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Designing a Foodshed Assessment Model: Guidance for Local and Regional Planners in Understanding Local Farm Capacity in Comparison to Local Food Needs

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DESIGNING A FOODSHED ASSESSMENT MODEL:

GUIDANCE FOR LOCAL AND REGIONAL PLANNERS IN UNDERSTANDING LOCAL FARM CAPACITY IN COMPARISON TO LOCAL FOOD NEEDS

A Thesis Presented

by

SHEMARIAH BLUM-EVITTS

Submitted to the Graduate School of the University of Massachusetts Amherst in partial fulfillment of the requirements for the degree of

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DESIGNING A FOODSHED ASSESSMENT MODEL:

GUIDANCE FOR LOCAL AND REGIONAL PLANNERS IN UNDERSTANDING LOCAL FARM CAPACITY IN COMPARISON TO LOCAL FOOD NEEDS

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ABSTRACT

DESIGNING A FOODSHED ASSESSMENT MODEL:
GUIDANCE FOR LOCAL AND REGIONAL PLANNERS IN UNDERSTANDING
LOCAL FARM CAPACITY IN COMPARISON TO LOCAL FOOD NEEDS

MAY 2009

SHEMARIAH BLUM-EVITTS, B.A., BRANDEIS UNIVERSITY
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This thesis explores how to conduct a regional foodshed assessment and further provides guidance to local and regional planners on the use of foodshed assessments. A foodshed represents the land resource that supports food production for a region or community: it is the geographic origin of a food supply. The size and location of a foodshed is shaped by economic, political and transportation structures that influence the flow of food from farm to table. Before the 1800s, foodsheds were predominantly local — within the city or neighboring countryside. Today most urban areas are supported by a global foodshed.

While the global foodshed can present many benefits, it also creates tremendous externalities, including wastes, environmental and health concerns, and exacerbated inequalities in food distribution and access. In an attempt to address these concerns, promotion of alternative local foodsheds has re-emerged.

To better understand the opportunities and challenges of a local foodshed, a foodshed assessment can be conducted. A foodshed assessment serves as a planning tool for land use planners, as well as for local food advocates. For community and regional planners, a local
foodshed assessment offers an understanding of land use implications that is not often carefully considered. By determining the food needs of a region’s population, the land base needed to support that population can then be identified. In this way, planners can have a stronger basis for promoting working farmland preservation measures and strengthening the local foodshed.

Foodshed assessments have been conducted sparingly on state, regional and local levels. This thesis compares the approaches of five previous foodshed assessments and presents a model for conducting an assessment on a regional level. This model is then applied to the Pioneer Valley of Western Massachusetts with the goal of determining how much the agricultural production in the Pioneer Valley fulfills the food consumption needs of the region’s population. The assessment also compares the amount of current working farmlands to open lands available for farming, as well as the extent of farmland necessary to meet regional food demand for various diet types.
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2. LITERATURE REVIEW</td>
<td>12</td>
</tr>
<tr>
<td>3. METHODS</td>
<td>27</td>
</tr>
<tr>
<td>4. FINDINGS</td>
<td>41</td>
</tr>
<tr>
<td>5. ANALYSIS</td>
<td>55</td>
</tr>
<tr>
<td>6. CONCLUSION</td>
<td>68</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>75</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Comparison of Data Sources and Methodology from Various Foodshed Assessments</td>
<td>33</td>
</tr>
<tr>
<td>2. Pioneer Valley Households Type, 2007</td>
<td>42</td>
</tr>
<tr>
<td>3. Comparison of 2007 Annual Consumer Expenditures</td>
<td>43</td>
</tr>
<tr>
<td>4. Food Expenditures 2007</td>
<td>45</td>
</tr>
<tr>
<td>5. 2007 Farm Sales for Pioneer Valley from US Census of Agriculture</td>
<td>46</td>
</tr>
<tr>
<td>6. Agriculture Lands in Pioneer Valley, 2007</td>
<td>47</td>
</tr>
<tr>
<td>7. 1999 Land Use by Acres</td>
<td>49</td>
</tr>
<tr>
<td>8. Farmland Soils in Pioneer Valley</td>
<td>53</td>
</tr>
<tr>
<td>9. What the Farmer Got Paid or Farm Value Share of Retail Cost</td>
<td>57</td>
</tr>
<tr>
<td>10. Comparison of Food Consumed at Home and Local Farm Production</td>
<td>58</td>
</tr>
<tr>
<td>11. Food Projected to cover at Home and Away Consumption</td>
<td>60</td>
</tr>
<tr>
<td>12. Comparison of Current and Estimated Need of Farmland for Food Self-Sufficiency</td>
<td>62</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Phase Three – Determining extent of farmland in the Pioneer Valley</td>
<td>39</td>
</tr>
<tr>
<td>2. Food at Home Expenditures by Commodity Group, Northeast 2007</td>
<td>44</td>
</tr>
<tr>
<td>3. Pioneer Valley Farmland</td>
<td>48</td>
</tr>
<tr>
<td>4. Pioneer Valley Farmland by Use per County</td>
<td>48</td>
</tr>
<tr>
<td>5. Land Use in Pioneer Valley, 1999</td>
<td>50</td>
</tr>
<tr>
<td>6. Map of Land Use in Pioneer Valley</td>
<td>51</td>
</tr>
<tr>
<td>7. Map of Farmland Soils in Pioneer Valley</td>
<td>52</td>
</tr>
<tr>
<td>8. Map of Farmland Available in Pioneer Valley</td>
<td>54</td>
</tr>
<tr>
<td>9. What a Dollar Spent on Food Paid for in 2006</td>
<td>56</td>
</tr>
<tr>
<td>10. Comparison of Food Consumption at Home and Local Farm Production</td>
<td>59</td>
</tr>
<tr>
<td>11. Comparison of Projected Total Food Consumption and Local Farm Production</td>
<td>60</td>
</tr>
<tr>
<td>12. Farmland Needed for Food Self-Sufficiency in Pioneer Valley</td>
<td>63</td>
</tr>
</tbody>
</table>
Chapter 1

INTRODUCTION

The notion of a ‘foodshed’ may seem like a new idea, yet the concept can be applied even to the world’s first cities. Agricultural surplus has historically allowed for creation of population centers and surrounding agricultural lands continued to serve the city (Pothukuchi 1999). While in more recent times, industrialization and globalization of the food supply have changed the farm-to-city relationship, the concept of a foodshed remains constant. A foodshed is a geographic area within which the food for a population originates. Unlike a watershed, defining and delineating a foodshed is not an established science; instead, it is a mechanism to understand the systems in place that drive the flow of food supply (Kloppenburg 1996, Peters 2008).

Studying a foodshed has reemerged in academic research and regional governance partly in response to the growing local food movement in today’s society. For many reasons, local food is receiving increasing consumer demand, as well as national awareness. To highlight this phenomenon, the New Oxford American Dictionary picked ‘locavore’ as the 2007 Word of the Year. The term refers to individuals strategically opting to purchase and consume foods that they are growing, buying from local farms, or securing from alternative local sources rather than from the supermarket. Consumer interest stems from a desire to know the origin of the food and how it is produced. “Locavore” also relates to a social and economic effort of supporting local farms and farmers.

The onset of climate change and rising energy prices has strengthened both the local food and sustainable agriculture movements. The American Farmland Trust reports on their website that food travels an average of 1,500 miles from the farm to the kitchen table. With the rising cost of fuel and evidence of climate change, reducing transportation distance is becoming a higher priority for the American consumer. The great extent of petroleum products consumed
through industrial agriculture is also calling into question mainstream agricultural production and making a case for sustainable agriculture.

These trends and concerns have not gone unnoticed by some regional and municipal entities. The city of Keene, New Hampshire has recognized food security within their Resilient Cities Climate Change Plan. By 2010, the city intends to complete a food security assessment and plan (City of Keene 2007). Also, the American Farmland Trust, in conjunction with other area organizations, recently published the San Francisco Foodshed Assessment, which analyzes the capacity of food production compared to consumption within 100 miles of the Golden Gate Bridge (Thompson 2008). Building from these efforts, this thesis research strives to develop a foodshed assessment model for use in New England.

The Place of Food in Regional Planning

While food and food systems have not traditionally fallen within the realm of regional planning, a number of planners and educators are now calling for that professional disregard to change (Pothukuchi 2000, Campbell 2004, Hammer 2004). Since planners are often engaged in creating better communities and livable spaces, ensuring the necessities of life – air, water, shelter and food – are of prime importance. The first three of these elements (air, water and shelter) are regularly addressed by planners through environmental regulations, land use and affordable housing initiatives. Food, however, has yet to be adequately addressed. (Pothukuchi 2000).

Surveys have been conducted to understand planning practitioners’ current involvement in food system work (Abel, Pothukuchi 2000). In a survey of 33 county and municipal planners in Pennsylvania, 70 percent of the respondents noted their involvement in food systems as minimal. When asked how their agencies’ key issues were connected to food, nearly three out of four (or 74%) planners noted their efforts in relation to limiting sprawl and preserving farmland (Abel). Farmland, however, is only one component of a food system’s multi-faceted character.
In our assessments of entire food systems, planners must take into consideration whether these lands are actively farmed (and why or why not), if the agricultural product is getting sold (and if so, to whom and where). Planners’ involvement in the above mentioned cases focuses too narrowly on the designation of land use, and not enough on such elements as food production, food distribution, food accessibility and long-term stability of farmers’ income.

A second survey conducted across 22 cities in the United States demonstrated that planners felt they had the most involvement with the food system in connection with locating supermarkets, grocery stores, fast food outlets and food wholesaling (Pothukuchi 2000). Here, again we note planners focusing on a particular aspect of the system – food access. For example, planners from an urban area may assess a foodshed from a perspective of access to and nutritional quality of foods. However, this approach omits how the food is grown and processed, where the food originates, and the transportation and energy systems that are needed to transport the food to the urban areas.

In response to the overlooked significance of food within the field of planning, several journal articles have called for planners to further focus on the issue of foodsheds (Campbell 2004, Pothukuchi 2000). Hammer (2004) suggests a detailed curriculum on food systems is appropriate for a university’s planning classroom. The American Planning Association has also responded by producing a Policy Guide on Community and Regional Food Planning in 2007. The policy guide calls for planners to take an active role in food system issues and identifies over a hundred ways in which to do so.

This thesis research aims to add to the limited, but expanding body of work concerning regional foodsheds by drawing on foodshed assessments that have been undertaken on various scales and locations. After examining these approaches, a method is developed appropriate for the region of study. The developed methodology and lessons learned from this study provide
further guidance for local and regional planners or organizations to pursue a comprehensive foodshed assessment.

**Project Description**

This thesis explores how to conduct a regional foodshed assessment and further provides guidance to local and regional planners on the use of foodshed assessments. It strives to answer, “What is the local foodshed capacity for the Pioneer Valley of Western Massachusetts?” In other words – “Could the agricultural production in the Pioneer Valley be sufficient to feed the region’s population?” The Pioneer Valley is a region of abundant farms as well as a prominent and well-supported campaign to buy local foods. However, support for local food supply is juxtaposed by the region’s connection to the global marketplace, one which enables local grocery stores to offer strawberries anytime of year or pear varieties from around the world. While acknowledging that some crops may require importation from distant areas, this study seeks to understand the Pioneer Valley’s current and potential self-reliance in local food production.

Several models have been developed for food system analysis. They explore a variety of food system elements, including examination of food access, equity concerns, farmland and farm livelihood protection, transportation and processing of food. In examining a comprehensive set of steps within the food system, a complete foodshed assessment is utilized to better understand and communicate current and potential capacity for local food production. It may account for commercial farming, as well as backyard gardens, hunting, wild foraging and urban agriculture.

Further, a foodshed assessment links the data of local food production occurring in an area with the consumption patterns of the regional population. Examining consumer dollars spent on each commodity can help determine the quantity of consumption. For example, if the amount of consumer dollars spent demonstrates demand, and the production output of local farms and gardens constitutes supply from local sources, then the difference between demand and local
supply will be filled with imported products. This proportion demonstrates a region’s self-reliance. The foodshed assessment for the Pioneer Valley was conducted using readily available data sets to create a model that others can more easily replicate.

A foodshed assessment serves as a planning tool for land use planners, as well as for local food advocates. For community and regional planners, a local foodshed assessment offers an understanding of land use implications that is not often carefully considered. By determining the regional population’s food needs, the land base needed to support that population is identified. In this way, planners can have a stronger basis for promoting working farmland preservation measures.

Assumptions

In assessing the sustainability of the food system for a region, it is important to consider numerous issues regarding the production of major food crops. Local agriculture in the Pioneer Valley may never produce coffee, cocoa, or bananas – tropical crops that are staples in today’s global food diet. Grains and beans, however, offer potential as crops that can be locally grown in western Massachusetts. Nevertheless, optimal growing conditions in the Midwest (dry, sunny seasons), along with the long shelf-life of these products, continue to support the long-distance transportation of these products to the Pioneer Valley.

What about shipping salad greens to Amherst from California? Transportation of these goods is generally highly intensive in its use of energy, largely because of long-distance fuel consumption and the need for refrigerated transport. Further, is it sustainable for our region to depend heavily on California’s agricultural goods when the state’s Central Valley is facing critical natural resource concerns, specifically unprecedented water shortages? Or, consider another common scenario: local butternut squash growers in the Pioneer Valley ship their crops to New Jersey, while grocery stores purchase squash from Mexico to stock on their retail shelves.
These examples represent the high costs related to energy, infrastructure and the environment that occur in maintaining an extensive food system, especially in a modern era defined by post-peak oil prices and global climate change.

