make a major contribution to the local economy and sustainability there has to be many more of them so that people can purchase their food locally without having to travel huge distances. They have to really challenge the virtual monopoly of supermarket chains in providing food.

We should create a policy of actively encouraging weekly farmers markets on city owned (and other) land so that everyone in the community has easy access to fresh locally produced food. This objective would be consistent with the objectives of CityPlan to have a city of neighbourhood centres where each centre offers the requirements for daily living. These should be true urban farmers markets selling primarily fresh produce.
Food distribution co-operatives

In Japan, cooperatives (called Teikeis) have been set up that collect, distribute and sell the produce of thousands of local farms and allotment gardens. This is one way to make small-scale urban agriculture an economically sound activity and provide the market for food produced on a micro-scale.

Local Exchange Trading Systems

A Local Exchange Trading System (LETS) allows its members to trade with other members without the need for national currency. It is essentially a form of community money that goes beyond the limitations of barter and would fit in well with any urban agriculture project. Gardeners/producers could sell their produce to other members of the scheme who in turn could sell their labour to dig allotments or water when someone was away.

Turning Waste into Food

One of the most crucial aspects of sustainability is reducing the amount of waste that the city produces. I will therefore give this topic a fairly comprehensive treatment. Organic waste actually represents the mined fertility of our soils - if this fertility is to be replaced and maintained then it is crucial that the nutrients contained in our waste be returned to the soil. Household waste (both solid and liquid) contains virtually all the nutrients plants require.
(Nitrogen, Potassium, Phosphorus and other micro-nutrients) (National Research Council, 1996). Urban agriculture offers a great opportunity to use these otherwise wasted nutrients.

The City already has a progressive composting program in operation although this is rarely linked decisively to urban food production. There are also a lack of incentives and disabling regulations that mean that recycling waste-water and sewage at a local level is problematic. For example the use of composting toilets is illegal and there are no incentives to use alternative local treatment systems such as solar aquatics sewage treatment which can facilitate the use of wastewater for food growing and irrigation. Figure 4 illustrates the multitude of possibilities for reusing and recycling waste for the purpose of food production.
Figure 4 - Food from Waste: options for recycling and reusing the municipal waste stream
SOLID WASTE

Vancouver already has one of the most progressive composting programs in North America.

This includes the following initiatives:

Home Composting

The GVRD has developed a number of demonstration gardens where organic gardening and composting techniques are demonstrated to the public. Composting can reduce the typical household waste stream by up to 30%. The GVRD supports the municipal compost bin distribution program and has produced a number of explanatory and educational resources. To encourage composting, Vancouver and sixteen other local municipalities offer compost bins for sale at a highly subsidized price ($25 in 1996). This program seems to have been an outstanding success - 88,000 bins have been distributed in the region so far (16,000 in Vancouver) and 70% of these are used on a regular basis (Angus Reid, 1996). This has resulted in the diversion of, on average, 250kg/person/year and means that 22,000 metric tonnes of organic waste per year has been saved from the landfills. However, with the total residential organic waste stream amounting to 210,000 tonnes per year there is still much room for improvement. Vancouver also subsidizes worm composting bins ($25 in 1997) which comes with a free demonstration workshop. These are ideal for apartment dwellers who previously would have been unable to compost due to lack of suitable space.

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Urban Agriculture: The Potential for South-East False Creek 95
Municipal Composting

In some situations composting is done better at a larger scale. Some materials, such as yard waste are difficult to break down using a home composter but can be efficiently dealt with using a municipal system. Each fall Vancouver collects leaves from residents' backyards in special Kraft paper collection bags. These are then turned into compost. In 1994, a total of 5,000 tonnes of leaves were collected for composting at the City's composting facility. The compost meets the criteria for unrestricted distribution as described in BC Ministry of Environment, Lands and Parks' 'British Columbia Production and Use of Compost Regulation'. Following processing, the compost is sold to the City's Park Board and landscapers, primarily as a landscape mulch. This compost could, no doubt, be used as a valuable soil amendment for growing food although at present this does not seem to happen.

The macro-scale efficiencies of centralized composting do not take into account the full costs of transporting the material back and forth from the facility. Home composting and smaller scale neighbourhood facilities tied into community gardens and parks would reduce the transportation requirements and also allow the process to become more transparent and integrated with food production. South-East False Creek should contain its own composting site especially since few people will have their own backyards.
SEWAGE AND WASTE-WATER

There is an exciting opportunity to close the loop of production in, partial consumption, waste out. At present we are literally flushing a valuable resource down our sinks and toilets.

Eventually this potentially valuable food fertilizer is combined with chemical pollutants from storm run-off which are discharged into the Fraser River or Pacific Ocean and becomes a damaging pollutant affecting marine and lacustrine ecosystems. This material could be used at source, on backyard gardens through the installation of compost toilets (which break sewage down into a safe compost). Waste-water could be utilized for irrigation after ultra-violet treatment to remove pathogens, or used in aquaculture to produce fish and shellfish suitable for human consumption. If this idea sounds outlandish it is worth considering that Hong Kong, the world’s densest city, produces 40% of its own demand for fish and Calcutta raises one fifth of its fish demand in sewage-fed lagoons (Smit et al. 1996).

Utilization of composted sewage-sludge in urban food production.

“Sewage sludge contains all the elements essential for the growth of higher plants.” (National Research Council, 1996). Many municipalities are now composting waste sludge left-over after treatment of sewage. In other cases treated sludge is applied directly to farmland. Previously this material was destined for the land-fill. This material could be used for food production and indeed the city of Milwaukee manufactures its sewage sludge into a sterilized fertiliser that they call Milorganite™. The use of bio-solids in food growing applications does not pose great technical problems but at present the GVRD declines to use its Nutrifor™ product for food.
growing because of the perception of growing food in composted human waste. The negative perception of growing food using human waste is a major obstacle to sustainable communities. It could be that our eschatophobic tendencies are too severe to attempt this at present.
Municipal sewage sludge can contain high concentrations of heavy metals and these may build up to toxic levels after a number of applications. These heavy metals originally derive from industrial and automobile sources because domestic sewage is combined with storm-water and
industrial discharges. If these components of sewage at South-East False Creek were separated they could be treated and composted at a more local level and the problem of heavy metal contamination would be lessened or removed altogether. Nutrifor is currently used for silvicultural and land reclamation projects.

The Use of Treated Waste-Water for Crop Irrigation.

The other by-product of conventional sewage treatment is effluent or waste-water. This is also rich in valuable nutrients especially nitrogen, and if treated (with chlorine, ozone or ultra-violet) it can be used for crop irrigation (National Research Council, 1996). For this to be effective for urban agriculture means that alternative, local, small-scale sewage treatment systems need to be used. One of these is described below.

Solar Aquatic Sewage Treatment Systems

Solar Aquatic™ sewage treatment mimics the natural purifying processes of meadows and wetlands using bacteria, algae, plants and aquatic animals. The process is accelerated using controlled greenhouse conditions and hence uses less space than an outdoor system of comparable treatment capacity. This system can produce tertiary level treatment, using no harmful chemicals with no unpleasant odours and is a visual treat which attracts many visitors (Farrell, 1996). Systems are up and running in Bear River, NovaScotia and in British Columbia. Eco-tek Wastewater Treatments Inc. operate a system near Parksville on Vancouver Island.
As mentioned above, fish are a vital component of the solar aquatic system and could also be grown for human consumption, adding much needed protein into the diet. For further details about raising fish that can be used to treat waste-water and can also be fed food wastes see "techniques and approaches."

**Grey-water**

Solar Aquatic systems can also be used just to treat grey-water (from sinks, showers and baths) and much less space is required for this than treating the total waste-water output as there are less nutrients to process. There are some restrictions about what sort of household cleaning chemicals can be used. Grey-water treatment can also be achieved using storage tanks and reed-bed systems. The C.K. Choi Building at The University of British Columbia, a 30,000 sq. ft. office complex, uses such a system. A subsurface, grey-water recycling system with phragmite (tall grasses), cleanses the grey-water which is used for on-site irrigation. The building also utilizes composting toilets and urinals for human waste disposal which are perhaps the simplest solution to the problem of human liquid waste treatment and re-use.

The fear of pathogenic contamination needs to be addressed with grey-water systems. Although there are no documented cases of disease caused by the use of grey-water in the US, public health officials have been very careful in restricting its application. In California and twenty-two other western states (where severe droughts have led to municipally-endorsed grey-water
use) grey-water is not allowed for the irrigation of annual vegetables. Perennials, however, can be irrigated as long as surface pooling is avoided by using sub-surface drip-lines or leach fields nine inches or more below the soil surface. This is so that contaminated water will not come directly into contact with the human body (Kouric, 1995). At South-East False Creek grey-
water could therefore be used to irrigate perennial fruit bushes and trees in public parks and in community gardens.

**Water Conservation**

"The City of Vancouver has developed the *Water Conservation Program* to educate citizens about the principles and practices of natural cultivation of the land that conserves water. These methods include contouring of the ground, soil conditioning using compost, collection of rain water, the use of native plants, and passive watering." (Wadell, 1997). Water shortages in 1996 meant that water restrictions were imposed in Vancouver from June 1st to September 30th. During that time sprinkling was allowed only twice a week. It is estimated that 40% of demand for water during the summer is for garden irrigation. Recognizing this, the City is selling subsidized, recycled, 75 gallon, plastic rain-water barrels. They are available to Vancouver residents for $68.05 (half the regular price).

The City of Vancouver is also undertaking a *Down-spout Disconnection Pilot Project*. This project is looking at the feasibility of disconnecting residential rainwater down-pipes from the combined sewer system. The rainwater is simply discharged onto the yard where it soaks into the soil. This simple solution could redirect millions of gallons of rainwater from the (already stretched) combined sewer system and prevent untreated sewage entering False Creek, English Bay and the Fraser River.

At South-East False Creek there will likely be five acres of rooftop that could collect rain-
water and efforts should be made to collect and store much of this for summer irrigation.

Those buildings nearest to community gardens and commercial greenhouses are an obvious place to concentrate this effort. Rooftop gardens are prone to excessive drying due to high winds at increased altitude. Every effort should be made to collect and store rain-water in-situ to minimize the amount of municipally supplied water for irrigation.

As already discussed, residential Sewage (including black and grey water components) represents a huge potential source of nutrients and irrigation water for the production of food.

For this resource to be safe and effective means that it needs to separated from the storm-water and industrial-flows that can contaminate it to an unacceptable level. Encouraging local, small scale treatment systems can create a safe and easily accessible resource. Integrating treatment systems with the production of food means that costly transportation of material is not necessary. The fledging city policies of disconnecting down-spouts and subsidizing rain water barrels are good first steps in this direction. The adoption of biological treatment systems for sewage and grey water at a neighbourhood or individual building scale could further this cause.

