

Seattle Food System Enhancement Project

**Program on the Environment
Certificate in Environmental Management
Keystone Project, 2006-2007**



SPECIAL THANKS TO:

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FORWARD

The Seattle Food System Enhancement Project is a two-year cooperative effort between students from the University of Washington's Program on the Environment and the City of Seattle food policy Interdepartmental Team (IDT). The IDT is a voluntary group comprised of City officials from different departments including but not limited to Department of Neighborhoods, Planning and Development, Public Health, Human Services, Seattle Public Utilities, Public Health, and Office of Sustainability and the Environment. The timeframe for this project correlates to the University of Washington's academic year.

The students involved in 2006-2007 phase of the project come from diverse personal, professional, and academic backgrounds but share a common interest in the health and sustainability of Seattle's food system. The team includes Heidi Radenovic of the Business School, Rich Cook of the Evans School, Dan Morgan of the Department of Earth and Space Sciences, and Stephanie Renzi of the Jackson School of International Studies. Branden Born, Assistant Professor in the Department of Urban Design and Planning has been the faculty mentor for the project since its inception. Laura Raymond, P-Patch Community Garden Coordinator in the Department of Neighborhoods, chairs the IDT and served as the principle liaison between the team and the City of Seattle IDT for this phase of the project.

The 2005-2006 team collaborated with the City of Seattle and other partners to characterize the local food system. They researched the study of food systems and interviewed local stakeholders to validate their research and findings. The final product presented to the City included a set of 32 recommendations to 1) increase neighborhood food access, 2) increase sale/availability of locally/regionally grown food, 3) increase urban food production, 4) recover/recycle food from the waste stream, and 5) organize and enhance City response to food issues. The 2005-2006 project and the Mayor's Climate Action Plan, which states the connection between agricultural practices and climate change, prompted the City to ask additional questions about the local food system. The 2006-2007 Food System Enhancement Project was thus designed to 1) better understand residents' experience with the food system in specific neighborhoods, and 2) Investigate the relationship between the food system and climate change.

Our team was tasked with two objectives. First, building on the research of last year's study, we conducted a neighborhood food assessment of First Hill and South Beacon Hill to identify issues residents have concerning food accessibility, affordability, and availability. Second, we quantified and compared greenhouse gas emissions from the production and manufacturing of four food items produced by the conventional food network, and the same items when grown organically/regionally. Our hope is that this analysis will provide further insight for the City to define and analyze food system enhancement opportunities in ways that will foster social justice and environmental sustainability.

**Seattle Food
System
Enhancement
Project:
Neighborhood
Food System
Assessment**

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INTRODUCTION

Many families in the United States are not meeting their basic food needs. A study conducted in 1999 by the United States Department of Agriculture suggested that 10% of American families did not have adequate access to food at all times to ensure an active and healthy lifestyle.¹ In Seattle, recent surveys have suggested that between 12% and 20% of Seattle residents have experienced food insecurity, 63,000 residents could be classified as food insecure and 31,500 residents are hungry.²

In recent years, researchers, policymakers and social activists have suggested that hunger and food insecurity can be partly attributed to broader social, socioeconomic and institutional characteristics of the communities from which these issues emerge.³ This has spawned a relatively new field of empirical study focused on how interrelated characteristics of communities' support (or fail to support) the food needs of their residents.

Community Food Assessments (CFAs) have been undertaken in numerous cities throughout the United States and internationally to examine the interconnectedness of numerous factors that affect community residents' ability to access food. These factors can include:

- The size and proximity of food retail stores
- The variety, quality and quantity of food available to residents
- The availability of public transportation to access food resources
- The availability of locally produced food resources
- The availability of culturally appropriate food resources

If policymakers are to better understand the sources of food security, potential barriers to food access and policies that could be identified to improve people's food access, the first step is to understand how the above-mentioned factors come together at the neighborhood level through CFAs.

METHODOLOGY – COMMUNITY FOOD ASSESSMENT

Community food assessments were first developed by a group of researchers, policymakers and community advocates who came together to form the Community Food Security Coalition (CFSC) in 1994. As research on how a community's physical, social and economic infrastructure supported food accessibility; a movement towards encouraging local residents to examine the quality of their food access emerged. According to Pothukuchi, a "CFA is a collaborative and participatory approach that systematically examines a broad range of community food issues and assets, so as to inform change and actions to make the community more secure."⁴

The primary purpose in conducting a community food assessment is to encourage a process led by community members to identify how well their community currently serves the basic food

¹ <http://www.ers.usda.gov/publications/efan02013/efan02013a.pdf>

² Sound Food Report.

³ Ibid

⁴ Pothukuchi (2002)

needs of all its residents with regards to the five factors listed above. To further promote community-based food research, the United States Department of Agriculture (USDA) published the *Community Food Security Assessment Toolkit*, which provides the clearest methodology for conducting a community food assessment.⁵ The toolkit outlines six components that should be included in a community food assessment. These include:

- Profile of community socioeconomic and demographic characteristics
- Profile of community food resources
- Assessment of household food security
- Assessment of food resource accessibility
- Assessment of food availability and affordability
- Assessment of community food production resources

The scope of the project addressed in this report did not include conducting a Community Food Assessment, which requires a high level of community involvement from the public and private sector and other stakeholders. The time and resources needed to conduct a complete Community Food Assessment exceeded the capacity of our research team. Instead, we conducted a neighborhood food assessment in First Hill and South Beacon Hill. This involved profiling each neighborhood's demographic and socioeconomic characteristics, as well as community food resources – which meets the first two guidelines above. In addition to gathering this data, we solicited qualitative information from neighborhood residents, by way of focus groups, to better understand residents' experience with the food system.

By meeting the first two components of the USDA's CFA toolkit assessment guidelines and by engaging the community in five focus groups aimed at soliciting broad responses about how well the food system is meeting the needs of residents, this research has created a foundation for further study of these neighborhoods.