This thesis does not set out to define a local foodshed in the Pioneer Valley that is self-sufficient. It accepts the fact that many global crops do not offer practical or economic benefits to be grown locally. This work aims to guide land-use planning and development towards a more self-reliant region, one that is more self-aware of its farmland resources, regional food needs, and commodities that offer potential for greater local production. With this knowledge planners and advocates can work to narrow the gap between supply and demand of appropriate commodities.

**Limitations/Delimitations**

This thesis research builds from the efforts of many who are undertaking food system studies across the nation and worldwide. It is not an exhaustive study of potential approaches to food system analysis, nor does it cover all of the concerns a community or region may want to consider when undertaking such an endeavor. Instead, this work offers the preliminary tools to assess the local farmland resource base (local food supply) and compare it with food consumption (demand).

When considering food consumption needs, this study uses current consumption patterns based on expenditures for the Northeast US. Changes in eating habits or in national dietary guidelines are not addressed. Population is assumed to remain constant at its current level and does not consider population forecasts.

Current local food production is measured through the US Census of Agriculture, particular to the three county region of the Pioneer Valley. While the farms represented are local producers, it is unknown whether they are actually selling to residents in the Pioneer Valley. Therefore, this measure provides a valid picture of current production, but does not conclusively
document that these products enter local consumer markets. Data that trace food from origin to consumer do not exist.

Local food production can also include backyard gardens, forest foraging, hunting, fishing, community gardens and urban agriculture. These elements can supply a substantial portion of a family’s food source. Some food studies are striving to include this detail in the analysis (Shelburne Falls). Due to limited research time, this thesis does not include such a level of detail, but rather focuses on larger commercial agricultural operations.

Potential regional food production is extrapolated from land use and farmland soils data. However, it is not known whether these lands are currently in production or being utilized to their highest yield potential. Again, backyard or urban growing space is not included in this method for calculation of potential production.

Climate change and technological improvements will certainly shape our climate and communities in the coming century. With shifting climates, some farmland may become unavailable due to flooding and certain crops may become too challenging to grow. On the other side, technologies, such as those that extend the growing season and long-term storage options, could enable greater availability of local food. While examination of these impacts and how they would directly affect the Pioneer Valley may be relevant, this research does not cover these possibilities. Instead, it estimates current production capability to serve as a baseline from which to address future challenges.

**Definitions**

Many terms are utilized when discussing the process of getting food from the farmer’s field to the consumer’s table. To offer a consistent framework, an overview of some of these key terms follows:
**Foodprint**: area of agricultural land needed to support a person’s annual diet (Peters 2008).

**Food security**: “access by all people at all times to enough food for an active, healthy life” (Nord 2008).

**Foodshed**: geographic area that represents the flow of foodstuffs from its origin to consumer markets (Hedden 1929).

**Food sovereignty**: “[state of being in which] all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes community self-reliance and social justice” (Bell-Sheeter 2004).

**Food system**: the multi-phased process of the development of food for consumption; including pre-production collection of inputs and raw materials, production techniques, and post-production mechanisms of processing, packaging, distribution, marketing, consumption and waste management (UN Development Programme 1996).

**Globalization**: shift in global economic system intensifying in the late 1960s, which allows capital, labor and commodities to cross national borders. In regards to food production, for example, it enables the development of a livestock operation in Europe where animals are bred in Latin America, fed with export grain from the United States, slaughtered under international standards, and consumed across the globe (Gouveia 1994).

**Local**: an area in proximity to a specified location. The distance included can vary based on the region and residents’ perception. A 2008 study by the Hartman Group found that 57 percent of consumers completely agree that buying local food refers to products that are grown close to their home and sold within their community. Generally carries the perception that the product is sustainably grown, which is often, but not always, the case (Thompson 2008).

**Local food movement**: “collaborative effort to build more locally-based, self-reliant food economies – [an effort] in which sustainable food production, processing, distribution and
consumption [are] integrated to enhance the economic, environmental and social health of a particular place” (Feenstra 2002).

*Locavores*: individuals strategically opting to purchase and consume foods that they are growing, buying from local farms, or searching out from alternative local sources rather than the supermarket. (New Oxford American Dictionary 2007 Word of the Year).

*Self-reliant*: “the reduction of dependence on other places, but does not deny the desirability or necessity of external trade relationships” (Kloppenburg 1996).

**Research Questions**

The purpose of this research is to demonstrate the use of foodshed assessments for regional planners by identifying the extent of food self-reliance for the Pioneer Valley of Western Massachusetts. To this end, the following five research questions are posed:

1. **What is a foodshed?**
2. **What are the benefits of assessing and planning for a local foodshed?**
3. **How can planners conduct a foodshed assessment to determine the existing and potential capacity of a region to grow more local foods?**
4. **What is the current level of food self-reliance for the Pioneer Valley of Massachusetts?**
5. **What is the relevance of foodshed assessments for regional planners?**

**Goal and Objectives**

The five goals and corresponding objectives of this research are as follows:

**Goal 1: Define foodshed.**

Objective 1.1: Demonstrate the origin of the term *foodshed* and its continued use through literature review; and
Objective 1.2: Document the historic evolution of the agricultural system from the onset of industrial agriculture to a global food system.

Goal 2: Identify reasons and advantages for conducting a local foodshed assessment.

Objective 2.1: Review literature on local food system benefits; and
Objective 2.2: Explore its relevance especially in the face of climate change and post peak oil concerns.

Goal 3: Determine relevant methods for performing a foodshed assessment.

Objective 3.1: Compare foodshed studies conducted on varying scales and with different parameters to demonstrate the range of approaches that have been utilized.

Goal 4: Conduct a foodshed assessment for the Pioneer Valley in Massachusetts.

Objective 4.1: Establish a methodology for conducting this local foodshed assessment following a review of other assessment methods and available data;
Objective 4.2: Determine region’s food needs based on current consumer spending;
Objective 4.3: Calculate current local food production; and
Objective 4.4: Identify potential capacity for local food production.

Goal 5: Convey lessons learned to serve as a guide for other planners and locations.

Objective 5.1: Explain challenges and benefits of a foodshed assessment;
Objective 5.2: Describe methods and opportunity for adaptation; and
Objective 5.3: Describe the potential roles for local and regional planners in foodshed assessment and planning.

Outline of Chapters

Chapter Two presents a literature review of relevant disciplines approaches to regionalism and food systems. The definition and evolution of the term ‘foodshed’ is explored.
The importance of planning for and assessing the foodshed is investigated, as is the significance of local foods.

In Chapter Three, a variety of food system analysis tools are presented. These models include community food assessment, community food security, food sovereignty assessment, community mapping technique, and foodshed assessment. Clarification on the methodology for the foodshed assessment of the Pioneer Valley is then provided. This chapter also includes a discussion of how to determine the foodshed study area, data collected and analytical methods.

Findings of the Pioneer Valley study are shared in Chapter Four. First, a geographic and demographic explanation of the study area is presented. This is followed by data on consumption patterns of residents and the quantity of local food production. Current systems that facilitate the sale and purchase of local agricultural products are documented.

Chapter Five offers an analysis of these data sets. Comparisons between consumption and production are conducted to understand the region’s actual and potential sustainability in terms of food production. Commodities that offer the opportunity of increased local supply are identified. Significant challenges and limitations to local production of certain food commodities are delineated and addressed.

The conclusions in Chapter Six relate the assessment process and results of this Pioneer Valley case study to a wider audience. The study results not only have implication for the study area but offer insight into similar opportunities and challenges that may be faced in many regions. Additionally, the lessons learned from this assessment process serve as guidance for regional and local planners. The author shares recommendations for further work and appropriate application of foodshed assessments.
A Foodshed Defined

Foodshed is the geographic extent of food production that is needed to feed a population. The term is used to describe where food is grown for a given city or region. In pre-colonial times, a foodshed was localized. Farmers grew crops that were shared among the community and trade was relatively limited. Getz (1991) describes today’s foodshed as an octopus with tentacles extended around the globe representing extensive food chains of products being shipped around the world. In this time of globalization, local foodsheds can offer a strong parallel food system.

The term ‘foodshed’ was derived from the concept of a watershed. A watershed is a region that collects and channels precipitation, snowmelt, and tributaries toward a substantial waterway. This resource nourishes the region. With changes upstream, the entire watershed is affected. Watersheds are determined by the contours of the land and influenced by human interventions. They provide a base for sustaining the natural ecosystem of the region.

Although a foodshed does not geographically match a watershed, the idea is similar. In both, the ‘sheds’ represent tributary resources that converge toward a particular end point. Rather than natural physical barriers as in a watershed, a foodshed is shaped by economic, transport and distribution mechanisms. Whereas in a watershed, all water flows downstream, in a foodshed products or crops may cross paths with each other. It also differs in the fact that for most regions of the world, populations are served by both a global foodshed and a local foodshed. A foodshed also can be segmented into various commodities, such as a milkshed or cornshed.

Healthy ‘sheds’ are cyclical. The closed loop system integrates waste of one process as food for another. For example, a healthy foodshed absorbs solid and liquid wastes from humans and livestock as soil and crop enhancements. In contrast, open or linear systems create an
unhealthy balance. Wastes are pumped and processed in isolation; synthetic and chemical inputs are then needed to nourish croplands (UN Development Programme 1996).

**Hedden’s Foodshed**

The term ‘foodshed’ was first used by Walter Hedden (1929) to describe the flow of food to markets. Hedden’s exploration focuses on the economic barriers and constructs that shape the movement of foods. Hedden undertook this study in response to the threat of a national railroad strike in October 1921. His book, *How Great Cities Are Fed*, seeks to understand the foodshed of New York City and offers transparency to a food system that feeds millions without anyone fully understanding the whole system.

Hedden’s work recognizes the “revolutionary” technologies that had recently altered how food made it from farm to table. The creation of refrigerated railroad cars in the 1890s and the subsequent expansion of refrigerated storage and motor vehicles enabled long distance transport and an expanding of the foodshed. Long distance shipping became more economically viable and increasingly undercut traditionally local sources. This made the foodshed more dependent on attenuated supply chains and an extensive distribution system. While this afforded an increase in the quantity and cheapness of food in the city and greater efficiency in making perishable foods more readily available to consumers year-round, the system was unsteady in the face of a railroad or port strike. Although strikes and food shortage catastrophes were ultimately diverted, Hedden took the opportunity to detail a critical historical assessment of New York City’s foodshed.

**Building from Hedden**

In 1991, Arthur Getz revived the term ‘foodshed’ as a graphic image of the flow of food supply to a particular location. His approach to a foodshed analysis considers where the food originates as well as how it gets there. By connecting food to its source, the farm, Getz argues for
increased agricultural protection. Instead of criticizing suburban sprawl as a contributor to farmland loss, Getz recognizes the opportunity this provides. He advocates the interspersion of agriculture and residence to create a stronger urban foodshed. This would more appropriately mesh urban morals and rural area values in low-density suburban areas. Getz notes, however, that the modern foodshed graphic would look like an octopus with tentacles covering the globe.

Kloppenburg et al. (1996) builds from Getz’s imagery and asserts that the foodshed image should imply local, alternative agriculture and not refer to global, industrial agriculture system. Both call for an alternative foodshed that reduces social and environmental degradation through sustainable agriculture. For Kloppenburg, the consumer’s proximity to the food source should define the foodshed rather than distinct boundaries. Additionally, the foodshed is shaped by the “plant community, soil types, ethnicities, cultural traditions, and culinary patterns” of the region. Kloppenburg’s presentation has given rise to the association of the term foodshed with the idea of local food system (Peters 2008). External trade needs are recognized, however, and a stress on self-reliance rather than self-sufficiency is presented. A foodshed analysis would include understanding the current global system, its local effects and opportunities for regional changes. Kloppenburg notes that a foodshed assessment approach will vary depending on the location, population and needs of a region that is being analyzed.

Peters (2008) presents key reasons to undertake foodshed assessments at this time. Current industrialized agriculture creates high environmental costs, produces large amounts of green houses gases, and presents food safety risks. Rising world food prices and energy costs place greater burdens on the food system. Debate ensues over the use of agricultural lands for food versus fuel. With all of these concerns highlighted, Peters reinforces the need for foodshed analysis.

Foodshed assessments have been completed on varying scales and levels of detail since Hedden’s first attempt. The Cornucopia Project (1982) provoked over thirteen foodshed
assessments on a state level in the late 1970s. More recent statewide assessments have been conducted in Massachusetts (Holm 2001), New York (Peters), and British Columbia (British Columbia 2006). In 2008, San Francisco completed a regional assessment that included all populations and productive farmlands within 100 miles of the Golden Gate Bridge. This was a regional assessment that crossed county lines. Local foodsheds for each urban center in New York State were mapped to demonstrate the potential of local food production for each city. On the smallest scale, a food security plan for Shelburne Falls, Massachusetts is looking at the potential growing space within the village itself.