Builders and owners need incentives to start implementing these ideas. One way to achieve this would be to stop insisting on main sewer connection and deducting the sewage component of the municipal tax if a safe, local alternative can be demonstrated. This will require close cooperation between GVRD, health, engineering and planning departments to establish regulations that reflect new technologies and opportunities. At present, heavy water usage is
subsidized by municipal and regional government. A user-pays principle would be an incentive to re-use water.

**INCOMPATIBLE LAND USES**

Food production can be seen as a noxious use, detrimental to the public good. For example, smells from mushroom growers or small animals may be unacceptable for local residents. Care also needs to be exercised so that any chemicals or organic fertilizers used do not pose a threat to human health through water contamination and air pollution.

**UNCERTAINTIES OF TENURE**

Establishing a garden or small farm is a time, capital and labour intensive occupation. There needs to be a guarantee of tenure to any temporary tenant to make this investment worthwhile. Planners can help facilitate lease agreements between tenants and land-owners to ensure a degree of tenure security.

**PERCEPTIONS**

One of the major obstacles to growing a lot of food in the city is that many people think of it as an inappropriate use. Although public perceptions do seem to be changing, an educational program to highlight the benefits of urban agriculture is necessary for broader public
acceptance. This problem is highlighted by the mixed reaction to the Park's Board “Community Gardens Policy”. Although the majority supported the idea of forming community gardens in park space, many people felt that gardens were an inappropriate use in a park because they were a private use in a public space.

**POLICY/REGULATORY BARRIERS**

Certain city by-laws and zoning regulations impede the development of sustainable food production systems. In most areas (all but RA-1, HA-1 and HA-1a zones) of the city, commercial greenhouses, field crops and nurseries are not allowed uses. The by-law against keeping small farm animals in the city reduces the capacity to recycle waste and produce a protein component to the diet. The insistence that all residential dwellings be connected to the mains sewer system impedes the ability of forward-thinking individuals to do their bit for sustainability. The flat-rate for most residential household water means that there is little incentive to adopt conservation strategies. The GVRD has plans to implement water metering in all municipalities but this is a costly endeavour in the short run. The policy of using non-fruiting cultivars as street and park trees also needs to be re-considered (Vancouver Park's Board).

**THEFT AND VANDALISM**

Many community gardens report substantial losses from theft and vandalism. This can discourage gardeners from bothering to garden at all. Reports from Montreal suggest that those
gardens with overlooking residential buildings have far fewer problems. Integrating community gardens into housing developments may reduce this problem as will clearly stating the unacceptability of minor pilfering from community gardens.

**SOLAR ACCESS**

In dense urban spaces land may well be in shade for substantial periods of time each day. Most fruits, herbs and vegetables need good solar exposure in order to produce a heavy crop. Inadequate sunlight produces "leggy" plants that may be reasonably nutritious but look very unappealing and produce smaller yields. It is therefore necessary to consider solar access when reviewing designs if there is any intention of growing food. Rooftop gardens are one solution that creates maximum exposure to sunlight - so much so that partial shading may be necessary.

**POLLUTION AND CONTAMINATED LAND**

Disused industrial sites do offer the potential for food production but great care needs to be taken in properly testing and remediating these sites. Partnerships between government, academic institutions and the private sector may prove fruitful in these situations. Bio-remediation (using plants to take up toxic waste) is a current area of research that has great potential. Air pollution, as well as a major contributing factor to human ill-health may also be detrimental to plant growth if too concentrated. Heavy metal contamination of food plants may be a problem in areas of high vehicle traffic.
LACK OF SKILL

Lack of gardening skill may be a real problem in the city where most people have had no experience of agriculture. Many people are, of course, adept at vegetable gardening but the degree of skill varies widely and so do the results obtained. Gardening without pesticides and chemicals may require more thought and knowledge than its chemically intensive cousin.

ECONOMIC DILEMMA - NUTRITIONAL VALUE VS. ECONOMIC VALUE

The economic strategy of adding value to products can reduce the nutritional value of food. Value-adding means processing food to a greater degree which tends to reduce the nutritional value of the food and of course increasing the cost to the consumer. We therefore need to balance the needs of a strong economy with people's nutritional needs.

POLITICAL BACKLASH FROM FRASER VALLEY GROWERS.

If we start to grow large quantities of vegetables in the city and start to become more self-reliant for food then it may decrease the profits of Fraser Valley growers to some extent. This may be a political hot potato as farmers are a strong lobbying force in the Province. One solution may be to concentrate on foods for which there are inadequate local supplies and are therefore imported from afar, rather than duplicate the foods grown in the region.
Food Growing Techniques and Approaches

A sustainable food system depends to a large extent on the techniques used to grow the food. This is a brief overview of the potential alternatives to chemically-intensive business-as-usual approach.

Organic Agriculture

The cornerstone of sustainable food production at South-East False Creek should be organic gardening. Organic agriculture, otherwise known as restorative agriculture, regenerative agriculture, ecological agriculture or bio-dynamic gardening, is a production technique that emphasizes the maintenance of soil fertility and productivity without resorting to synthetic chemical fertilisers and harmful pesticides. Soil fertility is maintained and improved using techniques of composting, animal manures, mulching, crop rotation, biologically fixed nitrogen and cover crops. Pests and disease are prevented using techniques such as biological pest control and beneficent plant pairings (Altieri, 1989). Mulching is the use of organic materials such as straw, bark, paper, leaves around the base of plants to provide a protective covering that prevents excessive moisture evaporation and leaching of soil nutrients by heavy rain. The technique also prevents weeds and serves to add valuable organic matter to the soil, increasing its ability to retain water.

The Organic Agricultural Products Certification Regulation under the Food Choice and Disclosure Act of British Columbia empowers the Certified Organic Associations of British
Columbia (COABC) to be responsible for accrediting certification agencies. In British Columbia strict guidelines for production operation and farm management exist. Only those farms certified by an approved certification agency (in this region British Columbia Association of Regenerative Agriculture - BCARA) are allowed to market and label their products as "organic" and attach the "BC Certified Organic" label.

In some countries organic food is becoming thoroughly mainstream. Sweden has a policy to convert 10% of all farms within three years. In Denmark 10% of all food sold this year is expected to be organic and the (supportive) government is revising its goal upward to 20%. Similar moves are being made in Finland, Sweden, and Germany (Vidal, 1997). Organic methods and scales of production tend to be more labour intensive and less subsidized (in the form of cheap chemical inputs and fossil fuels for which the damage is not accounted for), and this is usually reflected in a higher cost product in the stores. However, this is simply the true, non-subsidized cost of food production. Presently we are not accounting for the full costs of food production.

**Edible Landscaping**

Edible landscaping (or food-scaping) is the conscious use of edible plants in the creation of a garden that is both aesthetically pleasing, nutritionally providing and lessens the use of harmful chemicals and resources. It is an approach to gardening that allows us to have both a beautiful landscape and healthy, fresh food at the same time. By the use of carefully selected plants it is
possible to have a garden that provides a nutritionally significant portion of our food requirements, makes a significant contribution towards reducing water, fertilizer and pesticide use and is far more visually interesting and stimulating to the senses than a conventionally planted garden. Planting drought tolerant species (xeriscape) is a way of reducing the water requirement of our gardens.

This century has seen the whole scale substitution of food-producing plants with barren ornamental landscapes of lawn and shrubs. At the same time our edible fruit and nut trees that once lined city streets, have gradually been replaced with non-fruited cultivars. For many years gardens have been developing away from the nutritious towards the purely ornamental.

Rosalind Creasey (1990), in her book *Edible Landscaping*, attributes what she calls the “edible complex” to several factors:

1. The post W.W.II shift from rural to urban environments has disconnected us from the land
2. The development of a highly efficient mechanized agribusiness industry that can produce the food we need with less than 5% of the population employed in agriculture has made backyard growing seem futile
3. The control of the landscape by developers who have little interest or incentive to accommodate food production into their sub-divisions means that buyers inherit bland, lifeless yards which have been designed for minimum cost and maintenance requirements. vii

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*Urban Agriculture: The Potential for South-East False Creek* 111
4. We have inherited a very ordered, formal taste in landscaping from the seventeenth and eighteenth century ornamental gardens in which beauty was expressed in the form of manicured lawns, shaped shrubbery and flowering ornamentals.

The environmental cost of maintaining these artificial landscapes is enormous. In 1977, it was estimated, 200 million gallons of gasoline were used just for the power equipment to mow American lawns (Niering, 1977; as cited in Creasey, 1990). Three million tons of fertilizer are used every year to keep these lawns green and, as much as India uses for its entire food production to feed 800 million people (Niering and Goodwin, 1975; as cited in Creasey, 1990). The use of water to irrigate is equally shameful. We use drinking quality water to irrigate landscapes that are unsuitable for our climate. Despite a good supply of fresh drinking water in Vancouver, this does not come without a cost. Dams have to be built and maintained. The water has to be purified and piped many miles. The infrastructural system needed to accomplish this is phenomenally expensive. Rationing of supplies in summer months is becoming more frequent as population grows. Edible landscaping is an alternative approach to landscaping that can both mitigate these negative factors and produce a garden full of food in the bargain.
HYDROPONIC GROWING

Hydroponic production is a half-century old method of cultivating plants using a soil-less medium. The true hydroponic method of growing plants in a water and nutrient solution is rarely used as it is more difficult to use than the more frequently used method of growing in a sand, gravel or vermiculite medium in beds or containers. The idea is to achieve maximum and uniform growth of plants by carefully controlling the amount of water and nutrients. The advantages of this method are:

1. does not require soil
2. can use lightweight materials that may suit rooftop growing
3. higher yields because of more rapid maturation of plants and more plants per unit area (no competition for nutrients)
4. soil nutrients are not diminished so crop rotation is unnecessary.
5. weeds are minimal as sterile media are used
6. uniform results mean greater marketability
7. automation of process is possible - less labour costs
8. closed system means that pesticides and fertilisers are not washed into water table or streams.

These are real and tangible benefits for urban agriculture but they need to be weighed against the findings of an ecological footprint study which reveals the danger of conventional economic analysis when comparing efficiencies. Yoshihiko Wada's (1993) thesis compared the ecological footprint of conventional field production of tomatoes to that of hydroponic
greenhouse production. He discovered that for the same growing areas (the amount of land that
the plants themselves occupy) the productivity of hydroponic greenhouse production is 5 to 9
times that of field production, the revenues generated 8 to 13 times higher, and the
profitabilities 2 to 9 times higher. However, when taking into account all the material and
energy inputs and the land required to assimilate the waste products he found that the ecological
footprint of hydroponic greenhouse production was 14 to 21 times higher than for field
production. In other words, to produce 1000 tonnes of hydroponic tomatoes requires the output
and services of 14 to 21 times as much ecologically productive land as is required to produce
1000 tonnes of field tomatoes. This is mainly the ecologically productive land needed to
assimilate the carbon-dioxide generated by heating the greenhouses. Despite the economic
efficiencies, hydroponic greenhouse production is grossly inefficient in an ecological sense.
What we are seeing here is the distortion of the ecological truth by the economic system.
Conventional economic accounting simply does not account for the full ecological cost of
different types of production. The increased profitability of the greenhouse farmers arises from
their ability to exploit subsidized resources such as cheap energy.