The profile of community socioeconomic and demographic characteristics and food resources details the resources and challenges First Hill and South Beacon Hill face in achieving food security for their residents. While the community focus groups solicit candid input from neighborhood residents as to how well their neighborhood food system is working, it also creates interest and excitement for potential community-driven processes that could fully assess the final four components identified in the USDA CFA guide.

NEIGHBORHOOD SELECTION

There are many ways to scope a food assessment. For example, one can look at the food system of an entire state, region, county, city, or narrow down further to a district level, neighborhood, or square mile. Based on last year's report (Sound Food Report), which discussed food systems in general and referenced Seattle's food system in particular, the City hoped to take a closer look at Seattle's food system and how it functioned in Seattle neighborhoods.

Determining which neighborhoods to select for our study was a process of initial research and deliberation with the city's Interdepartmental Team. For the sake of time and resource

⁵ <http://www.ers.usda.gov/publications/efan02013/>

constraints, we determined early on that we could reasonably assess one or two neighborhoods within the nine-month timeframe of our project.

Our first task was to identify and define neighborhoods in Seattle. We utilized the City's Community Reporting Areas (CRAs), which divide Seattle into 53 neighborhoods that are consistent with census geography. We then compiled basic socioeconomic demographic data, by census tract, for each neighborhood to compare and contrast neighborhood characteristics. We considered population, poverty rate, median household income, and other data.

We narrowed down the list of neighborhoods by selecting those at opposite extremes of the income and poverty spectrum. We presented this list to the IDT in December 2006, and then added health data on chronic disease rates and access to healthy food in the neighborhood selection process based on their suggestion. We included mortality rates related to heart disease, diabetes, and cancer, as well as percent obese and not meeting the 5-a-day requirement. When we next met with the IDT, we collectively decided that a neighborhood food assessment of two low-income neighborhoods would be most useful to the IDT in informing food policy. From the several possible neighborhoods we chose First Hill and South Beacon Hill based on IDT comments and the interest of individual neighborhood district coordinators and community organizations, who would be important in gaining entry to the communities and setting up focus groups.

DEFINING NEIGHBORHOOD BOUNDARIES

We defined neighborhood boundaries for First Hill and South Beacon Hill using the Community Reporting Area (CRA) guidelines as defined by the City of Seattle in 2005. The CRA concept was conceived and evaluated by a working group that included staff from the following offices: DON, DPD, DOIT, OSE, SOT, and SPU⁶.

Boundaries for each neighborhood are as follows. South Beacon Hill is defined at the northern boundary by Graham Street, I-5 to the west, Martin Luther King Jr Way S to the east, and the City limits to the south. First Hill has an irregularly shaped neighborhood boundary. I-5 bounds the neighborhood on the west, Yesler Way to the south, and 15th to the east. The northwest boundary is Olive Way and the northeast boundary is Madison Street. The two northern boundaries are connected by 12th Avenue.

Using 2000 Census data, which is consistent with CRA neighborhood boundaries, First Hill is defined by census tracts: 5303301820, 5303301830, 53033018500, and 53033018600. South Beacon Hill includes census tracts 53033011000 and 53033011700. Neighborhood boundaries per census tract geography are detailed in Figure 1 below.

⁶ City of Seattle Department of Planning and Development
http://www.seattle.gov/dpd/Research/Population_Demographics/Census_2000_Data/Data_Maps_for_Locally_Defined_Areas/DPDS_007014.asp