The Changing Shape of the Foodshed

Until relatively recently in the evolution of societies, food production and distribution has occurred in proximity to a populated area. With the onset of the industrial revolution, new technologies and production techniques allowed for long distance foodsheds to emerge. More recently, globalization has brought a wide array of food options as well as resource challenges to the food system. The local foodshed has persisted alongside globalization as a parallel alternative food system.

Pre-industrial Cities: Self-sustainable, closed-loop Farming, specialized trade

Cities around the globe developed with symbiotic relationships to their agricultural productive areas. Perishable crops and livestock were raised within cities and directly abutting lands. Grains, fruits and vegetables were grown in the bordering countryside. In some communities, this production also occurred in the heart of the city. In the 19th century, the marais farming system enabled 100,000 tons of high value, out of season vegetable production in the center of Paris (UN Development Programme 1996). All steps of the food system – production,
handling, transportation and consumption – were localized acts and mainly a matter of self-sustenance (Friedland 1994).

These productions created self-sufficient regions, supplying the city’s food through intensive food production and innovative seasonal extension techniques. Irrigation systems and waste management practices enabled a closed loop system for the city to manage its waste products while enhancing agricultural production. For example, carts of food were brought to markets in the city and returned to the farm full of city waste to be composted and incorporated into the soils on the farm. Integrated irrigation channels enabled three crops a year compared with one or two currently in Mexico (UN Development Programme 1996).

Trade through the 16th century supplemented the local diet with salt, spices, wine and oil. During colonization sugar, tea, coffee and cocoa, were added to the long distance foodshed. These are durable food products that can be mass produced and withstand long travel and storage. Wheat and other grains were soon to be produced farther away from their intended consumers as it was discovered that these crops also could hold up to travel and storage. While these trade items augmented the city diet, the foodshed remained substantially local (Friedland 1994).

**Industrial Revolution: Transportation and production advances, farmers flock to cities**

The Industrial Revolution starting in the late 18th century brought production efficiencies in the farm fields with the introduction of new machines. Agricultural improvements led the way for further innovation in the Industrial Revolution. Fewer farmers were needed to produce a greater quantity of crops. This in turn allowed rural residents and would be farmers to flock to manufacturing jobs in the cities. The efficiencies of machines in the countryside allowed for greater density in the cities (Bowler 1992).

Transportation advances supported this lengthened foodshed. Railroads and canal shipping enabled further transport of goods from the countryside into the cities with cost
efficiencies. This in turn extended the opportunity for farmlands to be expanded. For example, the Pacific Railway Act of 1862 in the United States opened the West for both new farmers and an accessible shipping avenue. Railroad companies received land grants from the US government to establish rail lines to cross the country. In turn, the railroad companies sold excess lands to farmers. This enabled new farms across the West and provided them new markets by opening trade and shipping by rail (Steiner 1988). The decline of local farming also enabled urban and suburban development on former agricultural lands.

These innovations allowed for an extended foodshed but perishables – milk, meat and produce – continued to be grown close to their consumption points. Crowded cities limited the space available for these activities. Consequently, the availability of these products for city residents was limited.

City Beautiful: Dichotomous planning relegates agriculture to the country

The segmenting of agriculture to the country and commerce to the city was furthered by the dichotomous planning of the City Beautiful movement of the early 20th century. Crowded cities were no longer seen as places for food production. Planners felt that this was an improper use of land and strived instead for a more sophisticated, clean and efficient city model. Concerns over health and sanitation led to limiting agriculture within the city and relegating it instead to the countryside. This also led to the creation of modernized sanitation systems to dispose of water and wastes. These waste streams once fed the local foodshed. Now polluted from industry outputs, these wastes were piped out of the city in separate sanitation systems.

Valid health concerns for the crowded city provoked planning responses that were well-intended yet created further complications. For food production, it meant further distancing between production and consumption. The many benefits of local agricultural – health, nutrition,
open space, waste management, environmental protection – were also distanced from population centers (UN Development Programme 1996).

**Garden Cities**

Another response was the Garden City Movement. Ebenezer Howard’s Garden City recreated the classic connection between urban areas and food production. His concept suggested joining the best attributes of both town and country for the benefit of human society. The Garden City was depicted as a central green space, surrounded by commercial and residential. Five thousand acres of agricultural lands surround the city as a greenbelt. Industry, livestock operations, and commodity farms are efficiently located for convenience of transportation, as well as separated from the community to avoid nuisances. Howard’s design acknowledges the integral role of the food system in a city. Food production, distribution, collective preparation and consumption, and waste recycling are all addressed (Howard 1898). Howard’s model has been partially adopted in a number of planning efforts but not widely nor comprehensively followed in terms of food systems.

**Before World War II: advances in refrigeration, storage, value added**

Despite the separation of city from country and food production, the foodshed of the late 19th century was still relatively local or regional. Diets before World War I consisted primarily of more durable goods and meats. Fresh produce was a luxury of the countryside. Further advances in refrigeration, storage and transportation, however, altered diets and availability of food choices (Friedland 1994).

Refrigeration in the 1920s dramatically shifted the food system. Refrigeration started in railroad cars and later expanded to motor transport. It was also incorporated into transfer and distribution facilities, eventually making it into consumers’ homes. Cooling systems relieved
concerns for handling of dairy and meat products. They also enabled fresh produce to be transported into the cities. Rather than diets based on long-term shelf life, products could be delivered to consumers fresh (Friedland 1994, Hedden 1929).

Accompanying advances in cooling were other processing techniques that allow for longer storage. This included canning of fruits and vegetables and improved storage procedures for apples and oranges, which made produce available for an extended period of the year. Bananas also found their way to the United States at this time. It was discovered that bananas could be harvested green and ripened at their end destination (Friedland 1994).

These advances led to greater food options within the foodshed as well as an expansion in its size. Longer term storage and cooling options promoted competition among agricultural productive areas. Areas with favorable growing climates and farming resources gained favor as primary regions for providing to the expanding foodshed, leading to regional crop specialization (UN Development Programme 1996). Except for bananas, however, the foodshed remained primarily a regional or national one until after World War II (Friedland 1994).

Post World War II: Globalization

After World War II, land use changes, economic shifts, integration of agricultural production and diet preferences led to the global foodshed. In the United States, federal housing and highway programs spurred suburban developments and sprawl that infringed on farmlands. The loss of farmland in America is an ongoing and increasing problem. According to the American Farmland Trust’s Farming on the Edge Report, nationwide two acres of farmland are lost to development each minute of every day. The report also shows that farm and ranch land was lost at a rate of 51 percent faster in the 1990s than in the 1980s. Prime farmland, which is the most fertile and productive, is disappearing the fastest.
Of particular concern is the amount of food production that occurs in proximity to urban or developed areas. Due to modern urban sprawl, this causes farms and food production to be increasingly in the path of development. 86 percent of U.S. fruits and vegetables, and 63 percent of our dairy products, are produced in urban-influenced areas (American Farmland Trust 2002). A global foodshed reduces the reliance on these local farmlands, making them more susceptible to development.

Globalization intensified in the late 1960s, creating opportunity for capital, labor and commodities to cross national borders. This has allowed for the creation of transnational corporations that control large extents of the food system and dominate across commodities and countries. Vertical integration of agriculture production has resulted. Increasing numbers of farmers grow for contract or corporate farms rather than as independent producers. Large firms direct most meat, poultry, egg and grain production with technologically advanced operations that are transferable around the globe. Due to their size, these firms assert a lot of control over the global market and are not held accountable for environmental or labor concerns. The production and economic efficiencies created in this system ignore the externalities of air and water pollution, water and soil loss, and energy use (Heffernan 1994).

Counterseasonal production is also a result of globalization. Providing crops in the off-season is considered counterseasonal, such as melons in December in a US supermarket. Counterseasonal production began with successive plantings of lettuce in California to provide weekly deliveries to consumers across the country. With globalization, this has expanded to growing tomatoes in Mexico when they are not available in Florida or grapes from Chile available year round (Friedland 1994).

Year-round availability of fruits and vegetables mirrors a consumer trend of concern over diet and increased desire for fresh produce. Two growing segments of American society are pursuing this healthier diet, both the aging baby boomer demographic and the educated,
professional workforce. Continued technological advances in cooling and optimal storage
techniques for each product have aided further availability, albeit at a greater externality cost in
terms of energy and ecological impact (Friedland 1994).

Parallel Alternative Food System

Complicated economic and political structures have shaped the global food system with
intentions of providing greater product variety, increasing revenues from trade, and improving
production efficiency. Simultaneously, an alternative, localized food system has continued or
been revived. The local foodshed is based on farmer’s markets, community supported agriculture
programs, niche value added products, and other direct sales to consumers. It is accompanied by
“buy local food” campaigns and increased interest in agro-tourism. Local foods do not only
indicate proximity of origin but also often connote an alternative food system, which relies on
small-scale farmers and sustainable agriculture (Thompson 2008, Campbell 2004).

While it may have resurged in the 21st century, the emergence of this alternative system
parallels that of globalization. This trend can be indicated by the increase in United States
farmers’ markets. From 1970 to 2006, the number of farmers’ markets grew from 340 to 4,385,
or by 1,190 percent (American Farmland Trust).

The Importance of the Local Foodshed

In a period of rampant globalization, the local foodshed is gaining more attention for
good reason. Many benefits can be attributed to a more localized food system. Some of these
key elements are:

- Reducing transportation and energy needs
- Improving nutrition and health
- Advancing environmentally sensitive agricultural practices
- Enhancing local economics
- Fostering community interaction and social networking
- Protecting local farms and farmers
- Preserving food safety

Reducing transportation and energy needs

In a global foodshed, food travels many miles to make it from farm to the table. The American Farmland Trust estimates on average that food products cover 1,500 miles to reach their destination. This travel translates to extensive fuel costs and air pollutants. Efficiencies in shipping and processing have increased the ease and extent of long distance transport (Halwell 2002). Rising fuel costs, as a result of post-peak oil, have highlighted the long distances food currently travels and translated into rising food prices. “Global food prices, in real terms, have increased by an average of 15% annually between 2006 and 2008, relative to a modest rate of 1.3% between 2000 and 2005” (Peters 2008).

Originally long distance trade was limited to durable long shelf life products. With the onset of refrigeration, this has changed. Intensive cooling chains have developed to chill fresh food products shortly after harvest, transport them in continuously cooled conditions, store and display them in chilled containers until they make it to the kitchen refrigerator. This extensive refrigeration system adds significantly to the energy consumption of the global foodshed. Perishables are the fastest growing segment of food shipments around the world. Imported ingredients have four times the amount of energy consumed and greenhouse gases produced as the same food from local sources (Halwell 2002).

The concrete evidence of climate change necessitates a reduction of greenhouse gas emissions from agricultural practices. 14 percent of anthropogenic emissions are linked to
agriculture (Peters 2008). Fewer food miles means reduced fuel use and reduced greenhouse gas emissions.

**Improving nutrition and health**

Local products are typically fruits, vegetables, grains, meat and dairy products – items that are the foundation of a healthy diet rather than packaged, processed foods that proliferate in today’s supermarket. Local crops can also be more nutritious and tastier. Crops harvested closer to their consumer mean they can be harvested when ripe and at their peak nutrient quality. Less travel and handling time means foods maintain their vitality. The local foodshed is more likely to offer heirloom varieties, ethnic crops and unique products that can offer new tastes and diversity (Pirog 2009). Urban agriculture and backyard food production have shown to improve residents’ health through active lifestyles and increased open spaces (UN Development Programme 1996).

**Advancing environmentally sensitive agricultural practices**

The environmental degradation of soil and water resources caused by conventional, industrial agriculture has become apparent (Kloppenburg 1996). Farmers that support the local foodshed and direct sales to consumers are more likely to be engaged in alternative agricultural practices. Similarly, because most people who are looking to purchase locally are also looking for sustainably grown food, local foods can represent more environmentally sensitive production (Pirog 2009).

**Enhancing local economies**

Money spent locally at farmers’ markets, farm stands and community supported agriculture programs is an investment in the community. A greater portion of this spending remains in the local community. The farmer in turn will use these funds to shop at local
businesses, employ community members and invest in the farm. Spending at a grocery store chain means that a sliver of the dollar remains local while the majority feeds into the global economic system (Persky 1993, Halwell 2002). Local foods may also cost less, particularly as industrial food costs continue to rise.

**Fostering community interaction and social networking**

Consumers have an increasing interest in knowing where their food comes from and how it is produced. The local foodshed offers consumers the opportunity to directly interact with local farmers and other like-minded community members. This interaction strengthens community relationships. Promoting local foods can also involve engaging local citizens in growing their own food through community farming and gardening projects. These serve as both a means to grow food and a way to bring community together (Murphy 2008, Pirog 2009, Kloppenburg 1996).

**Protecting local farms and farmers**

Purchasing from local farmers means that local farms will continue to prosper. Direct sales from farm to consumer mean a higher portion of the consumer’s dollar is supporting the farmer’s livelihood. This increased income stream can make the difference of staying in business for some farmers. Additionally, keeping local farmers in business means the preservation of valuable open spaces. These working farmlands offer natural resource protection, waste and water management, wildlife habitat and beautiful vistas (Halwell 2002, Murphy 2008, Pirog 2009).
Preserving food safety

Food safety scares have become increasingly recognized concern. National recalls of food products have occurred in recent years due to E-coli and salmonella contamination of a variety of products – beef, spinach, peanuts. These outbreaks have created a new demand for improved food safety measures. High concentration of food producers and processors within the global food system has created a greater risk for consumers. Contamination in one location can have a widespread impact. Local food production offers greater assurances by allowing clearer transparency and accountability in the food system. Tracing contamination in a local foodshed can be conducted more swiftly and prevent extensive outbreaks of food born illness (Pirog 2009).