AQUACULTURE

In their book *Bio-shelters, Ocean Arks and City Farming* (1984), John and Nancy Todd who
started the New Alchemy Institute on Cape Cod, recommend solar pisciculture (raising fish in
tanks) as one viable means of protein production in the city. This, they say, can range from
small scale, residential tanks in the living room to large scale commercial applications. They
recommend the use of cylindrical translucent tanks that allow the development of algal-based ecosystems ideal for supporting fish. They have produced tilapia, catfish, trout, white amur, mirror carp and pacu feeding them on pressure-cooked organic waste and garbage. A five foot high by five foot diameter (1.5metre) tank produces up to sixty pounds of fish a year. These tanks also serve the function of trapping and storing solar energy and therefore help to regulate the temperature of a house.

The essential thing to remember when discussing any form of fish or livestock production for sustainable communities is that fish and animals are a long way up the food chain. The protein produced by them available for human consumption is therefore considerably less than that available from the food they are being fed. Therefore if we want aquaculture to make a contribution to reducing the ecological footprint of food production we cannot feed them with high grade protein that could be used for human consumption - this will only exacerbate the problem of excessive resource consumption. This is currently the situation with much fish-farming especially in the developed nations. In BC, salmon farmers use fish-feed made from inexpensive pollack or from grain to feed high price salmon. Although this makes perfect sense economically, it is ecologically ludicrous as we are losing rather than gaining valuable protein in the process. From a ecological standpoint then, we should only raise fish if we can feed them on what would otherwise be waste products and this is what makes the idea of utilising waste-water so attractive. After all, waste-water not only represents a valuable source of nutrients but also presents a major environmental and economic problem i.e. the problem of how to safely treat and discharge this waste-water.

Urban Agriculture: The Potential for South-East False Creek 115
**MICRO-LIVESTOCK**

The current city by-law that disallows the keeping of animals should be reviewed. Animals can be an important component of organic agriculture. Although not absolutely essential to the systems maintenance they enable waste to be recycled easily and their manure can be used to fertilize and condition the soil. Chickens can be used to prepare the soil and can remove harmful insect pests from the soil. Despite these advantages, South-East False Creek is probably not a good place to start experimenting with keeping animals in the city. A less dense environment where animal smells and appearances might be less offensive should be used to experiment with.

**PERMACULTURE**

Perhaps the most comprehensive approach to small-scale sustainable agriculture is the *Permaculture* system developed and expounded by Bill Mollison. “Permaculture (permanent agriculture) is the conscious design and maintenance of agriculturally productive eco-systems which have the diversity, stability and resilience of natural ecosystems.” (1990) Permaculture is a comprehensive philosophy, system of ethics and ecologically restorative techniques, many common to organic farming practices in different parts of the world but brought together in a uniquely integrated way.

- using wastes as resources
- using perennial species rather than annual species
• replacing tilling the ground with mulching
• overlapping uses to maximize productivity of vertical and horizontal space to create optimal yields - e.g. plant stacking and balancing animal and plant needs
• placing great emphasis on recycling and conservation
• placing emphasis on good site design to achieve optimal system functioning
• designing fail-safe systems that avoid total system collapse through multiple approaches and diversity.

Summary

So far I have made the case for pursuing urban agriculture in Vancouver and explained why I think it has a number of potentially significant benefits. This chapter has examined some potential approaches that have been applied elsewhere and may work at South-East False Creek. Now comes the point when I need to the proposed sustainable community at South-East False Creek to examine whether urban agriculture will be feasible in such a dense city environment.
Chapter 5: The Case Study

Having established that urban agriculture can offer numerous benefits to Vancouver I want to turn to the question of how best to pursue urban agriculture at South-East False Creek. The proposed model sustainable community, on this site in the heart of the city (see Figure 7), offers a great opportunity to realize the potential benefits of urban agriculture and to study, and eventually show-case, many of the techniques that could be applied to future developments on a city-wide basis. Sustainable development has yet to be defined by the planning department in the context of this project and it is one of the tasks of the planning process already underway. I will therefore, evaluate the potential contribution of urban agriculture to sustainable development as I defined it in chapter two.

Description and History of the S.E. False Creek Project.

The development of the idea for a model sustainable community in Vancouver has taken a number of years to unfold. The resolutions below show the significant steps in the process so far.

Significant Council Resolutions

- On October 16th, 1990, Council adopted the *Clouds of Change Report* (C.O.V., 1990) recommendations which called for planning initiatives that
  - Bring housing and employment closer together
  - Increase housing adjacent to Vancouver's Central Area: and
• The principles of energy efficient community design be incorporated into the planning of the South-East Shore of False Creek.

• On July 26, 1990, Council identified lands, north of First Avenue between Cambie and Quebec Streets on the South-East shore of False Creek as an area that should be released from industrial use.

• On December 3, 1991, as part of the Central Area Plan, council resolved that
  • Housing should be the predominant land use when planning the Southeast Shore of False Creek; and
  • The provision of housing for families with children was identified as a priority for South-East False Creek.

• On December 6, 1994, in connection with the Clouds of Change status report, Council resolved that the Special Office for the Environment liaise with Planning and Properties to explore the potential for utilizing city lands in South-East False Creek as a model sustainable development.

• On May 8th the Planning and Environment Committee recommended
  • That Council received Stanley Kwok’s report Creekside Landing
  • The director of Central Area Planning was instructed, by council, to proceed with the Council-approved planning process for South-East False Creek, with the consultancy on sustainable development as an initial activity in that planning process.
Figure 7 - Location of the site at South-East False Creek (Kwok, 1997)
Sheltaire Ltd. was chosen as the sustainable development consultant and is expected to report back in April 1998. Meanwhile the city is engaged in meetings and discussions with various stakeholders and managing an extensive public process.

OTHER CITY OBJECTIVES

"On June 17, 1975, Council established the Property Endowment Fund Board ...with the goal of generating reasonable economic return where possible, and supporting the City’s public objectives.” (Planning and Environment Committee, 1997).

Council and the Manager of Real Estate Services have made it clear that the development should produce an economically viable return on the land investment in this area. The desire to develop a model sustainable residential community and also meet this financial objective may be thwarted by the expense of remediating the contaminated soils of the site, estimated at $27million (See Kwok’s Study below).

On August 30, 1988, Council approved the False Creek Policy Broad-sheets which incorporated a number of policies for South-East False Creek including:

- Parks and public open space - neighbourhood parks should be provided at a minimum of 2.75 acres per 1,000 population in addition to the waterfront walkway.
• Community facilities and services - community facilities and services should be provided for the education, social, health, and cultural needs of the resident, employee and visitor populations including pools, rinks, schools, libraries, fire, police and daycare and the community facilities and services plan will look beyond the limits of the basin (Planning and Environment Committee, 1987).

The City’s objectives can be summarized as follows:

• to develop a model sustainable residential community (which includes, but is not limited to, energy efficiency)

• providing housing suitable for families with children.

• the provision of community facilities which provide for the education, social, health and cultural needs of all.

• the provision of adequate park space

• to ensure a sound return on the financial investment of land acquisition.

**Other Objectives and Policies**

Other city and regional policies are relevant to the formation of a sustainable community:

Energy efficiency should certainly be one of major objectives of the South-East False Creek project and the intent to aim for this is clearly expressed in Council’s adoption of the *Clouds of Change* report recommendations (C.O.V. 1990). The link between emissions of greenhouse
gases and energy consumption is undisputed and the subsequent release of carbon dioxide is the major cause of climate change. The focus of the *Clouds of Change* report is therefore rightly on reducing emissions by transportation using various measures of proximity planning, and encouraging transit use and cycling as alternatives to the private automobile.

But other important objectives need to be aimed for if the community at South-East False Creek is to be truly sustainable as I defined the term earlier:

- We should also be concerned about the depletion of natural capital such as forests, fish, and most importantly for this thesis, the depletion of the productive fertility of the soil.
- We also need to address the current level of organic and inorganic waste being produced and the deleterious effects that the disposal of these wastes has on various ecological systems not to mention the non-use of valuable, recyclable or reusable resources.
- We need to consider the degree of community cohesion and involvement and the number of jobs created.
- We should aim for the creation of complete communities which can reduce the amount of transportation.
- We also need to aim for the reduction and recycling of wastes and the provision of food security.
- There are also the considerations of the quality of our food, the quantity of water used by the community, the use of pesticides and the quality of the public open space.
Public Involvement

A great deal of interest has been expressed from a number of organizations, institutions and individual members of the public about the South-East False Creek project. This is understandable as it represents the first true commitment to try to achieve a large scale sustainable development in Canada and is the realization of many years of work, pressure and enthusiasm by many people. The South-East False Creek Working Group (a coalition of various environmental groups in Vancouver) and others have expended tremendous effort in educating the public and trying to ensure the city adheres to far-reaching principles of sustainable development that are a true departure from current practices.

Kwok's Study - “Creekside Landing”

Council decided that due to a changing economic environment for development and the cost of remediating contaminated soil, “an economic analysis of development options for the False Creek lands [should] be carried out as a first step in analyzing redevelopment of the area.” (P & E Committee, 1997). Development consultant Stanley Kwok was hired to carry out this study “not as a planning exercise, but to provide a measure of reality for the economic analysis.” (P & E Committee, 1997). The report, titled Creekside Landing, considered various development options including an industrial park, mixed industrial and residential development, and a variety of residential scenarios. The report recommends building a residential community, with towers, which assumed a density in excess of 3.0 FSR (see Figure 8). Despite this high density which may conflict with the goals of sustainable development and the objective of providing family
oriented development, the assumed profit from the development was very modest at $8 million.

This, according to the manager of Real Estate Services, is "not considered adequate compensation for the risk involved in this development." (P& E Committee, 1997).
Urban Agriculture: The Potential for South-East False Creek
SHORTCOMINGS

_Creekside Landing_ does not deal with the difficult issues of sustainability, as defined in chapter two, in any serious way. It is, in essence, little different from other recent “mega-projects” such as the North Shore of False Creek. The main concept of a dense housing development (3,750 units housing 6,500 people) does of course contribute to the sustainability of the region and adheres to the GVRD’s call for more housing in Vancouver’s Central Area. There is also provision for up to 100,000 square feet of commercial space in the development. This, at least, goes some way towards integrating residential development with opportunities for shopping and jobs - the concept of mixed-use. It is also laudably designed as a “walking” neighbourhood through the inclusion of pedestrian mews that also allow emergency vehicle access if required. Cars and parking are kept to the periphery of the neighbourhood which although contributing little to the reduction of greenhouse gas emissions will make for a more pleasant urban experience. This is what the report has to say on the subject of sustainability:

Sustainability is a key principle behind the development concept. While the criteria will be refined in the next planning phase, there is a consensus from the literature and planning practice on the subject that Creekside Landing’s vision embodies the goals for sustainable urban development. This vision is for a mixed-use, walking neighbourhood which has critical mass and a strong identity in itself, and which is also integrated with the City’s utility and transit infrastructure. Following the principles City Council has established regarding housing mix, and the provision of community facilities will reinforce the social sustainability of this new community.