Figure 1: Community Reporting Area for First Hill

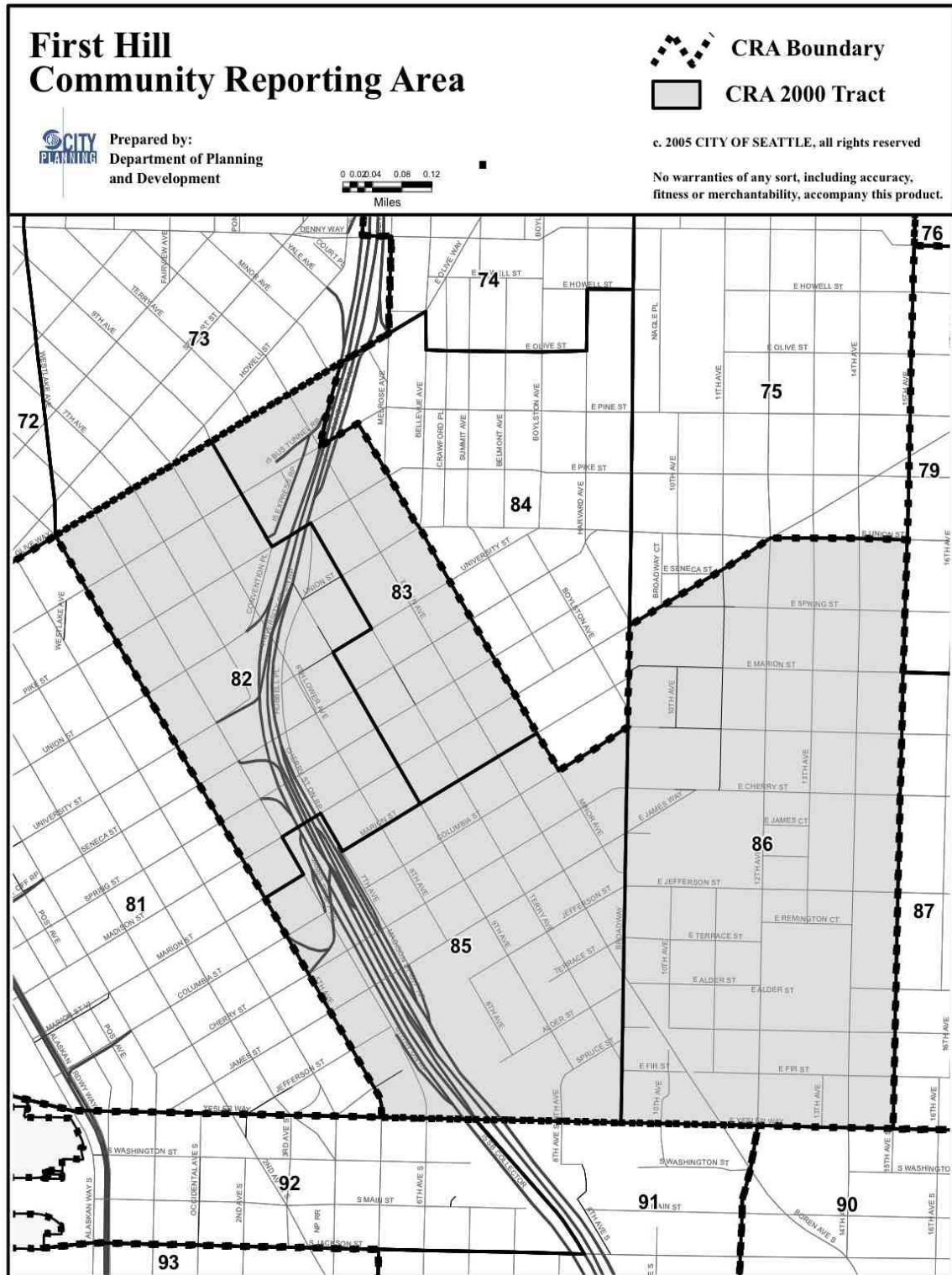
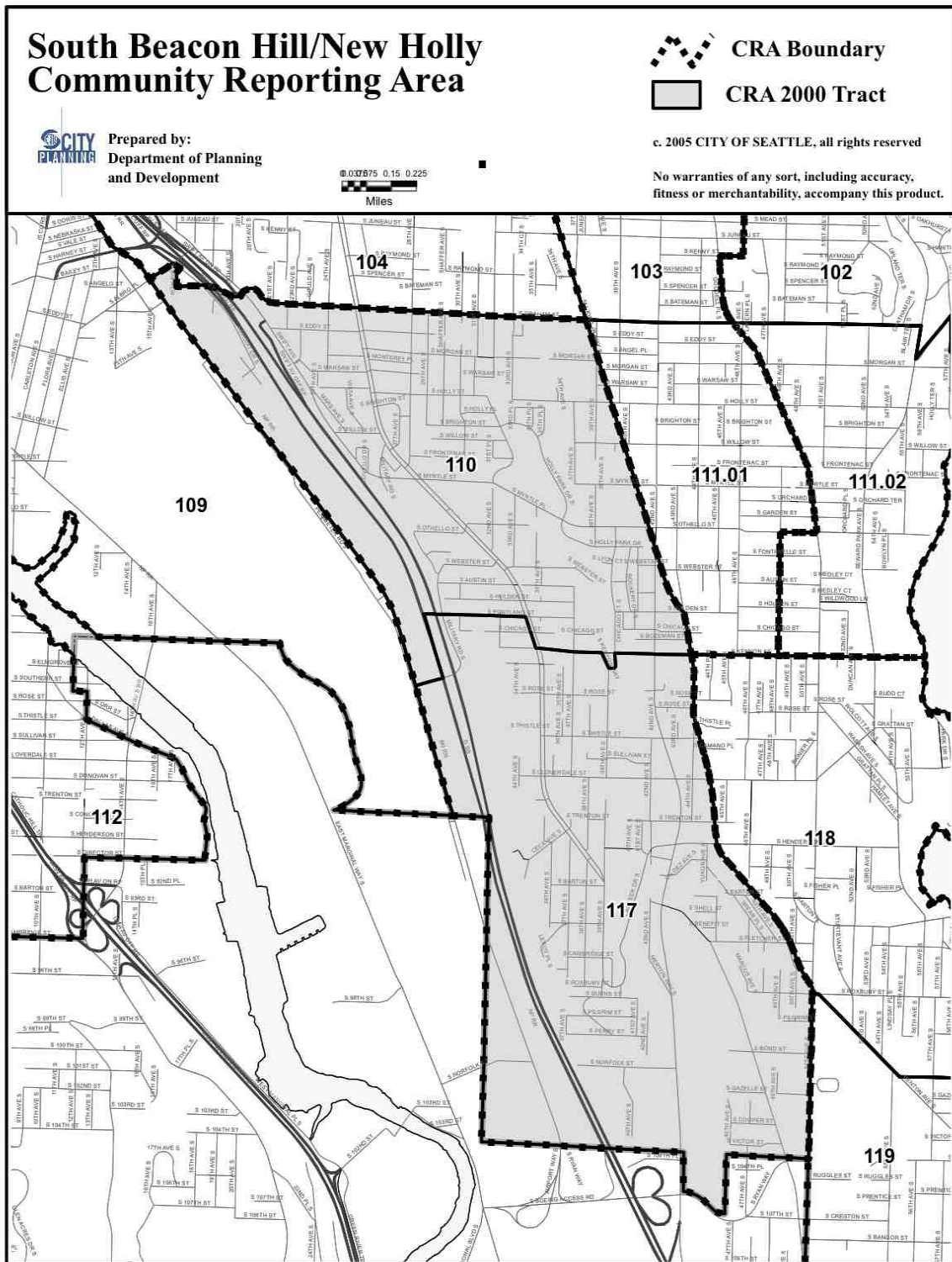


Figure 2: Community Reporting Area South Beacon Hill



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PROFILE OF NEIGHBORHOOD DEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS

The first step in conducting a neighborhood food assessment, as outlined by the Economic Research Report, USDA’s Community Food Security Assessment Toolkit, is to collect demographic and socioeconomic characteristics of the neighborhoods to be studied. This collection is guided by the following questions⁷:

- *Who are the people in this neighborhood?*
- *What are their demographic characteristics?*
- *What is their economic status?*

It is impossible to describe or outline First Hill and South Beacon Hill’s ability to access food resources without first describing their residents. Understanding income and poverty levels, racial makeup, age, gender, employment status, household size, primary spoken languages and percent of foreign born residents who reside in each neighborhood is crucial in gaining a more complete picture of the residents living in First Hill and South Beacon Hill.