Considerations for local food systems

A local food system presents potential challenges as well. Equity, environmental and economic concerns can be raised.

Local foods are currently most available at high-end stores and farmers’ markets, which are not available or convenient for all sectors of the population. Therefore, social justice and equity are concerns that need to be addressed in a local food system. Food security and access for all people to healthy foods is a growing concern among community planners (Campbell 2004, Pothukuchi 2004).

Also, local foods are not inherently or necessarily environmentally sustainable. The protection of natural resources will depend on restructuring how food is grown. This will require a switch from high energy, chemical and fossil fuel inputs to sustainable agriculture techniques (Bellows 2001, Hess 2008).

Economic impacts may not be positive. Regions that rely strongly on exporting food goods may experience negative economic impacts. Similarly, regions that rely on importing may not have sufficient local production, storage, processing or distribution capacity. Again, this
could create an economic strain at least in the short term. It may continue to be more beneficial, both economically and environmentally, to import certain goods (Bellows 2001, Hess 2008).
Chapter 3

METHODS

Foodshed assessments gauge the ability of a locality to feed its local population. They can be done on varying scales – local, regional, state or national. Depending upon the researcher’s purpose and concern, the assessment can be shaped to include many parameters. Available and accurate data often pose a challenge. Estimation and clarifying assumptions are necessary. The data to pursue and the scale are dependent upon the purpose of the study. In all cases, a foodshed assessment enables planners to further understand the food needs and the ability for self-reliance. It provides tools for understanding and protecting farmland as a critical local resource. Planners have more data to direct land use decisions to help anticipate future needs.

Other tools and methods have emerged for community planners to assess the local food system. Community food assessments are asset based assessments conducted with extensive community participation. These assessments are place-based, providing information on all aspects of the food system as they relate to the local town or region. They often include an examination of production, processing, distribution, consumption, and waste management for the locale. Nine such community food assessments have been completed in cities across the United States (Pothukuchi 2004). The US Department of Agriculture has developed the Community Food Security Assessment model and toolkit to encourage availability of nutritious, low cost foods for all people. The Food Sovereignty Assessment model addresses concern of food and agricultural policies within Native American communities. These approaches involve inventories of food resources and community surveys and focus groups to understand challenges and opportunities to accessing appropriate foods.

Community mapping techniques may be utilized, as was done in England, to gain insight into underserved populations’ food system (Sustain 2000). A diversity of interactive and graphic
methods was implemented to engage a cross-section of people and there was great attempt to reach socially marginalized groups that would not typically participate in a planning process. The project was sponsored by a coalition of local organizations interested in engaging the community in determining solutions to their food poverty and access to a healthy diet. Participants placed color codes on maps to distinguish varying food projects, which included food growing sites, distribution, cooking and education.

Food policy councils are another mode being used in cities across the United States. These organizations include a cross section of participants interested in the local food system. The council can serve as a resource and motivating body for local change. Often councils begin with conducting a foodshed or food system assessment at some level to better understand their locality and the current resources.

Comparing Foodshed Assessment Approaches

Food system studies can address various concerns and values, such as food access, equity and nutrition. In compliment, a foodshed assessment reinforces the connection between food production and the land resource from which it originates (British Columbia 2006). A survey of several foodshed assessments displays their similarities and differences. These studies were chosen to display a range of scope and approaches. This is not to serve as an exhaustive list of studies to date or establish a set way to approach a foodshed assessment. This review rather highlights some of the varying efforts in this field and informs the method for conducting a foodshed assessment of the Pioneer Valley in Massachusetts.

The studies that are reviewed include two on a state level – British Columbia and Massachusetts. The foodshed assessment for San Francisco is discussed. Smaller urban centers are considered in New York’s foodshed mapping technique. Finally, a village center assessment is noted. A comparison of these models follows.
**British Columbia**

British Columbia’s Ministry of Agriculture and Lands undertook a food self-reliance study in 2006. The study was concerned with the ability of British Columbia’s farmers to feed the province’s growing population. The results demonstrated that farmers could provide 48 percent of all foods consumed. To attain this figure, current consumption patterns are compared to average yields from the area’s productive farmlands. Further analysis reveals that only 34 percent could be attained if B.C. residents were following Canada’s recommended diet for healthy eating. The healthy diet calls for a greater intake of fruits and vegetables as compared to current consumption patterns. Fruits and vegetables require irrigated farmlands. In this manner, the British Columbia study directly links the food needs of the residents to agricultural land use and demand on water resources if they are to increase produce production.

**San Francisco**

In the San Francisco Foodshed Assessment (Thompson 2008), the authors answered the question, “Could the City of San Francisco feed itself with local food from farms and ranches within 100 miles of the Golden Gate?” The 100-mile foodshed was utilized in response to the growing acceptance of this measurement. The use of the term locavore originated in Berkeley and challenged people to eat within 100 miles. Since then 100-mile diets have been encouraged in regions across North America. A survey by the Hartman Group found that more consumers associate local to mean “within 100 miles” than any other distance. San Francisco agricultural production capacity was measured within the 100 miles, as was consumer dietary spending and estimated intake for each commodity. The comparison demonstrated that, with the exception of a few crops, the area could be highly self-reliant.

In further study of how local food is accessed by the San Francisco consumer, however, it was found that there are many gaps in the system that limit the consumption of local foods. The
assessment attempts to identify the percent of sales that were locally produced. The only source for this information is the US Census of Agriculture, which includes sales that were made “direct to consumer.” These data, however, are misleading because the consumer could be someone outside the region. For example, an Amherst farm might sell directly to a consumer, although the consumer is in Boston. This represents a critical gap in understanding how much locally grown makes it to local consumers. Instead the organizers of the study conducted literature reviews and interviews to understand local food infrastructure and identify the extent of community supported agriculture (CSA) farms, farmers markets, local wholesale venues, and restaurants and institutions serving local foods.

**New York State**

Peters et al. at Cornell University in New York have developed two innovative models that are relevant to the discussion of foodshed assessments. The first is the concept of an ecological ‘foodprint’: the extent of agricultural land needed to support a person’s annual diet (Peters 2008). The project quantifies land use based on pasture and crop lands necessary to support a complete diet with varying degrees of meat and fats in the diet. The study is specialized to the New York land resources and production yields. Holding the extent of grains, fruits, vegetables and dairy steady, they found a larger foodprint as the amount of meat intake increases. With about half an acre, one person could be fed a complete diet for the year with no meat. This land area jumps to almost 2 acres with 381 g of meat per day. Not only does the amount of land determine the impact of one’s diet, the researchers found that a diet with minimal meat and dairy is actually more efficient use of land despite its slightly larger foodprint of six-tenths of an acre. This is caused by the available soils – pastureland requires not as great soils that are more available in New York than prime farmland soils. Overall, New York State does not offer sufficient land to supply the state’s population with all food needs.
The second project is the Local Foodshed Mapping Tool. This model identifies the extent of farmland needed to feed each urban center in New York State. Appropriate farmland is determined by overlaying farmland soils and current land use. Population of a given city is multiplied by the average foodprint to determine the extent of farmland needed. This area is further defined by estimating the minimal distance needed to grow the food. A self-sufficiency percentage for the city is calculated. This model is based on the capacity of the foodshed to meet the total food needs for a population center based on current dietary patterns and conventional agricultural yields. It does not consider whether these farmlands are in production or to what extent the food is servicing a particular population. It is strictly an examination of the potential capacity of a local foodshed to provide for the population.

**Massachusetts**

A statewide assessment of Massachusetts’ food self-sufficiency was performed in 1975 and replicated in 1997 (Holm 2001). These studies examined the major commodities that are produced in New England – meat, dairy, poultry, eggs, vegetables, fruits, and seafood and aquaculture. Statewide purchasing for food products was compared to agricultural production happening within Massachusetts. Consumption was derived from the Consumer Expenditure Survey for the Northeast. Production was ascertained from USDA crop sales data. Farm gate prices were converted to retail dollars using the USDA farm retail price spread information. Those sales that were direct to consumer were not altered. A direct dollar to dollar comparison was made in each commodity group to determine the self-sufficiency of each food type.

The study showed that food self-sufficiency for Massachusetts has improved from 1975 to 1997. Data cannot confirm the extent of locally produced foods that are finding their way to local consumers. The state’s fruit and vegetable production has increased, while poultry and eggs declined. Self-sufficiency levels were measured at 19 percent in 1975 with an increase to 32
percent in 1997 when comparing major commodities produced in New England. These numbers are lower when grains, bakery products and miscellaneous foods are considered.

**Shelburne Falls**

All of the studies noted share a focus on commercial agriculture production. None have adequately accounted for productive backyard gardens, community agriculture projects and urban agriculture, which can directly feed the local food system. In contrast, the food security plan for Shelburne Falls, Massachusetts chooses to take this approach directly. Local residents are working with two non-profit organizations and a student group. The group will be quantifying the village center’s food needs. This will be based on US national nutritional guidelines per capita multiplied by the village center’s population. Open spaces and vacant lots within the village center are studied for produce and small livestock production capability. Prototype site conditions for the four neighborhoods are used to design appropriate agricultural operations for the sites. Yield amounts are calculated based on a comparison of US Department of Agriculture and leading agricultural instructors, such as John Jeavons and Elliot Coleman, who have been testing yields of biointensive small scale agriculture.

**Comparison of Methods**

Each of these foodshed assessments asked a slightly different question. Therefore slight differentiations in the data sources and methodology exist while overall the approaches are similar. Table 1 contrasts the data sources and methodologies. Not applicable or N/A is used when a study did not consider that aspect.
Table 1: Comparison of Data Sources and Methodology from Various Foodshed Assessments

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Demand</th>
<th>Yield</th>
<th>Capacity - Potential Production</th>
<th>Supply - Actual Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York State</td>
<td>Urbanized areas as defined by the U.S. Census Bureau were used as the population centers. Assume that rural residents obtain their food from the nearest population center.</td>
<td>Sub-model estimates land requirements to fulfill human diet</td>
<td>GIS &amp; optimization modeling – farmland soils &amp; land cover layers</td>
<td>N/A</td>
</tr>
<tr>
<td>San Francisco</td>
<td>Consumer Expenditure Survey (MSAs) to show $ value; Loss-Adjusted Food Availability Data (national) and Food Commodity Intake Database (urban residents in Western US) to demonstrate consumption by weight.</td>
<td>N/A</td>
<td>Farmland Mapping &amp; Monitoring Program – California Department, 1990 &amp; 2004</td>
<td>Annual reports of County Ag Commissioners – tried to track the amount that is organic or sustainable – farm gate values and product weight.</td>
</tr>
<tr>
<td>British Columbia</td>
<td>Compared current consumption &amp; current population; recommended consumption (Canada’s Food Guide to Healthy Eating) &amp; current population; recommended consumption &amp; 2025 projected population.</td>
<td>1.3 acres to fulfill person’s annual diet using current production technology; ~10% irrigated</td>
<td>Assess current v. need and how much it will need to increase to keep up with demand</td>
<td>Farm gate production values. Assumes food production technology is held constant.</td>
</tr>
<tr>
<td>Shelburne Falls, Massachusetts</td>
<td>Current population * national nutrient requirements. Later town will survey residents to find out specific diet, or ask residents to keep receipts for a year to tabulate</td>
<td>USDA, John Jeavons, Elliot Coleman</td>
<td>Design &amp; calculate yields for open spaces/back yard gardens/shared gardens in the village center - various scenarios - include livestock &amp; produce &amp; amaranth (no other grains)</td>
<td>N/A</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>Consumer Expenditure Survey for Northeast</td>
<td>N/A</td>
<td>N/A</td>
<td>USDA Census of Agriculture, Farm to Retail Spread is used to match farm sales to consumer dollars</td>
</tr>
</tbody>
</table>

To determine consumer demand, three approaches were taken – consumer spending on food, national nutrition recommendations, and estimates based on the average human diet type. Population was held constant in all but the British Columbia assessment, in which population forecasts were used to understand the impact of population growth on future self-reliance. Consumer spending allows the assessment to address current consumption patterns, where as
nutritional recommendations allow for consideration of a healthier diet. Another advantage of consumer spending is the dollar amounts can be compared to retail sales of farm products. Peters approach in the New York state foodsheds is more complicated analysis that relies on a sub-model to estimate land requirements per person. This approach also ignores the regional population and focuses only on the urban center.

Three of the studies calculate the current agricultural production or supply for their study area. None of these studies are able to trace this locally produced food from origin to consumption. Rather the calculation of supply demonstrates the amount of locally produced food that theoretically could be consumed locally if the distribution mechanisms allowed this. These studies do not attempt to assess the distribution mechanisms in any depth.

Studies that consider the current supply use two different types of source material, either weight or sale value of produced crops at the farm gate (i.e. when the basket or truck of food is sold off the farm). San Francisco and British Columbia use weight. The Massachusetts study chose dollar value because weight values are not available for all commodities from the US Census of Agriculture. In all three, a conversion must occur between the farm gate values and retail. When converting farm gate dollars to retail dollars, the USDA farm to retail price spread can be utilized. For weight conversions the USDA’s Loss-Adjusted Food Availability Data can be used to address the reduced amount of product that makes it to the consumer through losses by handling and transport. After these conversions, the data can be compared to consumption patterns. San Francisco study has the advantage of improved data tracking completed by the County Agriculture Commissions. Data sources are limited to the USDA’s Census of Agriculture in Massachusetts, making dollar comparisons necessary.