However, conspicuously, there is no mention of the importance of food production to sustainability and indeed the concepts of energy efficiency, waste reduction/recycling, or
resource throughput are also absent. It is true that in a regional context, the proposed project does help with some of the goals of sustainability but there are enormous gaps which the report does not even touch on. To be fair, many of these issues will be dealt with by the forthcoming consultants report which should provide a workable definition of sustainability and what that means in this urban context.

**OPPORTUNITIES FOR URBAN AGRICULTURE AT CREEKSIDELANDING**

While the Kwok report is by no means a sustainable utopia, it is the model that the city is using as a starting point and we can expect the finished project to resemble *Creekside Landing* in terms of its major components and density. I will therefore use this scenario to examine the potential for urban agriculture at South-East False Creek. The city has indicated that the community will likely house 4-6000 people. I have therefore used a community population of 5000 people and a site area of 43 acres for all of the calculations used in this and subsequent chapters.

**Spaces to Grow Food**

There are a number of potential spaces that could be used to produce food under the development scenario described in *Creekside Landing*. These are:

- Backyards (possible, but there will probably be no private backyards in this community)
- Public park space
- Rooftop space
In order to produce food in the city we need to provide adequate space. This means we have to re-think our current approach to planning and begin to consider food production in the city as a necessary land-use. However, to simply zone large areas of land for agricultural use in the city would be inappropriate because this would conflict with the aims of creating a compact, dense city outlined in the GVRD’s Livable Region Strategy and re-affirmed in CityPlan. Rather, we need to identify currently underutilized spaces and maximize their potential for agriculture. A diversity of different spaces and approaches will maximize the micro-scale efficiency of food production in the city.

**Backyards**

There seems to be little or no space allocated to private residential backyards in the “Creekside Landing“ concept. This is in contrast to the City as a whole which is dominated by single family houses often with large backyards.

**Park Space**

The “Creekside Landing“ concept allocates 18.6 acres to park space. There is considerable opportunity in this space to grow some food. This figure is 0.725 acres over and above the
city’s requirement of 2.75 acres per 1000 population of the community. A first step could be to use this additional land for urban commercial greenhouses. Some of the remaining park space could be used for “community gardens” which are explicitly encouraged in the Vancouver Park’s Board Community Gardens Policy. This could provide a much more productive, interesting and energy-efficient landscape than the current trend of barren grass and ornamental bushes which has high maintenance costs (Hough, 1989; Creasey, 1990).

The plantings in this park could also produce food. Some or all of the trees in the park could be fruit bearing and cared for by neighbourhood stewardship groups. The same principle holds for the bushes which rather than being purely ornamental could be fruit-bearing in the tradition of edible landscaping (see chapter 6).

Rooftop Space

Some of the illustrations depicting what Creekside Landing will look like, show most of the roofs sloping in excess of thirty degrees. This would make “greening” of the roof-space very difficult and food production near impossible as access would be severely limited. However, this could be easily remedied. There is no reason why all the buildings could not have flat or gently sloping roofs. The technology to make flat-roofs waterproof for long periods of time is

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On April 15th, 1996 The Vancouver Board of Park’s & Recreation unanimously approved a community gardens policy. The policy commits the Board to helping groups find resource information on gardens, locate suitable sites in the city (which may be in public parks), develop user agreements with the owners of the selected site and develop a community environmental education program.
available and widely used. If this were done it would make approximately 5.5 acres of roof space available for food production. ix

Rights of Way

There is some opportunity to grow food along the mews and streets in the development. A starting point could be planting fruit trees and fruit bushes along the streets. Again it will be necessary to establish neighbourhood stewardship groups to look after these.

Floating Barges

There is some potential for using floating concrete barges to grow food. This would only be economical if disused barges could be located and a high value crop produced. It is probably the last possibility to be explored if adequate space cannot be found elsewhere.

Inside Buildings

Food can be grown inside buildings as long as adequate sunlight is provided for photosynthesis. Reasonable crops of bell peppers, tomatoes, herbs and others can be grown near south-facing windows.

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ix Based on 44 building sites averaging 6000 sq. ft. - These figures are used in Creekside Landing.
Inside Buildings

Food can be grown inside buildings as long as adequate sunlight is provided for photosynthesis.
Reasonable crops of bell peppers, tomatoes, herbs and others can be grown near south-facing windows.

Vertical spaces

Walls can be utilized to grow food by mounting growing containers up the sides of buildings or by stacking specially designed growing containers. This approach is being experimented with by the Living Wall Company of Vancouver.

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>Area Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backyards</td>
<td>0?</td>
</tr>
<tr>
<td>Park space</td>
<td>18.6 acres (0.725 acres more than city requirement)</td>
</tr>
<tr>
<td>Rooftop space (if all buildings were designed with flat or shallow-sloped roofs)</td>
<td>up to 5.45 acres</td>
</tr>
<tr>
<td>Rights of way</td>
<td>&gt;500 planting sites for fruit trees +bushes</td>
</tr>
<tr>
<td>Floating barges</td>
<td></td>
</tr>
<tr>
<td>Inside buildings</td>
<td></td>
</tr>
<tr>
<td>Vertical Space</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 - Summary of Spaces Available To Grow Food

Waste Production

A community of 5000 people will generate significant amounts of solid and liquid waste.
Estimating the amount of the different types of wastes produced, and calculating the amount of macro-nutrients they contain, allows us to estimate the quantity of nutrients available for crop production (See Table 3). Exactly how this waste should be treated and used is considered in the following chapter. The human waste stream from South-East False Creek could fertilize 130 -
230 acres of crop at 300 lb.'s nitrogen per acre per year (a very generous amount). So this source is more than adequate to fertilize all the food producing land on the site of 43 acres. Small amounts of fertiliser supplements may be required from off-site to remedy chemical imbalances but otherwise the community could theoretically be self-sufficient in fertiliser if a safe, acceptable way is found to use human waste.
<table>
<thead>
<tr>
<th></th>
<th>Approximate quantity - Per capita per day (moist)</th>
<th>Approximate quantity - Per capita per day (dry weight)</th>
<th>x 5000 x 365 (dry weight for entire community /year)</th>
<th>Nitrogen (%)</th>
<th>Total nitrogen available per year</th>
<th>Potassium (%)</th>
<th>Total Potassium available per year</th>
<th>Phosphorus (%)</th>
<th>Total phosphorus available per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Faeces</td>
<td>0.3 - 0.6 lb.</td>
<td>0.08 - 0.16 lb.</td>
<td>146000 - 292000 lb./year</td>
<td>5.0 - 7.0</td>
<td>7300 - 20440 lb./year</td>
<td>1.0 - 2.5</td>
<td>1460 - 7300 lb./year</td>
<td>3.0 - 5.4</td>
<td>4380 - 15768 lb./year</td>
</tr>
<tr>
<td>Human Urine</td>
<td>1.75 - 2.25 pints</td>
<td>0.12 - 0.16 lb.</td>
<td>219000 - 292000 lb./year</td>
<td>15 - 19</td>
<td>32850 - 49640 lb./year</td>
<td>3.0 - 4.5</td>
<td>6570 - 13140 lb./year</td>
<td>2.5 - 5</td>
<td>5475 - 14600 lb./year</td>
</tr>
<tr>
<td>Faeces + Urine</td>
<td>0.2 - 0.32 lb.</td>
<td>0.36 - 0.52 lb.</td>
<td>365000 - 584000 lb./year</td>
<td>11.5</td>
<td>40150 - 70080 lb./year</td>
<td>2 - 3.5</td>
<td>8030 - 20440 lb./year</td>
<td>2.75 - 5.2</td>
<td>9855 - 30368 lb./year</td>
</tr>
</tbody>
</table>

*Table 3 - Availability of major nutrients in human excreta - Adapted from Farralones Institute, 1979, The Integral Urban House*
**Food Self-Reliance at Creekside Landing**

Table 4 is based on the per capita disappearance of food in Canada during 1994/5 and shows the composition of the average Canadian diet.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Per Capita annual consumption (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables (incl. tomatoes)</td>
<td>159.10</td>
</tr>
<tr>
<td>Tree Fruit</td>
<td>56.81</td>
</tr>
<tr>
<td>Berries</td>
<td>9.01</td>
</tr>
<tr>
<td>Cereals/Grains</td>
<td>70.18</td>
</tr>
<tr>
<td>Rice</td>
<td>6.57</td>
</tr>
<tr>
<td>Sugars and Syrups</td>
<td>19.09</td>
</tr>
<tr>
<td>Pulses and nuts</td>
<td>8.04</td>
</tr>
<tr>
<td>Oils and fats (excluding butter)</td>
<td>21.38</td>
</tr>
<tr>
<td>Fish &amp; Shellfish</td>
<td>7.84</td>
</tr>
<tr>
<td>Pork</td>
<td>27.69</td>
</tr>
<tr>
<td>Beef</td>
<td>31.39</td>
</tr>
<tr>
<td>Veal</td>
<td>1.36</td>
</tr>
<tr>
<td>Mutton &amp; Lamb</td>
<td>0.79</td>
</tr>
<tr>
<td>Poultry (eviscerated weight)</td>
<td>30.50</td>
</tr>
<tr>
<td>Eggs</td>
<td>9.8</td>
</tr>
<tr>
<td>Dairy Products (Fresh milk equiv.)</td>
<td>204.07</td>
</tr>
</tbody>
</table>

*Table 4 - Per Capita annual consumption of common foods. (source Statistics Canada (d))*

To get an idea of how much land is presently required to produce each of these components of our diet, we need to look at the yields of crops and the conversion rate of animal feeds to milk or meat (See Appendix A). The results of converting our present consumption of different categories of foods to equivalent growing areas is shown in Figure 9 (and appendix A) below which actually illustrates the growing area required for the entire community i.e. the area of land currently used to produce the food for 5000 people. The values were derived from standard yields using open field techniques in British Columbia and from elsewhere when BC figures were not available.
Notice how beef uses, at present, by far the largest growing area. This is partly due to the fact that many people eat a lot of beef but also because the conversion of the protein in grain to that in meat is very inefficient. This chart illustrates the huge task of self-reliance. At present a community of 5000 requires over 2200 hectares of land to produce its food. This is in fact a conservative estimate because it does not include grazing lands which may in fact double the figure (see Table 1). Remember this is only the growing area and not the larger ecological footprint.