Table 1 below defines both the indicator and data source this research uses in defining the socioeconomic and demographic characteristics of First Hill and South Beacon Hill.

Indicator	Data Source
Race	2000 Census
Age	2000 Census
Percent Foreign Born Population	2000 Census
Household Size	2000 Census
Employment	2000 Census
Income	2000 Census
Poverty Status	2000 Census

RACE

City of Seattle. The Census data shows the racial composition as 70.0% White, 8.3% Black and African American, 1.0% American Indian and Alaska Native, 13.1% Asian, 0.4 percent Native Hawaiian and other Pacific Islander.

First Hill. In comparison to these figures, the Census data shows First Hill’s racial composition is fairly consistent with that of the city of Seattle. However, the percentage of First Hill’s white population is 7.8% smaller, and the percentage of its Black and African American population is twice as large. Like the city of Seattle, the greatest majority of the population in First Hill is white.

South Beacon Hill. South Beacon Hill’s racial composition diverges greatly from that of the city of Seattle’s. The Census data shows the racial composition as 12.7% White, 23.8% Black and African American, 1.6% American Indian and Alaska Native, 50.6% Asian, 1.4% Native Hawaiian and other Pacific Islander, and 3.3% some other race. Therefore, the percentage of

⁷ USDA toolkit.

South Beacon Hill’s white population is 57.3% smaller; the percentage of it’s Black and African American is 15.5% larger; and the percentage of its Asian population—the greatest majority of the population in South Beacon Hill—is 37.5% larger.

Race	City of Seattle	First Hill	South Beacon Hill
White	70.0%	62.2%	12.7%
Black and African American	8.3%	16.6%	23.8%
American Indian and Alaska Native	1.0%	2.0%	1.6%
Asian	13.1%	11.4%	50.6%
Native Hawaiian and Other Pacific Islander	0.4%	0.3%	1.4%
Some other race alone	2.3%	3.6%	3.3%

Source: Census 2000, Race

AGE BY SEX

City of Seattle. The total male population for the city of Seattle is 281,245, and greatest majority of males comprise the age cohort of 25 to 44 years. The total female population for the city of Seattle is 282,130, and the greatest majority of females also comprise the age cohort of 25 to 44 years. However, the female population is more evenly distributed amongst age cohorts than the male population.

First Hill. The total male population for First Hill is 9,487, which represents 61.2% of the neighborhood’s population. The greatest majority of males comprise the age cohort of 19 to 44 years. The total female population for First Hill is 6,019, which represents 38.8% of the neighborhood’s population. Like the male population, the greatest majority of females comprise the age cohort of 25 to 44 years; however, there is also a significant female representation in the age cohort of 65 years and older.

South Beacon Hill. The total male population for South Beacon Hill is 5,541, which represents 48.4% of the neighborhood’s population. The male population is relatively evenly distributed amongst the age cohorts, with 19 to 24 years and 55 to 64 years being the smallest. The total female population for First Hill is 5,911, which represents 51.6% of the neighborhood’s population. Like the male population, the female population is relatively evenly distributed amongst the age cohorts, with 19 to 24 years being the smallest.

Population Cohort	City of Seattle		First Hill		South Beacon Hill	
	Male	Female	Male	Female	Male	Female
10 and under	9.9%	9.7%	3.0%	4.0%	17.6%	14.4%
11 to 18	7.1%	5.5%	4.0%	2.0%	14.0%	12.1%
19 to 24	10.5%	6.4%	21.0%	16.0%	6.9%	6.0%
25 to 34	22.8%	16.1%	28.0%	22.0%	14.5%	11.0%

35 to 44	18.2%	18.4%	21.0%	15.0%	15.5%	14.4%
45 to 54	14.4%	15.7%	11.0%	10.0%	12.9%	15.4%
55 to 64	7.4%	12.0%	5.0%	9.0%	8.2%	10.7%
65 and older	9.7%	16.2%	8.0%	23.0%	10.5%	16.1%

Source: Census 2000, Age by Sex

FOREIGN BORN POPULATION

City of Seattle. 16.9% of all residents in the city of Seattle are foreign born. The greatest percent of those individuals (26.3%) arrived between 1995 and March 2000, and the smallest percent of those individuals (3.9%) arrived between 1965 and 1969.

First Hill. 17.1% of all residents in First Hill are foreign born. 41.6% arrived between 1995 and March 2000; 24.6% arrived between 1990 and 1994; and 11.6 percent arrived between 1985 and 1989. Thus, the greatest percent of those individuals arrived during the latest period recorded in the Census.

South Beacon Hill. 47.8% of all residents in South Beacon Hill are foreign born. 19.8% arrived between 1995 and March 2000; 29.5% arrived between 1990 and 1994; and 16.7% arrived between 1985 and 1989. Thus, the greatest percent of those individuals arrived during the 1990 to 1994 time period.