All, except the Massachusetts self-sufficiency study, assessed the potential farmland or capacity for local food production. This is conducted in two general steps with various data sources for each depending on location and available local mapping and statistics. The first step
is to assess the amount of suitable farmland available. The second is to estimate the yield amounts that can be achieved on these lands. Conventional production techniques are assumed for British Columbia, San Francisco and New York. Partnering yields with the extent of available farmland can provide an estimate of the capacity of the region which may be above the current local production and supply of food.

The Shelburne Falls assessment is taking into account much smaller areas of production and is suggesting maximizing the production in these areas through intensive agriculture techniques as suggested by highly renowned biointensive agriculture proponents John Jeavons and Elliot Coleman. Biointensive farming includes maximizing space utilization, crop rotation and multi-cropping. It also involves season extensions and building back healthy soils. While a model for sustainable agriculture, it is yet to be practiced widespread or proven appropriate for mass production. These methods along with other accounts of high yielding urban agriculture projects demonstrate the potential for small areas – perhaps currently under utilized – to produce a significant amount of food. It also implies an increased amount of people engaged at least part of their time in the activity of growing food.

**Methodology for the Pioneer Valley Foodshed Assessment**

Defining the extent of a local foodshed is not an established process. In practice, it is formed by transportation routes, regional geography and markets, rather than county boundaries. The scope for this study of the Pioneer Valley was decided largely on the ease of data access. While the 100-mile diet is gaining in popularity, a foodshed based on this distance would have encompassed several states and divided counties. This presents data compatibility and access challenges. Data disclosure is also a complication for the US Census of Agriculture below the county level. For these reasons, the scope of this study was defined as three counties in Western Massachusetts.
The regional foodshed assessment for the Pioneer Valley is conducted in three phases. These phases are:

1. Determining consumer food demand,
2. Determining current local food production, and
3. Determining potential local food production.

**Phase 1: Determining consumer food demand**

Consumer demand for food is derived from the national 2007 Consumer Expenditure Survey. This survey is conducted by the Bureau of Labor Statistics to understand household and family purchasing habits. Data on home food purchases are collected via weekly diaries of survey participants. Average spending on food commodities per consumer unit is presented. A consumer unit corresponds to a household or family – any person or group of people living together and sharing purchasing decisions.

Data specific to spending in the Pioneer Valley are not available. Therefore, Northeast averages from the Consumer Expenditure Survey are utilized. The Northeast region is characterized by average household size of 2.4 and average number of workers per household as 1.3. For the Pioneer Valley these numbers are similar with the average household size at 2.5 and the average number of workers at 1.2 (US Census 2007).

Though some studies index nutritional needs based on national dietary recommendations, it was decided that consumer spending is a more appropriate measure. While some studies are interested in enhancing food nutrition in their study area, this study is more specifically interested in consumer demand for food and how that relates to current local production. It certainly could be argued that spending would be altered based on the availability of healthier food choices. It is not realistic to expect that purchasing would be altered dramatically in such a quick span of time. Therefore this study focuses on the current pattern of consumer spending.
Average spending per consumer unit for the Northeast is multiplied by the Pioneer Valley’s current number of households to extrapolate the region’s spending pattern. Estimated population and households is supplied by the 2007 American Community Survey conducted by the US Census Bureau. While population variations could have been considered, this assessment assumes a stable population. Additional population variables could have included visitors, seasonal adjustments due to tourists and school attendance, and/or population forecasts. Variations based on alternate diets, such as eating closer to the food pyramid, could also be tested.

**Phase 2: Determining current local food production**

Agricultural statistics on a national, state, county and zip code level are collected and published by the National Agricultural Statistics Service, a unit of the United States Department of Agriculture (USDA). The Census of Agriculture is conducted every five years to collect data on the previous year’s agricultural activities. It is then published the following year. Thus the 2007 Census of Agriculture was conducted in 2008 and made available in 2009. Currently, zip code level data are not yet published. The statistics for this phase of analysis are derived from the 2007 Census of Agriculture unless stated otherwise. The USDA defines a farm as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year. The Census of Agriculture tracks farm size, characteristics, crop varieties and value of commodities sold.

The USDA also tracts farm to retail price differential. This ratio is utilized to transfer farm sales value to retail dollars. This allows for a comparison of local farm sales to consumer spending.

This study considers primarily the following commodity groups: grains, dairy, meat, fruit, vegetables, poultry and eggs. Fish and seafood were not considered as they entail a limited
land use impact in the Pioneer Valley. While the USDA tracts aquaculture, additional data sources need to be consulted to get a full picture of the contribution of fish and seafood. This is outside the scope of this project.

Additional foodstuffs that are not compared include sugars, fats and oils, beverages, and miscellaneous foods. Oilseeds are grouped with grains and beans in the Census of Agriculture, making it difficult to separate. The only sugar tracked in the Pioneer Valley in terms of sugar is maple syrup; these data are not available in sales. The other miscellaneous items are not further defined and therefore complicate a comparison.

**Phase 3: Determining potential local food production**

The third phase of research conducts an investigation through the use of geographic information systems (GIS) into the extent of potential farmland in the Pioneer Valley. GIS is an appropriate tool as it allows the compiling of complex data layers and criteria to result in a clear and simple map with accompanying data tables.

Farmland in the Pioneer Valley was determined by a review of the region’s land use and farmland soils. These characteristics were chosen based on accessible public data from MassGIS and the criteria utilized in other case studies. Land use was a complete data set for the region, while the soils data layer is undergoing updates. Therefore potential farmland in Franklin County is represented only by identifying agricultural land use and not referenced against farmland soils. An overlay technique was utilized to match appropriate farmland soils with land that is currently being used as agriculture or open space. Refer to Figure 1 for an overview of the methodology utilized for this phase.
The MassGIS data layer for statewide soils was used as the base of the study. This data layer is based on soil surveys of the U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS). Franklin County is currently being resurveyed and therefore its data are not included in this study. The NRCS designates farmland soils as prime farmland soil, farmland soils of unique importance and farmland soils of statewide importance. Prime farmland soils are defined as those “that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. This land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water” (MassGIS Soils Datalayer Description). Soils of unique importance are noted for specific high value crop potential. Statewide importance is determined by state agencies for lands that are not quite prime soils but offer high production values using accepted farming methods.
For the purpose of this study all three farmland soil types were included. Lands with prime, unique or statewide important soils for agricultural production were selected by attribute and converted to a new farmland soils layer.

Next the statewide land use data layer available through MassGIS was analyzed. This land use data layer was derived by MassGIS from 1999 aerial photography and is complete statewide. Again selecting by attribute, a new layer was created from the following land use categories: cropland, pastureland, woody perennial, open land and urban open lands. Urban open lands were included to account for the possibility of urban gardens. Forested lands were also included, offering the potential for areas to be deforested if needed for food production. Protected forest lands were not excluded.

Lastly, the new agricultural and open space land use layer was intersected with the farmland soils layer to identify undeveloped lands with farmland soils, which indicates the extent of potential farmland in the Pioneer Valley. A new field was added to the attribute table and geometry calculations were performed to assess the area of the resulting polygons.

After determining the quantity of potential farmland, conventional yield amounts are utilized to explore the quantity of food production that could be possible. These yield figures are borrowed from the foodprint assessment conducted by Peters et al for New York. It is assumed that all of this land could be used for agriculture. Current agricultural practices and technology is also assumed to continue. For comparison, yields developed by John Jeavons through biointensive sustainable agriculture practices demonstrate the potential for local food production under a different approach.
Chapter 4

FINDINGS

Study Area

The Pioneer Valley refers to the region of Western Massachusetts that follows the Connecticut River. It encompasses three counties – Franklin, Hampshire and Hampden. While the area spans many environmental and geographically variations, micro-climates, cultural and social differences, the region has been linked together under the term Pioneer Valley. This term is commonly used by residents and visitors to identify the region.

Another unifying factor is the Connecticut River, which runs through the center of the Pioneer Valley. The floodplains of the river offer among the most valuable farmland soils in Massachusetts and the nation. This leads to a highly fertile and productive agricultural region.

This agricultural heritage continues to get support today with many local farmers, residents and community organizations striving to protect farmland and support local products. Community Involved in Sustaining Agriculture (or CISA) plays a visible role in promoting the growth and support of the region’s farmers. The organization runs a buy local campaign, among other programs, to inform consumers about available products that are grown within the region.

Demographics

The population for the Pioneer Valley region totaled 682,657 persons in 2007, as estimated by the American Community Survey of the US Census Bureau. Female persons comprise 52.1 percent of the population. 95 percent of the population is classified as living in households, with the number of households totaling 260,619. Table 2 provides further detail on the household structure for the region.
Table 2: Pioneer Valley Households Type, 2007

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Population</strong></td>
<td>682,657</td>
<td>100.0</td>
</tr>
<tr>
<td>Population in Households</td>
<td>647,345</td>
<td>94.8</td>
</tr>
<tr>
<td>Population in Group Quarters</td>
<td>35,312</td>
<td>5.2</td>
</tr>
<tr>
<td><strong>Number of Households</strong></td>
<td>260,619</td>
<td>100.0</td>
</tr>
<tr>
<td>1-person household</td>
<td>79,908</td>
<td>30.7</td>
</tr>
<tr>
<td>2-person household</td>
<td>85,640</td>
<td>32.9</td>
</tr>
<tr>
<td>3-person household</td>
<td>42,706</td>
<td>16.4</td>
</tr>
<tr>
<td>4-person household</td>
<td>32,749</td>
<td>12.6</td>
</tr>
<tr>
<td>5-person household</td>
<td>12,716</td>
<td>4.9</td>
</tr>
<tr>
<td>6-person household</td>
<td>4,940</td>
<td>1.9</td>
</tr>
<tr>
<td>7-or-more person household</td>
<td>1,960</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Average number of persons per household</strong></td>
<td>2.48</td>
<td></td>
</tr>
<tr>
<td><strong>Workers over 16 years in Households</strong></td>
<td>306,745</td>
<td></td>
</tr>
<tr>
<td><strong>Average Number of Workers per Household</strong></td>
<td>1.18</td>
<td></td>
</tr>
</tbody>
</table>


Current Consumer Food Demand

The Bureau of Labor Statistics tracks consumer spending on an annual basis. For 2007, national average annual expenditure was $49,638 per consumer unit. A consumer unit corresponds to a household or family – any person or group of people living together and sharing purchasing decisions.

Food purchases constitute 12.4 percent of consumer spending (BLS 2008). In 2000, consumer units spent an average $5,158 on annual food expenses. Compared to $6,133 in 2007, this represents an 18.9 percent growth. This period experienced an average annual growth of 2.9 percent. Table 3 contrasts national and northeast expenditures by major categories.
Table 3: Comparison of 2007 Annual Consumer Expenditures

<table>
<thead>
<tr>
<th></th>
<th>National</th>
<th>Northeast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Consumer Units</td>
<td>120,171,000</td>
<td>22,382,000</td>
</tr>
<tr>
<td>Average Number in Consumer Unit</td>
<td>2.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Average Number of Earners in Consumer Unit</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Average Annual Expenditures</td>
<td>49,638 Dollars 100.0</td>
<td>51,624 Dollars 100.0</td>
</tr>
<tr>
<td>Food</td>
<td>6,133 Dollars 12.4</td>
<td>6,419 Dollars 12.4</td>
</tr>
<tr>
<td>Housing</td>
<td>16,920 Dollars 34.1</td>
<td>19,085 Dollars 37.0</td>
</tr>
<tr>
<td>Apparel &amp; Services</td>
<td>1,881 Dollars 3.8</td>
<td>2,068 Dollars 4.0</td>
</tr>
<tr>
<td>Transportation</td>
<td>8,758 Dollars 17.6</td>
<td>8,014 Dollars 15.5</td>
</tr>
<tr>
<td>Health Care</td>
<td>2,853 Dollars 5.7</td>
<td>2,645 Dollars 5.1</td>
</tr>
<tr>
<td>Entertainment</td>
<td>2,698 Dollars 5.4</td>
<td>2,811 Dollars 5.4</td>
</tr>
<tr>
<td>Other Expenditures</td>
<td>9,939 Dollars 20.1</td>
<td>10,073 Dollars 19.7</td>
</tr>
</tbody>
</table>

Source: BLS Consumer Expenditure Survey 2007

Expenditures on food are divided into purchases for consumption in the home and out of the home. For the Northeast, meals consumed outside of the home constituted 44 percent of overall food spending. A detailed breakdown of this spending is not available. Further detail about food consumed at home is provided by distinguishing spending patterns by commodity groups.

The largest percentage of food spending was for the category of other foods. This includes fats and oils, sugars, nonalcoholic beverages, and other miscellaneous foods. This is a continuously growing sector of the diet, which corresponds with a growth in the purchase of packaged and pre-made foods (Holm 2001). Miscellaneous foods encompasses most packaged and prepared foods, including frozen prepared meals, pre-made packaged items, soups, salads, desserts, potato chips, snacks, nuts, relishes and condiments.