Clearly, we are unable to grow all the food for the community on the site simply because there is insufficient land. However, by using more intensive growing methods we could grow a lot more food at South-East False Creek than the above analysis suggests.
FIGURE 9 - Growing Areas Required to Produce Various Foods for Community Consumption

<table>
<thead>
<tr>
<th>Product</th>
<th>Growing Area (ha.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy Products (Fresh milk)</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
</tr>
<tr>
<td>Poultry (fresh weight)</td>
<td></td>
</tr>
<tr>
<td>Mutton &amp; Lamb</td>
<td></td>
</tr>
<tr>
<td>Veal</td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td></td>
</tr>
<tr>
<td>Pork</td>
<td></td>
</tr>
<tr>
<td>Fish &amp; Shellfish</td>
<td></td>
</tr>
<tr>
<td>(excluding butter)</td>
<td></td>
</tr>
<tr>
<td>Oils and fats</td>
<td></td>
</tr>
<tr>
<td>Pulses and tubers</td>
<td></td>
</tr>
<tr>
<td>Sugars and Syrups</td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td></td>
</tr>
<tr>
<td>Cereals</td>
<td></td>
</tr>
<tr>
<td>Butter</td>
<td></td>
</tr>
<tr>
<td>Tree Fruit</td>
<td></td>
</tr>
<tr>
<td>Vegetables (fresh)</td>
<td></td>
</tr>
</tbody>
</table>

Growing area required for entire community (ha.): 0
The yields obtained and therefore the quantity of food that can be produced will depend on a number of factors. These include:

1. growing methods used
2. type and relative size of the growing spaces available
3. type of food produced
4. technologies used
5. level of skill available
6. amount and quality of energy (solar and fossil-fuel) and inputs (composts/fertilisers) used

Each of these factors will influence the degree of self-reliance attainable under the development scenario of Stanley Kwok's Creekside Landing. The number of factors which determine yield make it very difficult to estimate how much food could be produced at South-East False Creek. However, an analysis of typical vegetable yields using different growing methods and estimates of fish production will at least indicate the approximate level of food production which is theoretically attainable.

Vegetable Yields of Different Growing Methods

Figure 10 (and appendix B) compares the growing area requirements for four salad vegetables using different growing techniques. Obviously people need more substantial food sources than these salad crops alone but these are the only crops for which there are reliable figures for
hydroponic greenhouse production in British Columbia. Almost all crops can be grown hydroponically and I am making the admittedly large assumption that other crops can show similarly increased yields using this method.

Examining these figures gives us some idea of how much food we could produce at South-East False Creek. Most of the data is taken from actual production figures in British Columbia and therefore these results should be replicable at South-East False Creek. The exception are the figures for Jevon's French Biodynamic Method which were produced in a warmer climate with unrealistically high levels of skill. These figures have therefore been revised downwards.

(i) Conventional horticultural and field methods produce, on average in British Columbia, 15,700 lbs of vegetables per acre (17600 kg/ha).\(^x\) Therefore, to produce only the fruit and vegetables adequate for a community of 5000 people for a year (based on consumption of 145 kg/person/year\(^{xi}\)) would require 102 acres (41 hectares) of land.\(^{xii}\)

\(^x\) Based on total 1992 BC production of vegetable crops divided by total acreage under production. Ministry of Agriculture, Fisheries and Foods. 1992 Annual Statistics.

\(^{xi}\) Figure quoted in Jevons, John. 1982. How to Grow More Vegetables Than You Ever Thought Possible on Less Land Than You Can Imagine. Although this is probably an underestimate for Canada (the figure is more like 450lb.s) I continue to use it for convenience so as to be able to compare Jevon's yields with other methods. Also it is unlikely that we could grow many of the more exotic vegetables which would continue to be imported. Therefore a lower figure is more realistic for community production.

\(^{xii}\) 5000 people X 320 lb.'s = 1,600,000 lb.'s of vegetables per year. At an average yield of 15,700 lb.'s per acre this would require 101.9 acres.
Community Gardening - the yields obtained from allotment and backyard gardens vary
tremendously as shown by the Philadelphia urban gardens report cited earlier. Various
experts have estimated the amount of land required to feed a family of four fruit and
vegetables for the year. Levenston (1980) reports that "Bernard Moore, a local garden
expert, says that 2400 square feet of land (40' x 60') will provide a family of four with 'more
than enough fresh vegetables plus sufficient to can or freeze for the winter.' Alan Littler, a
senior Ministry of Agriculture horticulturist says that 1000 square feet will feed the same
family." According to Levenston (1980), The U.S. National Garden Bureau believes that the
family of four can be fed from only 600 square feet.

Jevons (1982), researching in California, has shown that a complete nutritionally balanced
diet can be produced using an area as small as 2,800 sq. ft. (270sq metres). Therefore the
complete food needs for a community of 5000 people would require only 300 acres (121
hectares). He shows that the year's supply of vegetables and fruit for one person (he uses the
figure of 320 pounds) can be produced on an area as small as 100 sq. ft. (9.5 sq. metres). A
community of 5000 people using Jevon's method would therefore require 10.5 acres (4.2
hectares) of land to produce all its fruit and vegetable needs. This, however, assumes a very
high level of gardening skill, adequate compost, and the figures are for Californian climates
so we need too revise these production figures downwards. The high yields are achieved
using large amounts of compost and Jevon's (organic) deep bed cultivation method which
allows plants to be grown much closer together than conventional spacings. He recommends
cultivating the soil to a depth of 24 inches using the double dig method so that the roots of
plants are able to penetrate much deeper into the soil where they can find increased nutrients
and water for rapid growth.

(ii) Hydroponic greenhouse methods of cultivation can be used very intensively because the
nutrient supply and climate is artificially controlled. This method can produce 9 - 30 times
the yield of conventional open field methods and 4 - 5 times the yield of Jevon’s best results
(see Appendix A). One year’s supply of fresh fruit and vegetables (for one person) could
probably be grown using only 25 sq. ft. (2.4 m²) of greenhouse space (2.64 acres or 1
hectare for 5000 people). However, this increased yield is at the expense of a far larger
ecological footprint (Wada, 1993). Therefore, this form of agriculture is probably less
sustainable than conventional practices unless it can be supported by waste products from the
community such as the waste heat from buildings, sewage-nutrients from buildings and
passive solar gain. Eco-tek Ltd. In British Columbia is currently experimenting with this
novel approach. We should consider that even high-input hydroponic growing may be better
than importing our food from distant countries with warmer climates and the transportation
related pollution and potentially poor growing practices this entails.
Figure 10 - Comparison of growing area requirements for different growing methods.

The above analysis reveals different growing methods can produce vastly different yields (at least in terms of vegetable production). When dealing with very limited space (as we are at South-East False Creek), the high yielding, very intensive techniques of hydroponic greenhouse production and and Jevon’s bio-intensive method seem most appropriate. Achieving the yields boasted by Jevons requires high levels of skill, improved soil and full sunlight and it would certainly take time to approach his theoretical maximum yields. The yields from hydroponic greenhouses are certainly reproducible at South-East False Creek although if we are to use rooftop greenhouses then difficulties may be encountered as this is a novel and largely untested idea.
As already mentioned, if the buildings at Creekside Landing were developed with flat roofs there would be almost five and a half acres of roof space. If commercial, hydroponic greenhouse methods of growing were used, all the fruit and vegetable requirements of the community could likely be produced on the site. Combined with conventional growing in community gardens, and edible landscaping techniques in parks and along rights of way, the community could, theoretically, be more than self-sufficient in fruit and vegetables.

FISH PRODUCTION

Vegetables alone are unlikely to produce a varied enough diet for most people’s needs. Fish may be a viable source of protein that we can raise in the city. At 7.84 kg per person annual consumption, a community of 5000 people would require 39,200 kg (86,240 lb.) of fish and shellfish annually. The reported yields of aquaculturally-raised fish vary immensely (as much as vegetable yields) depending on the type and intensity of the method used. The Farallones Institute (1979) report yields of up to half a pound of fish per square foot annually under intensive culture. Todd and Todd (1984) have managed to produce up to one and half times that amount using small scale, indoor techniques and pressure-cooked garbage as feed. Ballarin and Haller (1982) report astonishingly high experimental yields from Asia using Tilapia which they say is well suited for intensive pond culture. Table 5 shows reported yields in intensive and non-intensive (open pond) culture and the space required to produce the average fish/shellfish needs of the community of five thousand people.
<table>
<thead>
<tr>
<th>Species</th>
<th>Approximate Annual Yield (pond culture)</th>
<th>Pond/Tank Space required to produce fish for whole community (5000 people)</th>
<th>Approximate Annual Yield (intensive culture)</th>
<th>Space required to produce fish for whole community (5000 people)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rainbow Trout</td>
<td>100 lb./acre</td>
<td>862.4 acres</td>
<td>0.5 lb./ft.²</td>
<td>3.95 acres</td>
</tr>
<tr>
<td>2. Sacramento Blackfish</td>
<td>800 lb./acre</td>
<td>107.8 acres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Fathead Minnow</td>
<td>1000 lb./Acre (without supplementary feed)</td>
<td>86.2 acres</td>
<td>3000 lb./Acre (with supplementary feed)</td>
<td>28.7 acres</td>
</tr>
<tr>
<td>4. Bluegill</td>
<td>300 lb./acre</td>
<td>287.5 acres</td>
<td>0.5 lb./ft.²</td>
<td>3.95 acres</td>
</tr>
<tr>
<td>5. Pacific Crayfish</td>
<td>400 lb./acre</td>
<td>215.6 acres</td>
<td>0.5 lb./ft.²</td>
<td>3.95 acres</td>
</tr>
<tr>
<td>6. Tilapia, Catfish, Trout, White Amur, Mirror-Carp, Pacu</td>
<td>up to 1.3 lb./ft.³</td>
<td>1.52 acres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Tilapia (Asia)</td>
<td>2-8 tonnes/acre</td>
<td>4.8 - 19 acres</td>
<td>up to 100 tonnes / acre</td>
<td>0.4 acres</td>
</tr>
</tbody>
</table>

Table 5 - Yields of various fish species in intensive and non-intensive culture (sources: [1-5], (Farallones Institute 1979), [6] - (Todd & Todd 1984), [7] - (Ballarin and Haller 1982)

This analysis reveals that the fish requirements of the entire community could theoretically be produced using as little as 0.5 acres of land. We should remember, however, that the more intensive production methods are energy and time intensive and require artificial systems to maintain the life support mechanisms of oxygenation, temperature and waste removal. We should also consider that fish have to eat too and the amount of protein gained from consuming
fish will be substantially less than the amount fed to the fish. Ecologically then, this only makes sense if, once again, we use waste products to feed the fish or find food sources unsuitable for human consumption. The following chapter considers the possibility of growing fish using sewage wastes.