Year of Entry	City of Seattle	First Hill	South Beacon Hill
1995 to March 2000	26.3%	41.6%	19.8%
1990 to 1994	20.2%	24.6%	29.5%
1985 to 1989	13.4%	11.6%	16.7%
1980 to 1984	12.6%	7.0%	14.8%
1975 to 1979	8.4%	4.7%	10.5%
1970 to 1974	4.7%	2.8%	3.5%
1965 to 1969	3.9%	2.0%	2.1%
Before 1965	10.5%	5.9%	3.2%

Source: Census 2000, Year of entry for foreign born population

HOUSEHOLD SIZE

City of Seattle. According to the Census, the majority of households surveyed in Seattle are non-family households. 40.8% are categorized as 1-person households; 33.8% are categorized as 2-person households; 12.1% are categorized as 3-person households; and 8.0% are categorized as 4-person households. The high number of non-family households might suggest temporary living circumstances. For the purposes of this study, it might thus suggest potentially limited commitment to and investment in community building.

First Hill. The vast majority of households in First Hill are also non-family households. 66.2% are 1-person households, and 24.9% are 2-person households. There are relatively few 4-person and greater households. These percentages might indicate temporary living circumstances, or cultural living preferences.

South Beacon Hill. The household size in South Beacon Hill is more evenly distributed than the city of Seattle. There are 19.7% 1-person households, 24.6% 2-person households, 15.3% 3-person households, 16.1% 4-person households, 11.0% 5-person households, 4.9% 6-person households, and 8.3% 7 or more-person households. These percentages might indicate temporary living circumstances, or different cultural living preferences or economic means.

Household Size	City of Seattle	First Hill	South Beacon Hill
1-person household	40.8%	66.2%	19.7%
2-person household	33.8%	24.9%	24.6%
3-person household	12.1%	5.2%	15.3%
4-person household	8.0%	1.9%	16.1%
5-person household	3.2%	0.8%	11.0%
6-person household	1.2%	0.6%	4.9%
7-or-more-person household	0.9%	0.2%	8.3%

Source: Census 2000, Household Size

UNEMPLOYMENT

City of Seattle. Unemployment provides a basic measure of an area's well-being. In the city of Seattle, 5.6% of males in the labor force are unemployed, and 4.5% of females in the labor force are unemployed. Individuals who are not in the labor force may include anyone who is homeless or not actively seeking employment.

First Hill. The neighborhood's unemployment rates are higher than those of the city of Seattle. 7.2% of males in the labor force are unemployed, and 7.8% of females in the labor force are unemployed.

South Beacon Hill. The unemployment rates in South Beacon Hill are even higher. 13.7% of males in the labor force are unemployed, and 8% of females in the labor force are unemployed.

	City of Seattle		First Hill		South Beacon Hill	
	Male	Female	Male	Female	Male	Female
Unemployed	5.6%	4.5%	7.2%	7.8%	13.7%	8.0%

Source: Census 2000, Unemployment Status by Sex

City of Seattle. Of those individuals who are employed, 70.1% of males usually worked 35 or more hours per week for 50 to 52 weeks of the year, and 67.9% of females usually worked 35 or

more hours per week for 50 to 52 weeks of the year. These figures are roughly comparable to working full-time.

First Hill. In contrast, only 36.3% of males in First Hill usually worked 35 or more hours per week for 50 to 52 weeks of the year, and 51.8% of females usually worked 35 or more hours per week for 50 to 52 weeks of the year. These percentages are notable in that 15.5% more females work the equivalent of full-time hours during the year.

South Beacon Hill. The percentages of males and females who work 35 or more hours per week for 50 to 52 weeks of the year differ by 1.1%, with 64.8% for males and 63.7% for females. Both of these percentages, however, are lower than the city averages.

Usually worked 35 or more hours per week	City of Seattle		First Hill		South Beacon Hill	
	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
50 to 52 weeks	70.1%	67.9%	36.3%	51.8%	64.8%	63.7%
48 to 49 weeks	6.6%	6.8%	4.6%	10.7%	11.2%	9.3%
40 to 47 weeks	8.3%	9.1%	13.0%	11.0%	8.3%	8.6%
27 to 39 weeks	5.2%	6.1%	12.5%	6.9%	6.9%	3.4%
14 to 26 weeks	5.7%	5.6%	18.6%	11.2%	5.8%	6.5%
1 to 13 weeks	4.2%	4.6%	15.0%	8.5%	3.0%	8.6%
Usually worked 15 to 34 hours per week						
50 to 52 weeks	37.2%	13.8%	26.9%	27.7%	22.3%	42.9%
48 to 49 weeks	5.6%	8.1%	4.6%	5.7%	10.4%	2.8%
40 to 47 weeks	17.1%	16.3%	17.5%	15.4%	12.6%	10.6%
27 to 39 weeks	13.9%	12.4%	25.3%	12.8%	13.1%	9.9%
14 to 26 weeks	14.2%	13.1%	15.5%	19.4%	27.4%	18.3%
1 to 13 weeks	12.1%	11.3%	10.1%	19.0%	14.3%	15.5%

Source: Census 2000, Work status in 1999 by usual hours worked per week in 1999

INCOME

City of Seattle. The two largest income brackets in the city are \$60,000 to \$74,999, which represents 10.3% of Seattle residents, and \$75,000 to \$99,999, which represents 11.4% of Seattle residents. Significantly, residents earning less than \$10,000 represent the next largest income bracket, with 8.9%. The White population earns the highest median income with \$49,667, and the American Indian and Alaska Native population earns the lowest median income with \$30,035.

First Hill. Residents earning less than \$10,000 constitute the largest income bracket in First Hill, with 21.4%. This percentage is overwhelmingly greater than any other income bracket. On average, First Hill residents earn less than the average resident in the city of Seattle. The White

population earns the highest median income with \$27,817, and the Black and African American population earns the lowest median income with \$17,762.