Meats, poultry, fish and eggs constitute the next largest percentage of spending at 813 dollars per year or 13 percent per consumer unit. A synopsis of food expenditures by commodity...
group for the Northeast is presented in Figure 2. All food expenditures in dollars and percentages with national and northeast data comparisons are presented in Table 4.

Figure 2: Food at Home Expenditures by Commodity Group, Northeast 2007

<table>
<thead>
<tr>
<th>Commodity Group</th>
<th>Percent of Overall Food Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other foods</td>
<td></td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td></td>
</tr>
<tr>
<td>Dairy products</td>
<td></td>
</tr>
<tr>
<td>Meats, poultry, fish, and eggs</td>
<td></td>
</tr>
<tr>
<td>Cereals and bakery products</td>
<td></td>
</tr>
</tbody>
</table>

- 2.0  4.0  6.0  8.0  10.0  12.0  14.0  16.0  18.0  20.0
### Table 4: Food Expenditures 2007

<table>
<thead>
<tr>
<th>Food</th>
<th>National Dollars</th>
<th>National Percent</th>
<th>Northeast Dollars</th>
<th>Northeast Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food at home</td>
<td>3,465</td>
<td>56.5</td>
<td>3,595</td>
<td>56.0</td>
</tr>
<tr>
<td>Cereals and bakery products</td>
<td>460</td>
<td>7.5</td>
<td>495</td>
<td>7.7</td>
</tr>
<tr>
<td>Cereals and cereal products</td>
<td>143</td>
<td>2.3</td>
<td>157</td>
<td>2.4</td>
</tr>
<tr>
<td>Bakery products</td>
<td>317</td>
<td>5.2</td>
<td>339</td>
<td>5.3</td>
</tr>
<tr>
<td>Meats, poultry, fish, and eggs</td>
<td>777</td>
<td>12.7</td>
<td>832</td>
<td>13.0</td>
</tr>
<tr>
<td>Beef</td>
<td>216</td>
<td>3.5</td>
<td>207</td>
<td>3.2</td>
</tr>
<tr>
<td>Pork</td>
<td>150</td>
<td>2.4</td>
<td>149</td>
<td>2.3</td>
</tr>
<tr>
<td>Other meats</td>
<td>104</td>
<td>1.7</td>
<td>121</td>
<td>1.9</td>
</tr>
<tr>
<td>Poultry</td>
<td>142</td>
<td>2.3</td>
<td>151</td>
<td>2.4</td>
</tr>
<tr>
<td>Fish and seafood</td>
<td>122</td>
<td>2.0</td>
<td>159</td>
<td>2.5</td>
</tr>
<tr>
<td>Eggs</td>
<td>43</td>
<td>0.7</td>
<td>45</td>
<td>0.7</td>
</tr>
<tr>
<td>Dairy products</td>
<td>387</td>
<td>6.3</td>
<td>400</td>
<td>6.2</td>
</tr>
<tr>
<td>Fresh milk and cream</td>
<td>154</td>
<td>2.5</td>
<td>151</td>
<td>2.4</td>
</tr>
<tr>
<td>Other dairy products</td>
<td>234</td>
<td>3.8</td>
<td>249</td>
<td>3.9</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>600</td>
<td>9.8</td>
<td>647</td>
<td>10.1</td>
</tr>
<tr>
<td>Fresh fruits</td>
<td>202</td>
<td>3.3</td>
<td>216</td>
<td>3.4</td>
</tr>
<tr>
<td>Fresh vegetables</td>
<td>190</td>
<td>3.1</td>
<td>205</td>
<td>3.2</td>
</tr>
<tr>
<td>Processed fruits</td>
<td>112</td>
<td>1.8</td>
<td>133</td>
<td>2.1</td>
</tr>
<tr>
<td>Processed vegetables</td>
<td>96</td>
<td>1.6</td>
<td>93</td>
<td>1.4</td>
</tr>
<tr>
<td>Other food at home</td>
<td>1,241</td>
<td>20.2</td>
<td>1,221</td>
<td>19.0</td>
</tr>
<tr>
<td>Sugar and other sweets</td>
<td>124</td>
<td>2.0</td>
<td>125</td>
<td>1.9</td>
</tr>
<tr>
<td>Fats and oils</td>
<td>91</td>
<td>1.5</td>
<td>93</td>
<td>1.4</td>
</tr>
<tr>
<td>Miscellaneous foods</td>
<td>650</td>
<td>10.6</td>
<td>626</td>
<td>9.8</td>
</tr>
<tr>
<td>Nonalcoholic beverages</td>
<td>333</td>
<td>5.4</td>
<td>333</td>
<td>5.2</td>
</tr>
<tr>
<td>Food prep for out-of-town trips</td>
<td>43</td>
<td>0.7</td>
<td>44</td>
<td>0.7</td>
</tr>
<tr>
<td>Food away from home</td>
<td>2,668</td>
<td>43.5</td>
<td>2,824</td>
<td>44.0</td>
</tr>
</tbody>
</table>

Source: BLS Consumer Expenditure Survey 2007
Current local farm production

The Census of Agriculture identifies over 121 million dollars annually in sales from Pioneer Valley farmers. More than half of these sales were crops and livestock for human consumption. The largest sectors for the region are vegetable and dairy sales. Pioneer Valley growers also contribute grains, fruit, meat, poultry and eggs. Thirteen percent of food related farm sales are sold directly to consumers, for example through farmers markets, community supported agriculture programs and farm stands. These sales are not attributed to specific crops. These sales are also not tracked to understand if the sale was direct to a consumer who lives outside of the Pioneer Valley. Table 5 presents farm sales for the Pioneer Valley.

<table>
<thead>
<tr>
<th>Table 5: 2007 Farm Sales for Pioneer Valley from US Census of Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL FARM SALES</strong></td>
</tr>
<tr>
<td>TOTAL FARM SALES</td>
</tr>
<tr>
<td>Crops – including nursery and greenhouse</td>
</tr>
<tr>
<td>Animals and animal products</td>
</tr>
<tr>
<td><strong>TOTAL FOOD SALES</strong></td>
</tr>
<tr>
<td>Crops</td>
</tr>
<tr>
<td>Grains, Oilseeds, Dry Beans &amp; Peas</td>
</tr>
<tr>
<td>Fruit &amp; Tree Nuts</td>
</tr>
<tr>
<td>Vegetables, including herbs, seeds, transplants in the open &amp; under cover</td>
</tr>
<tr>
<td>Livestock</td>
</tr>
<tr>
<td>Aquaculture</td>
</tr>
<tr>
<td>Cattle</td>
</tr>
<tr>
<td>Hogs</td>
</tr>
<tr>
<td>Dairy Products</td>
</tr>
<tr>
<td>Poultry &amp; Eggs</td>
</tr>
<tr>
<td>Sheep, Goats, and Products</td>
</tr>
<tr>
<td>Value of agricultural products sold directly to consumers</td>
</tr>
<tr>
<td>13.2 percent of Total Food Sales</td>
</tr>
<tr>
<td><strong>Source:</strong> 2007 Census of Agriculture, US Department of Agriculture</td>
</tr>
</tbody>
</table>
The Pioneer Valley’s almost 2,000 farms represent 14 percent of the land use in the region. Of the 169,062 acres of farmland, 34 percent is cropland and 14 percent is utilized as pasture land. The greatest segment at 44 percent is woodlands, which includes tapped maple forests and timber lots. Table 6 and Figures 3 and 4 offer further detail for the region and the three counties.

### Table 6: Agriculture Lands in Pioneer Valley, 2007

<table>
<thead>
<tr>
<th></th>
<th>Pioneer Valley</th>
<th>Franklin</th>
<th>Hampden</th>
<th>Hampshire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of farms</td>
<td>1,960</td>
<td>741</td>
<td>508</td>
<td>711</td>
</tr>
<tr>
<td>Average farm size (acres)</td>
<td>86</td>
<td>107</td>
<td>73</td>
<td>74</td>
</tr>
<tr>
<td>Percent in farms</td>
<td>14.3</td>
<td>17.7</td>
<td>9.3</td>
<td>15.6</td>
</tr>
<tr>
<td>Land in Farms (acres)</td>
<td>169,062</td>
<td>79,465</td>
<td>36,841</td>
<td>52,756</td>
</tr>
<tr>
<td>Cropland</td>
<td>61,213</td>
<td>24,429</td>
<td>12,984</td>
<td>23,800</td>
</tr>
<tr>
<td>Harvested</td>
<td>50,185</td>
<td>20,132</td>
<td>10,219</td>
<td>19,834</td>
</tr>
<tr>
<td>Other</td>
<td>6,174</td>
<td>2,046</td>
<td>1,634</td>
<td>2,494</td>
</tr>
<tr>
<td>Pastureland, all types</td>
<td>24,070</td>
<td>11,214</td>
<td>5,165</td>
<td>7,691</td>
</tr>
<tr>
<td>Cropland used as pasture</td>
<td>4,854</td>
<td>2,251</td>
<td>1,131</td>
<td>1,472</td>
</tr>
<tr>
<td>Non-Pastured Woodland</td>
<td>74,784</td>
<td>40,537</td>
<td>15,890</td>
<td>18,357</td>
</tr>
<tr>
<td>Land in buildings, facilities, ponds, roads, wasteland, etc.</td>
<td>13,849</td>
<td>5,536</td>
<td>3,933</td>
<td>4,380</td>
</tr>
<tr>
<td>Acres in Fruit &amp; Vegetables</td>
<td>9,542</td>
<td>3,614</td>
<td>1,255</td>
<td>4,673</td>
</tr>
<tr>
<td>Vegetable harvested for sale</td>
<td>7,844</td>
<td>2,794</td>
<td>884</td>
<td>4,166</td>
</tr>
<tr>
<td>Orchards</td>
<td>1,126</td>
<td>564</td>
<td>235</td>
<td>327</td>
</tr>
<tr>
<td>Berries</td>
<td>572</td>
<td>256</td>
<td>136</td>
<td>180</td>
</tr>
</tbody>
</table>

Source: 2007 Census of Agriculture, US Department of Agriculture
Potential Capacity for Local Farm Production

A comparison of current land use and farmland soils reveals the opportunity for more working farmlands in the Pioneer Valley. This section presents findings of the GIS analysis.

Land Use

The predominant land use of the Pioneer Valley is forestlands at 70 percent. Developed lands follow at 15 percent, with farmlands noted at 9 percent. Table 7 and Figures 5 and 6 demonstrate land use in the region according to MassGIS data derived from 1999 aerial photography. While development likely increased after 1999, this is the most recent data available for Massachusetts.

Agriculture includes crop, pasture and perennial farmlands. Forest refers to lands that are covered in woodlands, both managed woodlots and wild lands. Open space are lands without structures or improvements that are not in agricultural use. Wetlands and open waters are combined in the water category. Developed lands encompass residential, commercial, industrial, mining, transportation, waste disposal and recreation uses.

Table 7: 1999 Land Use by Acres

<table>
<thead>
<tr>
<th></th>
<th>Pioneer Valley</th>
<th>Franklin</th>
<th>Hampden</th>
<th>Hampshire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>107,270</td>
<td>42,825</td>
<td>24,010</td>
<td>40,435</td>
</tr>
<tr>
<td>Forest</td>
<td>854,147</td>
<td>356,415</td>
<td>258,942</td>
<td>238,790</td>
</tr>
<tr>
<td>Open Space</td>
<td>26,276</td>
<td>10,112</td>
<td>9,464</td>
<td>6,700</td>
</tr>
<tr>
<td>Developed</td>
<td>179,010</td>
<td>33,545</td>
<td>98,222</td>
<td>47,244</td>
</tr>
<tr>
<td>Water</td>
<td>51,760</td>
<td>20,824</td>
<td>15,145</td>
<td>15,791</td>
</tr>
<tr>
<td>TOTAL AREA</td>
<td>1,218,463</td>
<td>463,720</td>
<td>405,783</td>
<td>348,960</td>
</tr>
</tbody>
</table>

Source: MassGIS Land Use Summary Statistics, Set 2, August 2007
Figure 5: Land Use in Pioneer Valley, 1999
Farmland Soils

Over 300,000 acres of prime, unique and statewide important farmland soils exist in the Pioneer Valley. This covers a quarter of the land area. Figure 7 demonstrates the distribution of
these farmland soils in Hampshire and Hampden counties. While statistical data are available for Franklin County, its spatial equivalent is not available and therefore is not presented.

Figure 7: Map of Farmland Soils in Pioneer Valley
Available Farmland

The intersection of lands with farmland soils and lands that are not developed produced 179,325 acres of land that would be available for farming in the Pioneer Valley. It can be assumed that this includes lands that are already being used for agriculture. This amount is twice the acreage currently being used for crop and livestock production. It is also half the amount of identified farmland soils in the region, indicating that half of the region’s prime soils have already been developed. Table 8 displays the total farmland soils and the remaining lands once intersected with land use. Figure 8 demonstrates the extent of available farmland in the Pioneer Valley.