**Summary**

This chapter has introduced the South-East False Creek project and outlined its history and intentions. I have looked at Stanley Kwok’s study *Creekside Landing* to demonstrate the potential of food production on the site and described the possible spaces where food production might occur. By examining the average Canadian’s consumption of different foodstuffs and calculating the amount of land necessary to grow this food I have shown just how much of the communities food needs might be produced on the site and which foods we should concentrate on.
Chapter 6: Pursuing Urban Agriculture at South-East False Creek

So far then, I have outlined the some of the problems that face cities and the threat to the sustainability of the food supply. Chapter 3 described the decline of urban agriculture and some of the reasons and attitudes that account for this. Chapter 4 examined some of the potential barriers and problems with producing food in the city and also identified some of the potential solutions that have been successfully applied elsewhere. The preceding chapter was concerned with outlining the specific potential for urban agriculture at South-East False Creek and establishing how realistic it would be to achieve self-reliance in food. It remains for me to make recommendations about how to proceed with planning for large amounts of sustainable food production at South-East False Creek.

Producing a large quantity of food at South-East False Creek and making that production a major contribution to a sustainable community depends on several factors which a policy for urban agriculture should address:

Producing a large amount of food that is economically viable requires:

1. Creating the space needed to grow food
2. Ensuring adequate solar exposure
3. Providing adequate nutrients
4. Providing economic incentives - providing appropriate retail opportunities, credit and capital, subsidies, appropriate levels of taxation

5. Attaining a high level of technical skill

6. Overcoming policy and regulatory barriers

**Producing that food in an ecologically sustainable way requires:**

7. Growing food as close as possible to the point of consumption

8. Re-using and recycling wastes for the purposes of food production

9. Using sustainable techniques and approaches - the methods used to grow the food will determine, to some extent, the safety and nutritional quality of the food and also have a big impact on the quality of the soil, habitat and longevity of the urban agro-ecosystem

**Making urban agriculture socially acceptable requires:**

10. Equality - the system devised and the approaches used should benefit everyone in terms of access to healthy nutritious food and not exacerbate the problems of income inequality.

11. Making land uses compatible

12. Making food safe by dealing with contaminated land and air pollution

13. Dealing with the problem of theft and vandalism

14. Overcoming perceptions that urban agriculture is inappropriate - educating the public about the benefits of locally produced food and also about the problems of the current food system will help build support, increase the acceptability of urban agriculture, and encourage people to make wiser spending decisions.
Dealing with the potential political backlash from existing farmers

Let us look at how we can meet each of these requirements by suggesting policies that the City should adopt if it is serious about pursuing urban agriculture on this site.

**Creating the Space Required to Grow Food**

Determining the amount and location of land that will be specifically designated for food production is a vital first step if we want to seriously pursue urban agriculture at South-East False Creek. We have to start land-use planning for urban agriculture so that we can set aside land for this purpose where it will not have to compete in the open market against higher value uses. The different types of urban agriculture have different land-use requirements and the best eventual land-use pattern will be a complex configuration of uses that integrate different approaches to achieve efficiencies on a micro-scale.

**Urban Commercial Greenhouses**

It has already been mentioned that the space allotted to parks in *Creekside Landing* is 0.725 acres over and above the requirements of the City. This additional land should be made available for commercial greenhouses and would produce an annual yield of approximately 225 tons of cucumbers, lettuce, sweet peppers and tomatoes worth $182, 480.\(^{xiii}\) This type of activity

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would certainly add interest and activity to the community. There may be opposition to the substitution of a commercial activity for park space although, as pointed out, the city’s park requirements would still be met. There are a number of public benefits to this approach which have already been mentioned and the idea should be sold on such merits. This land may be zoned, very specifically for this use and hence avoid competition from other higher return uses. This would require a change in previous policy as commercial greenhouses are not an allowed use in most of the city.

COMMUNITY GARDENS

Some of the remaining park space should be used for community allotment gardens. This is in keeping with the Park Board’s recently formulated community gardens policy. The total amount should reflect the interest from the community and therefore should allow for some flexible space that can go into and out of production as demand fluctuates.

- The City should adopt a community gardens policy for South-East False Creek to support the establishment of community gardens on private and city-owned land (including park space).
- School Boards should also be encouraged to form community gardens policies and to incorporate food growing into the curriculum as part of an education about the food system and how it operates.

xiv On April 15th, 1996 The Vancouver Board of Park’s & Recreation unanimously approved a community gardens policy. The policy commits the Board to helping groups find resource information on gardens, locate suitable sites in the city (which may be in public parks), develop user agreements with the owners of the selected site and develop a community environmental education program.
• Some land should be zoned for community gardens to add a level of permanence necessary for the investment of time and energy.
• There should be adequate community gardens for the demand
• The location of the community gardens should enable easy (pedestrian or bicycle) access to the nearest community garden by anyone in the community
• The city should employ one or more full-time horticultural advisors (animateurs) to promote community gardening, provide technical advice, identify suitable sites, liaise with landowners, draw up lease agreements etc.
• Maintain an up-to-date inventory of suitable land for community gardens
• Allow the products from community gardens to be sold at farmers markets and through food-box schemes
• Continue to place emphasis on organic methods of production.

**ROOFTOP SPACE**

• The roofs of all commercial and larger residential buildings should be flat and designed with enough structural integrity to withstand the use of a rooftop garden or greenhouse. As shown in chapter five this would provide more than five acres of potential growing space.
• The City should conduct a study into the feasibility of rooftop gardens/greenhouses on residential, commercial and industrial buildings. This should examine the economic expenditures and structural adjustments necessary. The city may then decide to encourage or
even require the inclusion of rooftop gardens on new flat-roofed residential developments, commercial buildings, and industrial building.

• The City should allow flexibility in height restrictions and FSR for the purpose of rooftop greenhouses.

• The City should provide advice and guidelines should be provided about how to develop a rooftop garden, capture and use rainwater, re-use grey-water on rooftops and grow food plants (i.e. useful species and cultivars that can tolerate shallow soil profiles)

**VERTICAL GARDENS**

• The City should promote the work of the “Living Wall Project” as a good example of combining Community Economic Development with the principles of sustainability.

• Designers/planners should consider the use of vertical growing space and solar access to these spaces when reviewing landscape proposals and building designs.

**FRUIT TREES AND ORCHARDS**

Some park space should be planted with fruit trees and bushes rather than the barren, unproductive cultivars favoured at the present time. There are a potential 5,000 sites for new trees at Creekside Landing which represents an incredible opportunity for urban food production.

The City should:
• Adopt a policy of planting fruit-bearing trees on streets where this is appropriate - on new sites and as trees need replacement.

• Encourage the formation of neighbourhood stewardship groups who would take on the responsibility of pruning and harvesting in return for keeping the fruit.

• Offer expert advice to the above

• Begin a policy of planting fruit trees in parks.

**SPACE FOR KEEPING SMALL LIVESTOCK**

If it was decided to keep animals they should be a good distance from the residential buildings to minimize nuisance. The extensive park space along the edge of South-East False Creek offers potential space for some livestock. Before implementing this idea the planning department should consult with residents to gauge the level of acceptability.

**Solar Exposure**

Solar exposure is not a major problem on this site even though there are some tall apartment buildings. The buildings of *Creekside Landing* are tiered, sloping downward to the North. Therefore, as long as the community gardens and greenhouses are located at the Northern edge of the site, shading will be minimal until late in the day. Rooftop gardens and rooftop greenhouses will of course have maximum solar exposure and may even need partial shading for sensitive plants and frequent irrigation.
**Economic Incentives and Market Opportunities.**

A policy for urban agriculture at South-East False Creek should create economic opportunities for people to grow food that can supplement individual incomes and generate feasible business ventures. This could range from community gardeners selling their surplus produce at farmers markets, to commercial market garden and aquaculture operations selling to grocery chains.

The City should:

- Set aside adequate outdoor space for a weekly farmers market
- Allow community gardeners to sell their produce
- Give preferential tax rates to commercial urban farmers - i.e. the property tax for an urban commercial greenhouse should be similar to that in a rural area.
- Zone land specifically for this purpose so that it doesn’t have to compete with higher value uses.

**Technical Competence/ Research and Development**

A number of the ideas presented above have yet to be properly explored in a setting like South-East False Creek. There is therefore a need for on-going research and development to discover better and safer ways of, for example, producing food from waste. In this way, South-East False Creek should act like a macro-laboratory to research and demonstrate good practice. The level of gardening skill of the residents will probably vary widely and needs to be improved if community gardens are going to approach the yields attained by Jevon’s (see chapter 5) and contribute a significant amount to food supplies. One good idea that we should borrow from
the highly successful Montreal Community Gardens is a City-hired animateur (horticultural adviser) who can advise on gardening technique and improve skill levels as well as locate and develop new gardens, and arrange lease agreements between property owners and prospective gardeners etc.

**Overcoming Policy and Regulatory Barriers**

- The city should examine the policy of not allowing commercial greenhouses or animals in most areas of the city.
- The City should zone specific areas of South-East False Creek for commercial greenhouses, community gardens and commercial market gardening.
- In consultation with the future residents the City should explore the possibility of allowing small livestock animals and fish to be farmed at South-East False Creek.

**Proximity**

Much of this thesis has made the case for the localization of agriculture and the attendant benefits so I will not reiterate these points. Urban agriculture is an important part of this approach although by no means will it alone make our food system sustainable. As well as making food production more proximal to the point of consumption at South-East False Creek we should also think about the location of food processing and retailing. A number of micro-processors could be located at South-East False Creek which would enhance community economic development and local job creation. There should also be a farmers market at the
planned community commercial centre to sell what is produced and grocery stores could also be
encouraged or contracted to sell this produce.

Food from Waste

All efforts should be made to grow food from solid and liquid wastes. The City should therefore:

- Implement community-scale solid-waste composting and distribute the compost to urban
gardeners.
- Extend and encourage the collection and use of rain-water
- Further examine the feasibility and acceptability of using sewage and waste-water in food production. This should be done on a community scale so as to avoid heavy metal contamination of the waste and to facilitate easy distribution to locations where it is required to grow food. A certain amount of land will be required for this type of approach.
- Solar Aquatic sewage treatment should be explored as a way of re-using sewage and waste-water for growing food. Firstly, the treated water could be used to irrigate crops and hence reduce water consumption. The danger of pathogenic contamination can be solved using ozone, ultra-violet or chlorine treatment. Also, if a hydroponic vegetable-growing system were incorporated into the greenhouse before the water was fully treated then the nutrients could help grow food, hydroponically for human consumption. The water would probably have to be treated with ozone to remove any harmful pathogens first.
Ecotek Ltd. estimates that “the greenhouse portion of the [solar aquatic] system requires approximately 0.13 - 0.2 square feet per Imperial gallon of waste-water per day depending on the level of treatment required. Thus a 100,000 gallon per day system (waste from approximately 1,500 people) would use 13,000 - 20,000 square feet or .3 - .45 of an acre.” (Ecotek, 1996). Therefore South-East False Creek would require up to 1.5 acres of greenhouse space to treat its sewage.