South Beacon Hill. 12.5% of South Beacon Hill residents also fall within the income bracket that earns less than \$10,000. Though smaller than First Hill, it is still greater than the city average by 3.6%. The largest income bracket in the neighborhood is \$75,000 to \$99,999, which represents 13.1% of South Beacon Hill residents. In contrast to the city of Seattle, the Asian population in South Beacon Hill earns the highest median income with \$48,760, which is only \$907 dollars less than the highest average median income for the city, which is represented by the White population. The American Indian and Alaska Native population earns the lowest median income with \$16,500.

Income Bracket	City of Seattle	First Hill	South Beacon Hill
Less than \$10,000	8.9%	21.4%	12.5%
\$10,000 to \$19,999	10.8%	19.1%	11.9%
\$20,000 to \$29,999	11.9%	15.7%	10.3%
\$30,000 to \$39,999	12.1%	13.0%	12.5%
\$40,000 to \$49,999	10.0%	7.2%	10.0%
\$50,000 to \$59,999	8.6%	6.3%	10.7%
\$60,000 to \$74,999	10.3%	6.8%	10.5%
\$75,000 to \$99,999	11.4%	5.2%	13.1%
\$100,000 to \$124,999	6.2%	1.9%	5.2%
\$125,000 to \$149,999	3.2%	1.3%	1.1%
\$150,000 to \$199,999	2.9%	0.7%	1.2%
\$200,000 or more	3.5%	1.2%	0.9%