<table>
<thead>
<tr>
<th>Farmland Soils</th>
<th>Acres</th>
<th>Percent</th>
<th>Farmland Soils not Developed</th>
<th>Acres</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pioneer Valley</td>
<td>304,103</td>
<td>25.0</td>
<td>179,325</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>Franklin¹</td>
<td>114,054</td>
<td>51.683</td>
<td>46,726</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hampden Central</td>
<td>79,399</td>
<td>46,726</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hampshire Central</td>
<td>59,570</td>
<td>42,358</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hampden &amp; Hampshire East</td>
<td>31,982</td>
<td>23,935</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hampden &amp; Hampshire West</td>
<td>19,098</td>
<td>14,623</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SOURCES:
MassGIS Land Use Summary Statistics, Set 2, August 2007
MassGIS Soils Layer, October 2008

¹For Franklin County, “farmland soils not developed” reflects agricultural and open space land use in the county without incorporation of farmland soils due to lack of soils data.
Figure 8: Map of Farmland Available in Pioneer Valley

Legend
- Yellow: Undeveloped Farmland Soils
- Green: Other Undeveloped Land
- Red: Developed Land
- Blue: Water

Source: MassGIS, Land Use Summary Statistics, Set 2, August 2007
MassGIS, Soils Data Layer, October 2009
Further analysis of the preceding data show that the Pioneer Valley could not be food self-sufficient under current conditions, even with the region’s extensive farmland resources. While some commodities will most likely always be better suited to be grown elsewhere, there are opportunities for increased local production as identified both by available farmland and consumer demand. This chapter examines farm sales in comparison to consumer retail purchases, as well as available farmland to the amount of farmland needed for regional food self-sufficiency.

**Comparing Farm Sales to Retail Purchases**

Within the current globalized food system, the price a consumer pays at the store for a tomato includes many other costs beyond the payment to the farmer for growing the tomato. The Economic Research Service of the USDA calculates what a retail dollar pays for along the food chain. This calculation reflects spending for food eaten in the home and away from home, which has higher marketing costs. For 2006, 19 cents for every dollar spent on food was paid to the farmer. Marketing – including labor, storage, transport, energy, advertising, etc. – constituted the remaining 81 cents. Labor constituted the largest share at 38.5 cents. This refers to workers employed in stores, restaurants and other establishments that market food products. It does not refer to farm, transportation, manufacturing or distribution labor costs.

In the United States, the 881 billion dollars spent on food was divided between 163 billion dollars that farmers received and 718 billion dollars among the supporting structures to move this food to consumers. When farm crops are sold direct to consumers, such as through farmer’s markets, farm stands, and community supported agriculture programs, the farmer receives the entirety of the consumer’s dollar.
Farm to retail price spreads are also calculated for each food commodity. This price spread demonstrates the difference between the price farmers received for their products and the retail value of a market basket of a particular commodity. Farm value shares for fruits, vegetables, dairy, cereal and bakery products are available for 2006. Farmers growing fresh fruits, fresh vegetables and dairy products receive higher than 19 percent. Processed products – fruits, vegetables and grains – receive lower percentages due to the increased processing and packaging steps for these products.

Farm share values for beef and pork are updated on a monthly basis and annual averages are calculated. For consistency, the 2006 average is used for both beef and pork. Retail prices for lamb are not available and other meats – such as goat, elk, and bison – are not tracked at all by the USDA. Therefore farm share values are not calculated for other meat products.

The reverse is the case for poultry and eggs. Farm prices are not available. These industries have become integrated productions where most of the birds and eggs are produced under contract. Farmers are provided with chicks and feed from a producer and reimbursed for
the boarding services to raise the poultry. There are measures for wholesale to retail spreads but the farm values do not exist.

To convert farm sales to retail dollars for other meats, poultry and eggs, an older farm retail price spread is used for these commodities. Elitzak determined a farm value share for these products in 1997. Although dated and perhaps higher than current payments, this figure at least provides a base. Table 9 displays the farm value shares for all the commodities as used further in this analysis.

<table>
<thead>
<tr>
<th>Table 9: What the Farmer Got Paid or…</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Farm Value Share of Retail Cost</strong></td>
</tr>
<tr>
<td><strong>Farm value share</strong></td>
</tr>
<tr>
<td>(percent)</td>
</tr>
<tr>
<td>MARKET BASKET OF MIXED COMMODITIES</td>
</tr>
<tr>
<td>Fresh vegetables</td>
</tr>
<tr>
<td>Fresh fruit</td>
</tr>
<tr>
<td>Processed fruit &amp; vegetables</td>
</tr>
<tr>
<td>Cereals &amp; bakery products</td>
</tr>
<tr>
<td>Dairy products</td>
</tr>
<tr>
<td>Beef</td>
</tr>
<tr>
<td>Pork</td>
</tr>
<tr>
<td>Other meat</td>
</tr>
<tr>
<td>Poultry</td>
</tr>
<tr>
<td>Eggs</td>
</tr>
</tbody>
</table>


Farm value shares were used to convert the Pioneer Valley farm sales to be compatible with retail dollars. The first comparison includes only food that is consumed at home, 56 percent of all food purchases. Food consumed away from home is not divided into commodity groups, therefore direct comparisons are not possible. Table 10 and Figure 10 demonstrate the extent of regional demand that could be fulfilled by local supply.
Vegetables are produced in the Pioneer Valley at one and a half times the amount of regional spending for vegetables consumed in the home, meaning that this is clearly a product with significant export beyond the valley. The remaining categories are all produced at levels less than consumption demand. Dairy products and fruit add substantially to the region’s self-reliance with dairy products meeting 78 percent of the region’s needs and fruit at 31 percent. Overall, the Pioneer Valley residents could fulfill 28.7 percent of their at home consumption with local production. When considering only the identified commodity groups, this amount rises to 44.5 percent.

<table>
<thead>
<tr>
<th>Table 10: Comparison of Food Consumed at Home and Local Farm Production for Pioneer Valley</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dollars (Thousands)</strong></td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Cereals and bakery products</td>
</tr>
<tr>
<td>Meat</td>
</tr>
<tr>
<td>Poultry &amp; Eggs</td>
</tr>
<tr>
<td>Dairy products</td>
</tr>
<tr>
<td>Fruits - fresh &amp; processed</td>
</tr>
<tr>
<td>Vegetables - fresh &amp; processed</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

All food at home, including miscellaneous and other foods 895,487 256,841 (638,646) 28.7

Note: Fish and seafood have been excluded from supply and demand.
To explore further the extent of local production to meet food demands, an assumption was made that away-from-home food spending is proportionally the same across the commodity groups as consumers eating at home. This is a large assumption because people likely have different spending habits when they go out to eat. The lack of data, however, necessitates this assumption.

The capacity of local production to meet consumer demand is naturally lower when amending the extent of spending. In this comparison, none of the commodity groups exceed food needs of the region. Vegetable production meets demand at 83.9 percent. The food self-sufficiency rate can be measured as 24.9 percent for specified commodities and 16.1 percent for all spending. Table 11 and Figure 11 display the extent of food self-reliance for Pioneer Valley when full food spending is considered.
### Table 11: Food Projected to cover at Home and Away Consumption

<table>
<thead>
<tr>
<th>Goods</th>
<th>Regional Demand (Thousands)</th>
<th>Local Supply (Thousands)</th>
<th>Balance (Thousands)</th>
<th>Percent of Local Supply Fulfilling Regional Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals and bakery products</td>
<td>230,346</td>
<td>16,050</td>
<td>(214,296)</td>
<td>7.0</td>
</tr>
<tr>
<td>Meat</td>
<td>221,969</td>
<td>11,252</td>
<td>(210,717)</td>
<td>5.1</td>
</tr>
<tr>
<td>Poultry &amp; Eggs</td>
<td>91,208</td>
<td>3,410</td>
<td>(87,798)</td>
<td>3.7</td>
</tr>
<tr>
<td>Dairy products</td>
<td>186,138</td>
<td>81,422</td>
<td>(104,716)</td>
<td>43.7</td>
</tr>
<tr>
<td>Fruits - fresh &amp; processed</td>
<td>162,405</td>
<td>28,428</td>
<td>(133,977)</td>
<td>17.5</td>
</tr>
<tr>
<td>Vegetables - fresh &amp; processed</td>
<td>138,673</td>
<td>116,279</td>
<td>(22,394)</td>
<td>83.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,030,738</td>
<td>256,841</td>
<td>(773,897)</td>
<td>24.9</td>
</tr>
</tbody>
</table>

All food, including miscellaneous and other foods 1,598,924 256,841 (1,342,082) 16.1

Note: Fish and seafood have been excluded from supply and demand.

### Figure 11: Comparison of Projected Total Food Consumption and Local Farm Production

Assessing the Extent of Farmland in the Pioneer Valley

Current agricultural production in the Pioneer Valley cannot fully match the food needs of the region. The next question is whether additional land resources exist to expand the total of working farmlands to significantly narrow this gap. The 2007 Census of Agriculture identifies
80,463 acres of productive crop and pasture lands in the Pioneer Valley. Examination through GIS of lands in the region that have farmland soils and are not yet developed reveals 179,325 acres available. This suggests opportunity to more than double the amount of working farmlands in the region. Additionally, livestock can be raised on marginal lands that do not have prime farmland soils, which may offer a greater opportunity for local food expansion.

To explain the potential farmland that would be needed for regional food self-sufficiency, a detailed yield analysis of the region’s farmland could not be completed. Instead a comparison was drawn from models that others have developed to estimate the impact of one person’s diet on land use; these include the foodprint model developed by Peters et al. at Cornell University, and John Jeavons’ work on biointensive agricultural yields. The foodprint represents the amount of land needed to grow one person’s food intake for a year. Heavy meat diets require almost two acres compared to vegetarian diets of half an acre. This model uses conventional agricultural yields for New York State. Biointensive agriculture has been practiced for thousands of years throughout many different cultures. Dense crop planting, multi-cropping, soil sustenance and an integrated farming approach create high yields from small areas. Jeavons’ calculations of 4,000 square feet per person are based on decades of trials, intermediate yields and vegan diets.

Using conventional agricultural practices, there is not sufficient lands in the Pioneer Valley to reach self-sufficiency. Vegetarian or light meat diets require about twice as much land as is potentially available and over four times the amount of currently productive farmlands. A heavy meat diet would require the entirety of the Pioneer Valley to be farmed and then some. In contrast, a vegan biointensive agricultural approach would necessitate less than our current farmland to feed the region. This, however, would require some radical changes in diet, agricultural practices and the number of people engaged in growing food. See Table 12 and Figure 12 for a comparison of the acres needed.
Table 12: Comparison of Current and Estimated Need of Farmland for Pioneer Valley Food Self-Sufficiency

<table>
<thead>
<tr>
<th></th>
<th>Acres</th>
<th>Percent of Total Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Land Area(^1)</td>
<td>1,218,463</td>
<td>100.0</td>
</tr>
<tr>
<td>Current Farmland Available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productive Farmlands(^2)</td>
<td>80,429</td>
<td>6.6</td>
</tr>
<tr>
<td>Farmland Soils not Developed(^3)</td>
<td>179,325</td>
<td>14.7</td>
</tr>
<tr>
<td>Farmland Soils(^3)</td>
<td>304,103</td>
<td>25.0</td>
</tr>
<tr>
<td>Farmland Needed for Food Self-Sufficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian Diet(^4)</td>
<td>341,329</td>
<td>28.0</td>
</tr>
<tr>
<td>Light Meat Diet(^5)</td>
<td>409,594</td>
<td>33.6</td>
</tr>
<tr>
<td>Heavy Meat Diet(^6)</td>
<td>1,365,314</td>
<td>112.1</td>
</tr>
<tr>
<td>Biointensive: Vegan Diet/Soil Sustenance(^7)</td>
<td>62,687</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Sources:
\(^1\)MassGIS Land Use Summary Statistics, Set 2, August 2007
\(^2\)US Census of Agriculture, 2007 (USDA)
\(^3\)MassGIS Land Use & Soils Data Layers
\(^4\)2007 Population * Peters' Foodprint acreage (0.5 ac/person)
\(^5\)2007 Population * Peters' Foodprint acreage (0.6 ac/person)
\(^6\)2007 Population * Peters' Foodprint acreage (2 ac/person)
\(^7\)2007 Population * John Jeavons calculations (4,000 sq ft/person)
There are a number of caveats to the above presentation, which cannot be fully explored in this thesis but should be mentioned to present a clear picture. This study does not incorporate the production supply or capacity of backyard and community gardens, foraging, fishing, or hunting. These may or may not be significant factors contributing to local food supply.

Additionally, this analysis excludes fish and seafood on both the production and consumption sides. Holm (2001) notes that Massachusetts is self-sufficient in regards to fish and seafood. His analysis incorporates both aquaculture and commercial fishing. This may not be the case when assessing the Pioneer Valley in isolation.

For economic reasons and consumer preferences, it can be expected that the Pioneer Valley will continue to import goods that cannot be grown in Massachusetts. As mentioned, this study is concerned with increased self-reliance within the region and not total self-sufficiency. Grains, sugars, beans – items that store well and don’t need rapid transit and high energy cooling measures – continue to make energy and economic sense to be produced elsewhere and brought
into the region. Some crops are not adapted to the Pioneer Valley growing conditions and will continue to be imported.

Miscellaneous foods, which are fats, sugars and mainly packaged goods, have been a growing segment of the national diet. This trend is likely to continue or at the minimum take awhile to shift. These products generally have origins outside of the Pioneer Valley.