In addition, “if on-site composting of sludge and vegetation is required, a treatment area of sixty square feet per 1,000 Imperial gallons per day would be needed.” So for South-East False Creek an additional .45 of an acre would be required making a total of nearly 2 acres. These greenhouse systems could theoretically be mounted on the roofs of buildings which, in addition to saving land, could also make use of waste heat and reduce the need for expensive sewer infrastructure.

RE-USING WASTE HEAT

The waste heat lost through the roof of a building is a valuable resource and should not be wasted. Rooftop gardens (with or without greenhouses) should be mandatory so they can make use of this heat to extend the growing season by as much as three weeks. In Vancouver’s cool, temperate climate this would be an important bonus to growers. Typically the temperature of the soil on a rooftop garden is 5-10 degrees Celsius higher than in the surrounding landscape.
Wada (1993) has demonstrated that between 70% and 80% of the ecological footprint of a hydroponic greenhouse operation is due to the natural gas input used for heating purposes. If we were to locate hydroponic greenhouses on rooftops it would go a long way towards reducing the ecological footprint of this growing method. This approach certainly deserves more research.

**Using Sustainable Techniques and Approaches**

As noted in chapter 4, the type of approach used will determine to a large extent, how sustainable our urban food production will be. However, it is impossible to regulate good gardening technique but we can encourage certain approaches through both education and the regulation of certain chemicals. Encouraging innovation and experimentation and offering expert advice will quickly advance the level of skill and understanding of different techniques.

**PESTICIDE AND FERTILISER USE**

Pesticides, especially in amateur hands, can be extremely dangerous to human health. We should endeavour to regulate against the use of chemical inputs and educate people about the alternatives.

- The use of chemical pesticides should be regulated against in view of their harmful effects on wildlife, domestic pets and human beings - there are alternatives to these methods.
- The use of chemical fertilisers should be disallowed on the site in view of its proximity to False Creek.
• The use of animal manures should be carefully monitored so as leaching of too many nutrients into water bodies does not occur.

Equality

It is extremely important that urban agriculture does not exacerbate the disparity between rich and poor which is already very apparent in the city. Community gardening has been shown to alleviate poverty to a degree by freeing up meagre incomes for non-food uses. Plots at community gardens should be made available to anyone on a first come-first serve basis but it may be worth considering giving priority to those residents who can demonstrate financial hardship.

Making Land-Uses Compatible

Making land uses compatible will be essential in such a dense environment as Creekside Landing. Unpleasant smells, or visually unsightly allotments will do much to damage the reputation and future for urban agriculture. For this reason we should be careful that composts are properly maintained and gardens cleared of dead material in fall.

Food Safety

There are several threats to food safety that need to be considered at the site. The first and most obvious is the contamination of virtually all the soils on the site. South-East False Creek has
been a place of heavy industry from before this century. The legacy of this industrial activity is heavy metal contamination and PCB’s which if not removed could threaten any hope of food growing. However, the Province is requiring that the City deal with this problem which may well involve removing all the soil from the site and replacing it. If this is done then no doubt the threat of food contamination will be removed. The quality of the soil which replaces it, however, may itself, jeopardize food production. It is probably wise to test the soil when first setting up a community garden.

- The City could aid this process by offering a subsidized soil-testing service.

A second risk to food safety is from air pollution. Fortunately, since lead has been removed from gasoline, this previously important threat has been removed. However, there may well be risks from other air pollutants. This needs to be researched.

The use of chemical pesticides in amateur hands is risky to both the user and consumer of sprayed food. This is another good reason to regulate the use of pesticides.

**Dealing With Theft and Vandalism**

Theft and vandalism are small but annoying problems for most community gardens in Vancouver and other Canadian cities. This problem can be mitigated by placing community gardens where residents overlook the site. Thieves and vandals are less likely to persist in their
loathsome activities if many eyes could be watching. Some theft seems to be in innocence. Some people think that because the food is grown in a public park it is therefore public property. A sign clearly stating that the produce belongs to those who grow it will hopefully rectify this “mis-understanding”.

**Public Education**

Perhaps most important in gaining acceptance of urban agriculture at South-East False Creek, and indeed in other areas of the city, is educating people about the current threats to food security and safety and about the benefits of growing food in the city. The use of demonstration gardens achieves part of this function. The city also needs to produce and disseminate information on food security and the potential solutions of urban agriculture.

**Summary**

In this chapter I have moved beyond the general rationale and benefits of urban agriculture and have focused on the potential of the proposed model sustainable community at South-East False Creek. I have made a number of recommendations that I think the City should incorporate into a policy for urban agriculture at South-East False Creek. Each of the components necessary to pursue urban agriculture has now been considered with reference to the potential and limitations of the site. Some of the approaches and recommendations made in this or preceding chapters are simple extensions of current practice and will require only moderate effort and little change in attitudes. Others are a radical departure from current practice and may require a thoroughly
altered way of thinking on the part of planners, politicians and the public, whether they are gardeners or not. Table 6 organizes the recommendations into three categories that range from the simple to the radical. This continuum of approaches represents the potential evolution of urban agriculture as the unorthodox idea of urban food production becomes increasingly accepted and mainstream.
<table>
<thead>
<tr>
<th>Element</th>
<th>Stage 1 (simple)</th>
<th>Stage 2 (moderate)</th>
<th>Stage 3 (radical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use</td>
<td>• Community gardens in parks/vacant land • Backyard gardens</td>
<td>• Fruit trees and bushes in public open space • Rooftop gardens • Vertical gardens</td>
<td>• Fish ponds and intensive aquaculture • Rooftop greenhouses • Small livestock on open space</td>
</tr>
<tr>
<td>Waste management/turning waste into food</td>
<td>• Home composting of kitchen and garden wastes • Collection and use of rainwater</td>
<td>• Community-based (i.e. SEFC) composting of solid wastes • Re-use of grey-water • Rooftop greenhouses make use of buildings heat • Organic waste no longer collected by city</td>
<td>• Use of community treated/composted sewage sludge • Local solar aquatic sewage treatment integrated with food production • Fish production doubling as sewage treatment • Rooftop greenhouses reusing waste heat from heating ducts, industry and laundromats</td>
</tr>
<tr>
<td>Economic regime</td>
<td>• Production for immediate family (and friends) needs</td>
<td>• Production for immediate family, selling surplus to - • Farmers markets • Food box schemes</td>
<td>• Commercial horticulture and aquaculture businesses • Urban CSA • Food distribution co-ops • LETS • Urban farm capital and credit agency • Preferential tax rates for urban farmers</td>
</tr>
<tr>
<td>Improving technical competence</td>
<td>• Demonstration gardens • Information (skill sheets) • Good practice guides</td>
<td>• City hired animateurs/horticulturists</td>
<td>• Urban agriculture extension office</td>
</tr>
</tbody>
</table>
### Table 6 - A Continuum of Approaches for Urban Agriculture

<table>
<thead>
<tr>
<th>Policy and regulatory Change</th>
<th>Growing techniques and approaches</th>
<th>Growing techniques and approaches</th>
</tr>
</thead>
</table>
| • Allow urban commercial greenhouses at SEFC  
• Prohibit use of pesticides | • Organic gardening  
  • Greenhouse production  
  • Permaculture | • Organic gardening  
  • Greenhouse production  
  • Permaculture |
| • Allow grey-water use  
• Allow composting toilets  
• Allow bee-keeping  
• Allow community gardeners to sell produce | • Aquaculture  
• Hydroponic growing using human waste as nutrient source | • Aquaculture  
• Hydroponic growing using human waste as nutrient source |
| • Allow local sewage treatment systems  
• Allow animal rearing | • Aquaculture  
• Hydroponic growing using human waste as nutrient source | • Aquaculture  
• Hydroponic growing using human waste as nutrient source |
Chapter 7: Conclusions and Recommendations

In this last chapter I will attempt to sum up the benefits of pursuing urban agriculture at South-East False Creek and suggest why urban agriculture makes sense for a community that is aiming to be sustainable. I will also draw out some conclusions from the thesis and suggest the direction for further study.

In the first three chapters I developed a rationale for urban agriculture and showed why I think it is a necessary component of a sustainable community. I also dealt with some of the reasons behind the initial decline in urban agriculture and touched on some theoretical underpinnings of a new self-reliant direction. I think I have clearly shown that urban agriculture has a number of significant benefits for developing a sustainable community and that these benefit are multifarious and fit within the current discipline of planning even though urban agriculture is a neglected planning tool.

The case study, which looked at the specific potential for urban agriculture at South-East False Creek showed that although we should not expect to grow all the food required by the community, there is a realistic possibility of growing much of the communities demand for fruit and vegetables and in doing so we can have a positive impact on waste management, energy efficiency, reduction in water use, health (through diminished reliance on chemical inputs), economic development and the vibrancy of the community.
While real barriers do exist to urban agriculture, it seems we are seeing a changing attitude, signaled among other things by the commitment of community gardeners around the city and reinforced by gestures such as the Park Board’s “Community Gardens Policy”. In the developing world urban agriculture is a thriving movement that is having very positive effects on the health and incomes of those who practice it. There is much that we in the industrialized North can learn from these examples but we have to overcome some basic prejudices against, for example, reusing human waste.

**Answering the questions.**

At the beginning of the thesis I posed the general questions “what contribution can urban agriculture make to food security and community sustainability at South East False Creek? How can these benefits be demonstrated in Vancouver through planning for South-East False Creek?”. I also posed a number of sub questions related the two above.

- In what ways is the current approach to agriculture and the entire food system unsustainable?
- Could localizing food production generally (and growing food in dense city environments specifically) make our food system more sustainable?
- If it could, then how can municipal planning departments best encourage and plan for urban agriculture?
• What should urban agriculture look like for the proposed model sustainable community of SE False Creek? i.e. what types of urban agriculture should be encouraged and where should these be located?

• How can the necessary conditions be created so that urban agriculture flourishes on the site and makes a real contribution to sustainable development? What policies, programs and design elements should be incorporated into the planning process?

To address the sub-questions first:

(i) I would say that our current approach to agriculture is deeply flawed, concentrating as it does on a very limited conception of efficiency and productivity. Despite continued increases in productivity, the system is still unable to adequately feed a growing population. Rather than tackle the systemic nature of the problem which is linked with unequal distribution of wealth and inadequate incomes to purchase food, there is a naive optimism in the ability of human ingenuity and a reliance on technological advance to provide enough food into the next century and beyond. The global, ecological constraints highlighted by “Ecological Footprint” analysis are largely ignored as is the local environmental devastation of the business-as-usual approach which threatens the health of ecosystems and individuals.