Source: Census 2000, Household Income in 1999

Chart 1: Census 2000, Household Income in 1999 for First Hill

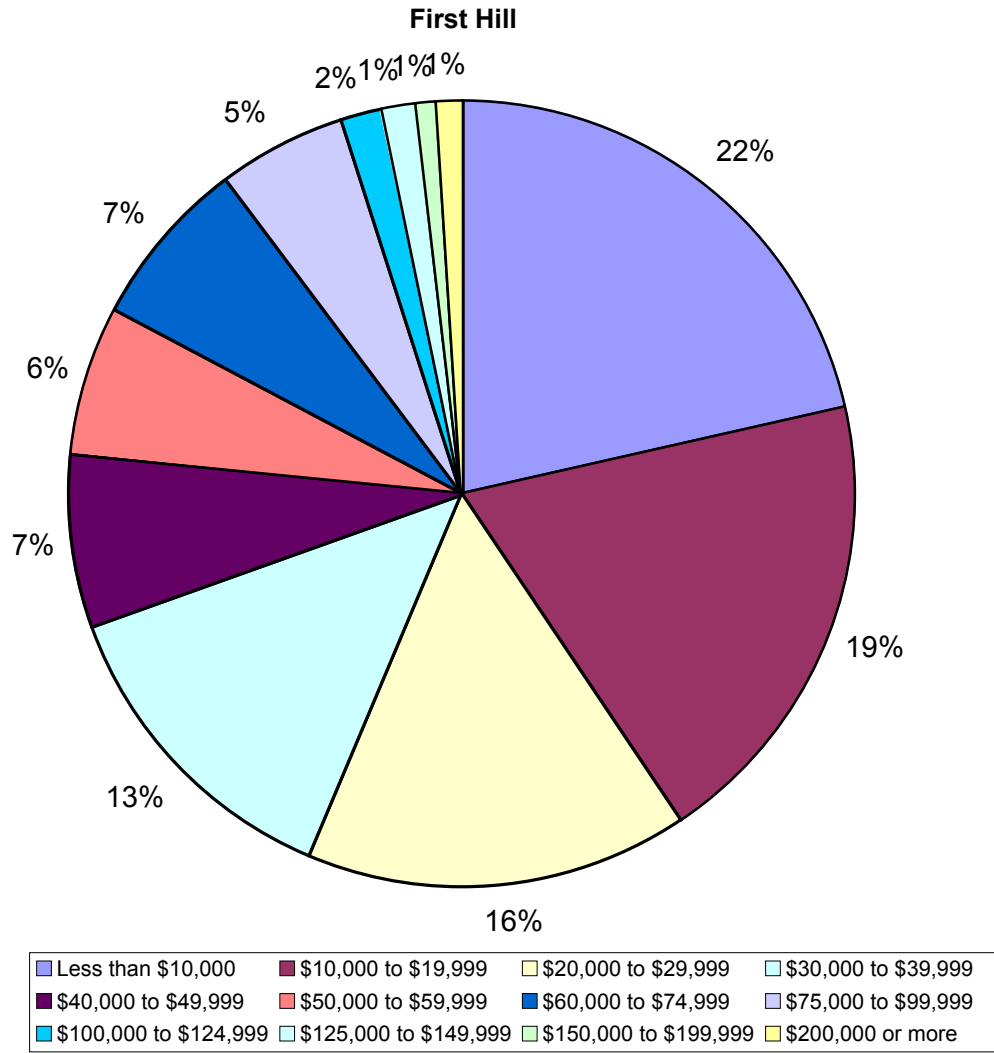


Chart 2: Census 2000, Household Income in 1999 for South Beacon Hill

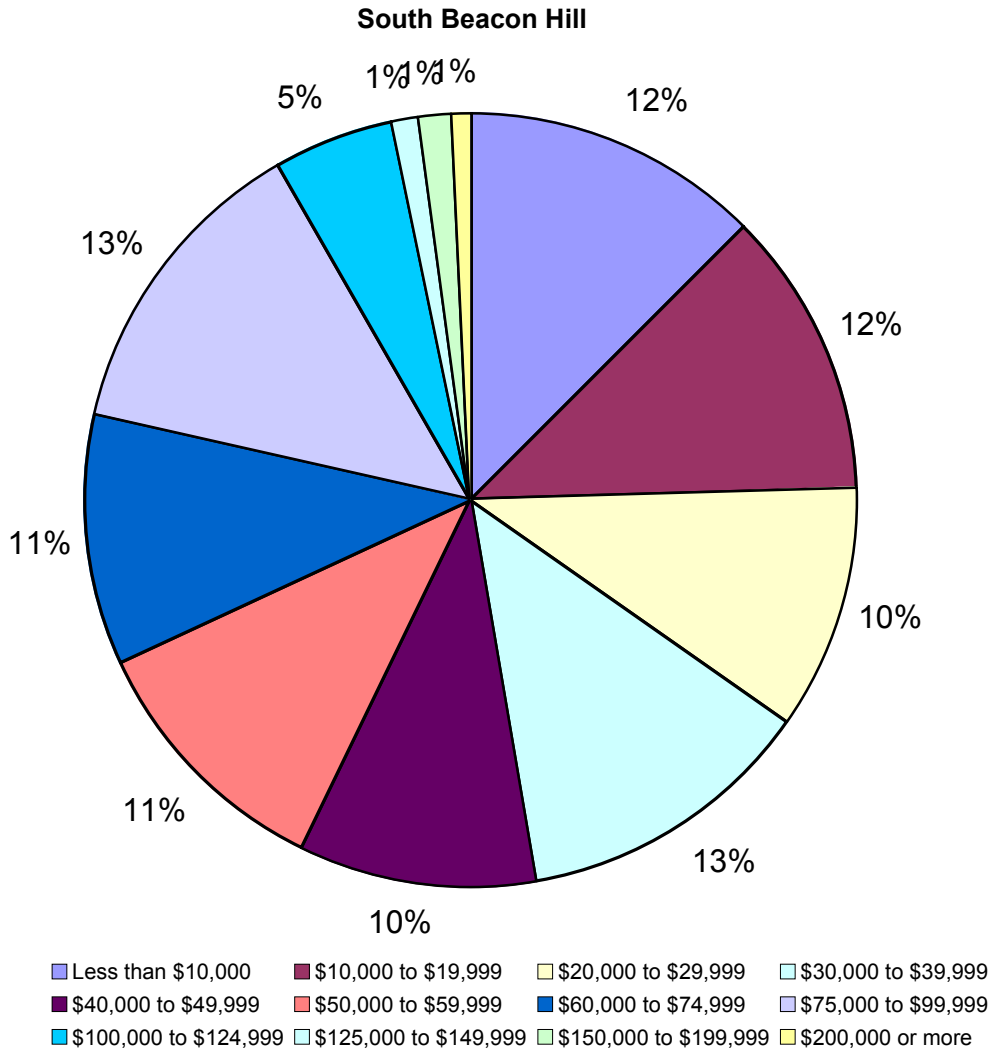
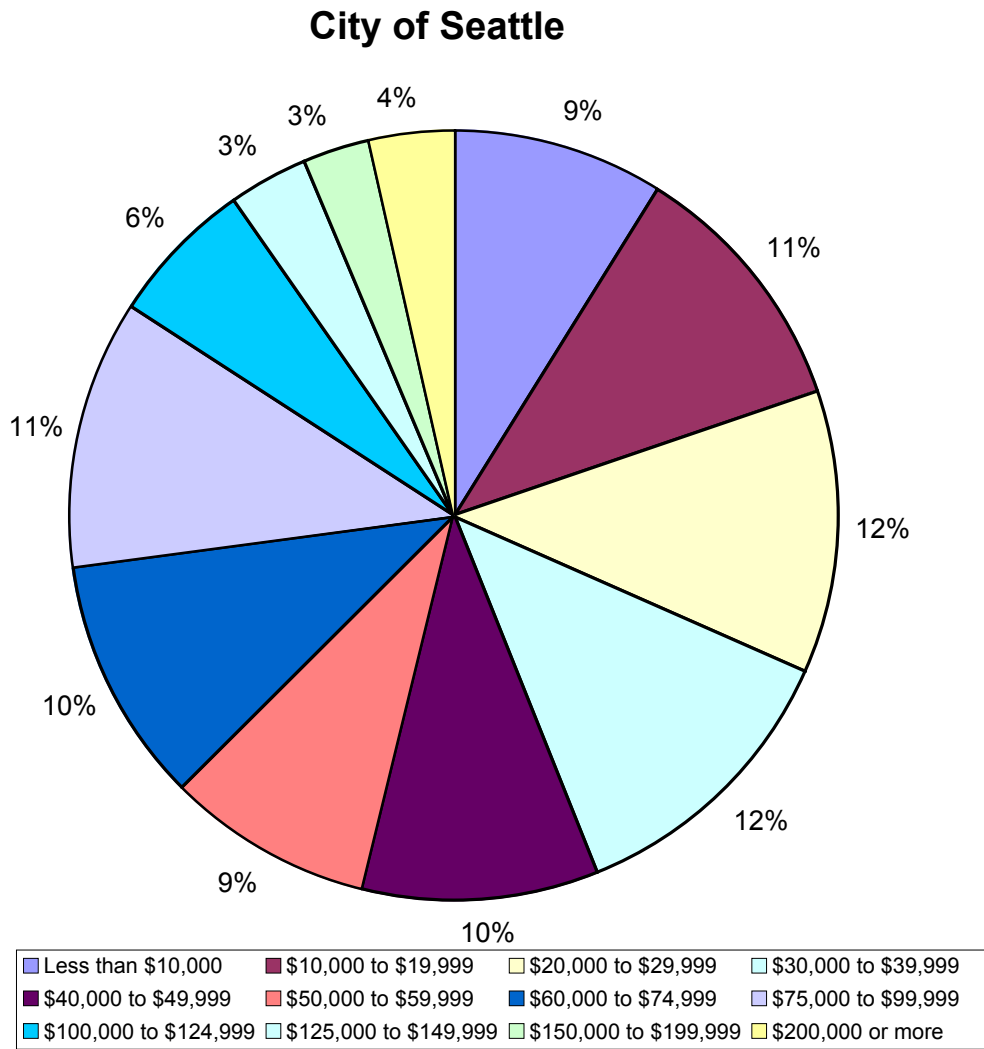