Further analysis would be needed to ascertain how much land would be necessary for local livestock, dairy, fruit and vegetable production, rather than the complete diet scenarios presented above. An analysis that removed grains and produce that cannot be grown in Massachusetts would give a more specific assessment of the needed land to grow local foods that can be reasonably expected to be grown locally. As these examples are for a complete diet locally grown, a diet that relies on a specific proportion to be grown out of the region would require less farmland.

The estimates of farmland per person are taken from various studies that are not specific to Massachusetts. They serve a heuristic purpose but may not demonstrate a definitive farmland need specific to the terrain, climate, or production capacity of Massachusetts or of the Pioneer Valley region.

It should also be noted that productive farmland in the Pioneer Valley is not currently fully in food production. Some of these lands support Christmas trees, nursery and greenhouse landscaping plants, tobacco, and biomass for fuels. These products are considered valuable for cultural, energy and economic reasons. For this research, it cannot be anticipated that all of the productive farmlands (current or potential) would or should be devoted to food products. The proportion of how much should be devoted to food versus other needs is beyond the scope of this research.
Opportunity for Increasing Food Self-Reliance

Preserving the Pioneer Valley’s current working farmlands and undeveloped farmland soils is a high priority to ensure the opportunity for as much local production as possible. Almost 100,000 additional acres of potential farmlands exist in the Pioneer Valley that are not currently in agricultural production. This amount is more than twice the current crop and pasture lands. Sprawl and encroaching development places pressure on these same lands. Farmland offers flat, clear spaces that are easily developed with desirable vistas. Innovative farmland preservation tools can be implemented to continue the practice of preserving these lands.

Increasing the acreage of active farmlands will likely involve expanding the number of farmers. It will also require growth in the number of persons engaged in the many aspects of the local food system – from wholesalers, to processors and distributors. These call for skills and systems that will need to be enhanced if local food production and access are to be bolstered. Additionally, consumer preferences will need to support local farmers.

Each commodity group has the potential for increased local production. Dairy, fruit and vegetables represent substantial proportions of the local food stream. Even vegetables, the highest at 84 percent, however, do not meet regional demand. Supporting these commodities will build on the strengths of the local foodshed.

Economic and political drivers have altered where most meat, poultry and eggs are raised in the United States. From the 1970s to 1990s, there has been a dramatic shift of these products toward being raised outside of New England (Holm 2001, Gouveia 1994). For this reason, there is great opportunity for increased local production in these commodity groups to meet Pioneer Valley consumer demand. Beyond land use there will be concerns of infrastructure – such as transport, slaughter facilities, packing facilities and distribution facilities – to enable local production.
Urban agriculture and backyard gardens offer great opportunities to enhance the local foodshed. While these are small production spaces, they can turn once infertile areas into thriving productive food spaces. This may involve utilizing multiple crop rotations, season extension techniques, and growing in unique spots, indoors, on roofs and vertical spaces. Biointensive techniques have been tried and tested by many urban homesteaders and rural farmers. The Pioneer Valley offers the extent of farmland needed to feed the region’s population with a complete diet utilizing biointensive techniques. However, biointensive techniques may require more hands working the earth, as well as significant dietary adjustments. Despite these challenges, shifts in diet and agricultural production techniques may aid in balancing local food needs and production.

**Role for local and regional planners**

A local foodshed assessment enables local and regional planners to make more informed decisions about their communities. Food offers an integral base for people and communities. The land resource where this food is produced is as integral to the community, whether it be the farm next door or the field in Peru. Understanding the local and global foodsheds serving the region provide further insight into strengthening the community’s land resources, economics and community well-being.

Planners can have a direct role in farmland protection and agricultural-friendly zoning. Zoning can encourage and enable local agriculture for commercial farms as well as community gardens and backyard food production. Planners can work with local farmers, agricultural commissions and land trusts to enhance farming and understand further needs and opportunities.

Foodshed assessments can provide a baseline from which to understand projections of population trends, climate change or energy concerns. They offer insight into potential areas of concern or weakness. Strengths and opportunities of the region can be clarified.
The economic impact of food purchases and farming operations comes to light through a foodshed assessment. This places value on a sometimes overlooked sector of daily life – eating and where that food comes from. It also raises the question of economic cost for the consumer and benefit for the farmer. Local production and direct sales to consumers aid both sides of the equation, with higher income for the farmer and healthier, fresh food for the consumer. This scenario also helps build stronger community relationships.
Chapter 6
CONCLUSION

This research demonstrates the use of foodshed assessments to inform regional planners. Its analysis of Massachusetts’ Pioneer Valley foodshed provides an example, which identifies the extent of food self-reliance for the region and the land use implications of local food production.

A foodshed represents the land resource that supports food production for a region or community. In other words, a foodshed is the geographic area that demarcates the origin of food we eat. The size and location of a foodshed is shaped by economic, political and transportation structures that influence the flow of food from farm to table. Before the 1800s, foodsheds were predominantly local – within the city or neighboring countryside. Today most urban areas are supported by a global foodshed.

The global foodshed presents many benefits. It offers a variety of produce and products available any time of year. The global food system has been built on standardized, specialized production and economic efficiencies. However, it has created tremendous externalities: wastes, environmental and health concerns, and exacerbated inequalities in food distribution and access. Promotion of alternative local foodsheds has re-emerged in an attempt to address these concerns.

To better understand the opportunities and challenges of a local foodshed, a foodshed assessment can be conducted. Such an assessment demonstrates the local foodshed’s capacity to provide the region’s food needs. Planners gain insight into the land use implications and service/infrastructure needs to support the local foodshed. The assessment can be altered to answer a variety of research questions.
Highlights of the Pioneer Valley Foodshed

This study undertook an assessment of the Pioneer Valley foodshed to explore regional food consumption, current food production in the area and opportunity to increase local production to improve food self-reliance. When comparing regional consumption patterns with local food production, the Pioneer Valley could provide 29 percent of food that is consumed in the home. Two commodity groups represented high percentages. Vegetable production reached 150 percent of at home consumption, and dairy products were at 78 percent. Fruits were lower but substantial at 31 percent. These products are strong elements of the local foodshed.

In contrast, local grain, meat, poultry and egg production is minimal compared to demand. While livestock used to be a prominent presence in New England, shifts to corporate and contract farming have altered where and how animals are raised. This system has favored large facilities in the south and west of the United States, resulting in reductions since the 1970s of local livestock production.

Grains have been long farmed in the Midwest, where favorable growing climates and vast open spaces are well suited to mass production of grain crops. These products also offer a long shelf-life and relatively minimal energy to transport. For these reasons, a long distance foodshed for grains may continue to be preferable.

In examination of the farmland resources of the Pioneer Valley, a comparison was conducted of currently productive farmlands, potentially available farmland and the extent needed for regional self-sufficiency. While self-sufficiency is not seen as the end goal, this comparison allows a baseline of understanding from which to work. A 123 percent increase could be realized in agricultural lands. Current productive farmlands constitute seven percent of the region. About 100,000 additional acres of non-developed farmlands exist.

Even with this possible increase in working farmlands, there would not be enough agricultural space using conventional farming techniques and yields to feed the region. Diet
choices impact the amount of land needed. Using conventional yields, a heavy meat diet would require more land than the entirety of the Pioneer Valley. A vegetarian diet would still require more space than the available farmland in the region. In comparison, current productive lands would be adequate for regional self-sufficiency using biointensive farming yields with vegan diets.

**Further Considerations for Pioneer Valley Foodshed**

This study indicates that there is opportunity to increase food self-reliance for the Pioneer Valley. Additional farmlands could be brought under production. Agricultural techniques could be altered to encourage sustainable farming practices, increase yields and engage more people in the growing of local foods. Commodity groups that are underrepresented could be increased to create a stronger balance across the foodshed. Building on the strength of the region’s vegetable crops and dairy products could expand these commodity sectors to more fully meet the needs of the region and increase export potential. Additional considerations may need be given to season extension opportunities and creating additional local storage and processing capacity to enhance the use of these products locally.

One aspect that this assessment could not fully estimate is the amount of locally grown food that is currently enjoyed in the Pioneer Valley. Is the extensive amount of vegetable crops sold to consumers in Boston or Springfield or elsewhere? Unfortunately, no data traces the path of food from origin to consumer. While the Census of Agriculture asks whether sales were direct to consumers, these consumers could live outside of the region of interest. Further detailed study would be needed to understand the true path of these commodities.

In regards to grains, meat, poultry and eggs, the lingering question is a different one. Does the local foodshed infrastructure exist in the Pioneer Valley to support these commodities?
Supporting local production for these items may require bolstering local food system structures, such as processing facilities, slaughter houses and distribution centers.

While the region has experienced sprawling development in recent decades, the Pioneer Valley still holds the possibility of expanding the current amount of working farmlands. Farmland protection measures and land use planning may be needed to ensure that these lands continue to be available for farmland use. These lands also need farmers to work them. Understanding the challenges and supporting new farmers may be a necessary element to reinforce the local foodshed.

Further analysis or implementation of the Pioneer Valley foodshed should be shaped by engaging the public to participate in further determining the Pioneer Valley foodshed goals. Then adjustments and incorporations of new elements can be based on publicly-defined goals as well as on capacity assessments. For example, if the goal is to build on the region’s current strengths, perhaps focusing on expansion of fruits, vegetables and dairy is appropriate. If instead the goal is to create greater self-reliance, an increased focus on grains, meat, poultry and eggs would be called for. While this study provides a baseline for planners and local foodshed advocates, further direction and recommendations must be crafted based on public feedback. Local production is not in all cases more economical or environmentally beneficial. Priorities and preferences will need to be established to direct these choices.

**Future Research**

This foodshed assessment of the Pioneer Valley serves as a baseline for further discussion and a model from which to build. Further refinement might include adjustment for products that reasonably cannot be grown in New England, such as tropical fruits, or that may be better suited for production elsewhere, such as grains. Adjustments for diets that follow the national dietary recommendations rather than current spending could be included. Population
forecasts or seasonal adjustments for population shifts due to the school cycles or visitors could alter the findings. Effects of increased development patterns could be modeled as well.

Two considerations seem timely for future study – impacts of climate change and the contributions of urban agriculture and backyard food production. Scientists are not yet sure how farmland will be affected as the global climate changes. Various scenarios have been modeled to estimate the loss of farmland due to flooding and drought. These models could be utilized within the foodshed assessment to understand the extent of farmland resources that would be affected and the resulting effect in food self-reliance.

This foodshed assessment of the Pioneer Valley and most other assessments found when conducting initial research reflect only the contribution of commercial agriculture. The role of urban agriculture and backyard food production is overlooked. Quantifying these contributions could highlight their value and demonstrate the potential to increase self-reliance through these methods.

Related, the foodshed assessment could be used to assess the impact of externality costs on local economies and ecologies. This work could strive to value the local foodshed as it internalizes these externalities, enabling them to be dealt with more effectively from a planning and policy perspective.

**Foodsheds and Regional Planning**

Food has not played a prominent role historically in the field of planning. While food access and the ability to grow food and nourish oneself is certainly a basic human need, food has been overlooked and assumed to be not within the scope of planning. In recent years, this is starting to change with planners highlighting the connection food and farming have with the foundation of communities.
A local foodshed assessment is a valuable planning tool to further this endeavor. It enables planners and the public to better understand the land resource that supports the community or region. The assessment can be used to establish a baseline to inform planning, and it can be shaped by the specific goals and questions posed by the region. The information generated through a foodshed assessment can directly aid future land use suggestions, food equity work and economic or community development efforts. Additionally, planners have a greater opportunity to be engaged in regulating or promoting policy at a regional level, rather than global.

**The Planner’s Role**

Local and regional planners can play key roles in the development and administration of a foodshed assessment. While refinements and detailed studies may require more in-depth work and creating data sources, the basic foodshed assessment presented in this study uses data which planners can readily access. Planners are in the unique position of garnering interest and public opinion to shape the study in an appropriate manner for the location. Planners also provide the vision and strategic planning to understand the multi-faceted impacts of the local foodshed and future challenges and opportunities. A foodshed assessment may compliment other food system or planning activities.

Beyond assessments, planners can offer additional expertise in supporting the local foodshed. Through agricultural friendly zoning opportunity for local food production is ensured. This includes zoning allowances for backyard and urban food production. Dichotomous planning in the past has segmented agriculture to largely rural areas. Vibrancy of the local foodshed depends also on the ability for community gardens and backyard chickens.

Farmland preservation tools are actively used by many communities to protect local agriculture. Development value adds pressure on these lands. Planners can engage in preservation efforts and be familiar with the variety of tools available.
Planners can serve as a liaison and/or partner with agricultural commissions, community groups and local farmers to establish and advance local foodshed goals. This partnership can be accomplished by initiating cross-communication and guiding the discussion of opportunities and challenges for the area.

Rebuilding the local food system involves new business and employment opportunities. Economic development planners can focus on farm and food related enterprises. Through reduced transaction costs, a robust local food system supports the regional economy by providing more funds direct to farmers and local businesses.

Community planners may chose to foster equal access to healthy and affordable food. A critique of local foods is that they can be more expensive. Community food system and security assessments can provide further direction for these efforts.

Supporting the local foodshed provides many regional benefits. While planners have not traditionally played a role, this is a gap that needs to be filled. Planners offer extensive expertise that could be utilized to further engage communities with where and how their food is produced. A foodshed assessment offers a key step for understanding the land resources and farms that are in the local foodshed.
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