(ii) Localizing food production could have a number of significant benefits that would contribute to the health and sustainability of the community. These cross the boundaries of ecological, social and economic spheres of sustainability and even touch on the
psychological well-being of individuals and communities and their relationship with the natural world. Urban agriculture, then, is more than a technical solution to the sustainability crisis. It is an approach that can have profound implications for the ecological literacy of a society and assist in revealing the debt to nature of our food economy.

(iii) Turning to the case-study, an analysis of how much land is needed to produce our current dietary needs showed that we cannot expect to grow all our food requirements on the site. However, by carefully using a combination of the food-growing spaces available (many of them unorthodox), and by using innovative production and waste management techniques, I showed that it would be possible to grow at least the fruit and vegetables required by the community’s population, on the site. It is also likely that we could produce a valuable protein component to the diet in the form of aqua-culturally-raised fish.

Achieving this level of food production means pursuing urban agriculture beyond the usual confines of backyard or community garden vegetable growing. It means extending food production to rooftop spaces, into commercial hydroponic greenhouses and even growing fruit in public open spaces. Approaches like these are a difficult conceptual jump for many people and I recommended that a broad campaign of public education be instigated to inform citizens of the rationale and potential of food growing in the city.
(iv) For urban agriculture to be truly sustainable it needs to be more than just the localizing of food production although that step in itself goes a long way towards reducing the ecological impacts of agriculture. In order to really contribute to the sustainability of the Community at South-East False Creek, urban agriculture needs to integrate the management of solid and liquid wastes with the activity of food production. Chapter 6 detailed several ways in which this could be achieved but it remains to be seen whether there is the political will and public stomach for such measures. Making this a reality, and indeed, just gaining the acceptability of food production so close to people’s homes, will involve careful planning and public relations but ultimately will be about the residents of South-East False Creek instigating this activity themselves. Urban agriculture is not something that can be foisted onto an unwilling populace.

So, to answer the primary question, it seems that urban agriculture could make a significant contribution to the food supplies and the health and sustainability of the Community at South-East False Creek. It is a small, but never-the-less vital part of an overall transition to a more sustainable agriculture and food system. It is also part of the transition to more sustainable cities generally, ones in which the historic tension between rural and urban culture finds a relative peace.
Further Study

This thesis has tackled the issue of food production from a very broad perspective. Many of the ideas it contains require a more thorough analysis to determine the feasibility and details of implementation. However, the proposed community at South-East False Creek is intended to be model for sustainable development practice, and it is the ideal place to take some calculated risks and use the opportunity to experiment with novel approaches. It should be the laboratory of sustainability where we learn from successes and mistakes. If South-East False Creek becomes merely another mega-project, albeit with cars parked on the perimeter and energy efficient heating systems, then a huge opportunity for innovation and research will be missed, an opportunity that may not arise again in the city.

Specifically we need to research the potential of rooftop greenhouses to see whether this approach could be economically feasible and what the best practices are. In conjunction with this we need to see if we can integrate the requirements of waste treatment with food production, overlapping these necessities so as to more efficiently use limited space and resources. The miniaturised ecosystem model of Solar Aquatic sewage treatment offers immense potential to fulfil both of these functions. If located on rooftops it could also use the waste heat of buildings and thereby reduce the ecological footprint of the hydroponic method which as currently practised is ecologically ludicrous. However, the real danger of pathogenic contamination which plagues many of the more simple efforts
of developing countries to use human waste, needs to be dealt with comprehensively so that a outbreak of disease does not jeopardise the entire reputation of urban agriculture. It is, as we remember, just such problems which gave birth to modern city planning and the demise of city grown food in the first place. To repeat such a folly and compound the prejudices against urban farming would be unconscionable, so as we need to be bold we also need to be careful.

Many of the other steps recommended in this thesis are more simple and less risky and in some ways require only an extension of current trends and practices already initiated by the city. The design of less energy-intensive and more productive landscapes makes simple economic and ecological sense and if linked with citizen action can nurture a community spirit that will help foster a sense of community amongst the residents of what could be a very bold experiment.

Perhaps most important is the recognition that food is complex subject that has huge inter-related impacts on many aspects of the city and its inhabitants. In a world of severely conflicting messages about food, eating and nutrition and a deep concern for the issues raised on the sustainability agenda, some sense may be drawn from a cross-disciplined approach that emphasize links and cooperation between the many actors involved and affected by issues of food production, hunger, health and environment. One step might be the formation of a municipal inter-departmental working group
concentrating on issues of food production and food security. Such a group might be comprised of representatives from planning and development, environmental health, waste management and engineering, the parks department and local economic development. A related model is already in operation in the form of Toronto’s Food Policy Council. This is a sub-committee of the Toronto Board of Health and its 21 members include city councilors, farmers, community activists, consumers, business representatives, and faith leaders. Locally the Vancouver Food Policy Organization, (an off-shoot of the influential Farm Folk/City Folk) brings together diverse actors from the food industry, health and nutrition sector as well as food activists. The group attempts to organize discussion and influence policy around pertinent issues such as biotechnology, support of local farmers and farmers markets.
### Appendices

**Appendix A - Growing areas required for major components of individual/community diet**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Average per capita annual consumption (kg)</th>
<th>Feed equivalent for meat/dairy</th>
<th>Pasture equiv.</th>
<th>Yield (kg/ha.)</th>
<th>Growing area to provide for individual consumption (m²)</th>
<th>Growing area required for community consumption (Ha.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Grain</td>
<td>Hay</td>
<td>Potatoe</td>
<td>Alfalfa</td>
<td></td>
</tr>
<tr>
<td>Vegetables (incl. tomatoes)</td>
<td>150.10</td>
<td>17,584</td>
<td>90.5</td>
<td>45.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree Fruit</td>
<td>50.61</td>
<td>1320</td>
<td>430.4</td>
<td>715.2</td>
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<td></td>
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<tr>
<td>Berries</td>
<td>9.01</td>
<td>6080</td>
<td>14.8</td>
<td>7.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cereals</td>
<td>70.18</td>
<td>1962</td>
<td>359.5</td>
<td>178.8</td>
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</tr>
<tr>
<td>Rice</td>
<td>6.57</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Sugars and Syrups</td>
<td>19.09</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Pulses and nuts</td>
<td>8.04</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Oils and fats (excluding butter)</td>
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<td>0.0</td>
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<tr>
<td>Fish &amp; Shellfish</td>
<td>7.84</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td></td>
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<tr>
<td>Pork</td>
<td>27.69</td>
<td>60.3642</td>
<td>5.26</td>
<td>310.1</td>
<td>155.0</td>
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<tr>
<td>Beef</td>
<td>31.39</td>
<td>192.735</td>
<td>507.262</td>
<td>2015.8</td>
<td>1007.9</td>
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<tr>
<td>Veal</td>
<td>1.36</td>
<td>8.3504</td>
<td>21.9776</td>
<td>87.3</td>
<td>43.7</td>
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<tr>
<td>Mutton &amp; Lamb</td>
<td>0.79</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td></td>
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<tr>
<td>Poultry (eviscerated weight)</td>
<td>30.50</td>
<td>67.10</td>
<td>9.455</td>
<td>362.9</td>
<td>181.5</td>
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<tr>
<td>Eggs</td>
<td>9.8</td>
<td>29.204</td>
<td>3.038</td>
<td>156.8</td>
<td>77.9</td>
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<tr>
<td>Dairy Products(Fresh milk equiv)</td>
<td>204.07</td>
<td>67.3431</td>
<td>124.483</td>
<td>597.4</td>
<td>298.7</td>
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<tr>
<td>Total of Grain Equivalent</td>
<td>425.096</td>
<td>1952</td>
<td>2177.7</td>
<td>1088.9</td>
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<tr>
<td>Total of Hay Equivalent</td>
<td>653.723</td>
<td>4932.5</td>
<td>1325.3</td>
<td>662.7</td>
<td></td>
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<tr>
<td>Total of Potatoe Equivalent</td>
<td>5.26</td>
<td>61563</td>
<td>0.9</td>
<td>0.4</td>
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<tr>
<td>Total of Alfalfa Equivalent</td>
<td>12.493</td>
<td>4932.5</td>
<td>25.3</td>
<td>12.7</td>
<td></td>
<td></td>
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<tr>
<td>Total all feeds</td>
<td></td>
<td>3529.3</td>
<td>1764.6</td>
<td>1764.6</td>
<td></td>
<td></td>
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<tr>
<td>Total growing area required</td>
<td></td>
<td>4424.5</td>
<td>2212.2</td>
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<td></td>
</tr>
</tbody>
</table>

Appendix B - Yields of selected vegetables using different growing methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Yield (av. annual) lb.'s/acre</th>
<th>Yield (av. annual) lb.'s/100 sq ft.</th>
<th>Area (sq.ft.) required to produce 320lb.'s selected vegetables</th>
<th>Area (acres) required to supply community of 5000 people with 320lb.'s of selected vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional [1]</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cucumbers</td>
<td>13,110</td>
<td>30</td>
<td>1064</td>
<td>122.0</td>
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<tr>
<td>Tomatoes</td>
<td>40,000</td>
<td>92</td>
<td>349</td>
<td>40.0</td>
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<tr>
<td>Lettuce</td>
<td>28,090</td>
<td>64</td>
<td>496</td>
<td>57.0</td>
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<tr>
<td>Sweet Peppers</td>
<td>8,879</td>
<td>20</td>
<td>1571</td>
<td>180.2</td>
</tr>
<tr>
<td>All four selected vegetables</td>
<td>22,520</td>
<td>52</td>
<td>679</td>
<td>71.0</td>
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<tr>
<td>Hydroponic Greenhouse [2]</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cucumbers</td>
<td>406,000</td>
<td>932</td>
<td>34.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>364,000</td>
<td>835</td>
<td>38.3</td>
<td>4.4</td>
</tr>
<tr>
<td>Lettuce</td>
<td>300,000</td>
<td>688</td>
<td>46.5</td>
<td>5.3</td>
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<tr>
<td>Sweet Peppers</td>
<td>164,000</td>
<td>376</td>
<td>85.0</td>
<td>9.8</td>
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<tr>
<td>All four selected vegetables</td>
<td>308,500</td>
<td>708</td>
<td>45</td>
<td>5.2</td>
</tr>
<tr>
<td>Jevon's Bio-intensive [3]</td>
<td></td>
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<tr>
<td>Cucumbers</td>
<td>137,706</td>
<td>316</td>
<td>101</td>
<td>11.6</td>
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<tr>
<td>Tomatoes</td>
<td>84,541</td>
<td>194</td>
<td>165</td>
<td>18.9</td>
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<tr>
<td>Lettuce</td>
<td>65,367</td>
<td>150</td>
<td>213</td>
<td>24.5</td>
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<tr>
<td>Sweet Peppers</td>
<td>36,170</td>
<td>83</td>
<td>386</td>
<td>44.2</td>
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<tr>
<td>All four selected vegetables</td>
<td>80,946</td>
<td>186</td>
<td>172</td>
<td>20</td>
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</tbody>
</table>

[2] - As above
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