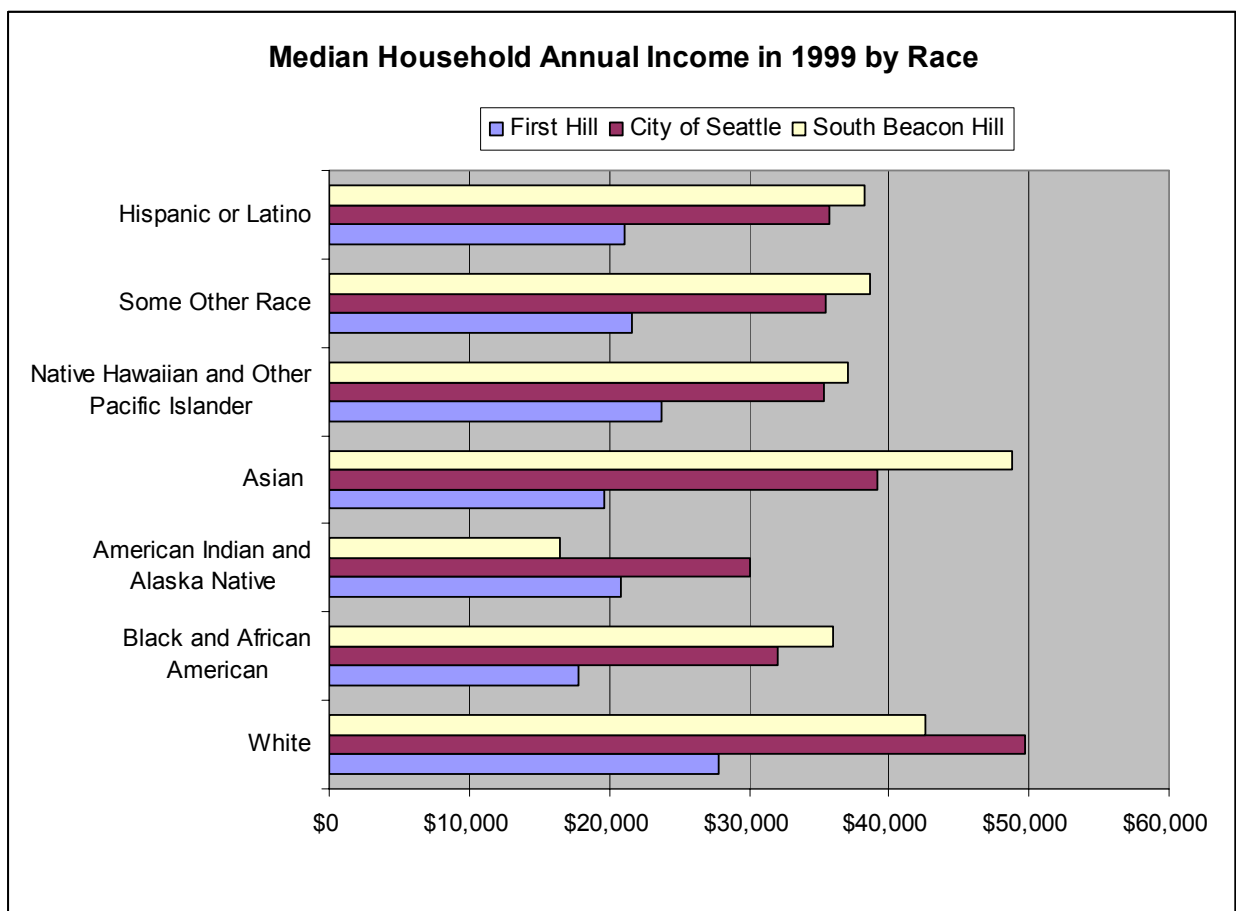
Chart 3: Census 2000, Household Income in 1999 for Seattle



Income by Race	City of Seattle	First Hill	South Beacon Hill
White	\$49,667	\$27,817	\$42,626
Black and African American	\$32,042	\$17,762	\$35,965
American Indian and Alaska Native	\$30,035	\$20,841	\$16,500
Asian	\$39,124	\$19,694	\$48,760
Native Hawaiian and Other Pacific Islander	\$35,300	\$23,750	\$37,084
Some Other Race	\$35,444	\$21,604	\$38,695
Hispanic or Latino	\$35,699	\$21,138	\$38,281

Source: Census 2000, Median Household Income in 1999 by Race

Chart 4: Census 2000, Median Household Income in 1999 by Race for First Hill, South Beacon Hill, and Seattle



	City of Seattle		First Hill		South Beacon Hill	
	%	Absolute	%	Absolute	%	Absolute
With Social Security Income	19.6%	50,817	21.9%	1,428	25.5%	880
With Retirement Income	13.2%	34,197	11.6%	758	17.9%	617
Other Types of Income	10.5%	27,034	10.4%	680	15.2%	525

Source: Census 2000, Income Source for Households in 1999

POVERTY STATUS

City of Seattle. Poverty is one of the most important indicators of food insecurity. 11.8% of Seattle residents are in poverty. Of those individuals, 70.3% are between 18 and 64 years. Significantly, there might be an under representation of poverty in the Census data, because 20,177 people in the total population of city were not included in this question.

First Hill. The percent of the population in poverty in First Hill is more than double that of the city of Seattle. 25.7% of the neighborhood is in poverty, and 75.2% are between 18 and 64 years. Here, again, there might be an under representation of poverty because 5,250 people in the total population of First Hill were not included in this census question. In other words, 33.9% of the population was not considered.

South Beacon Hill. 16.8% of South Beacon Hill's population is in poverty. Of those individuals, 50.4% are between 18 and 64 years. The percentage of impoverished children in South Beacon Hill is greater than the city average. Children under 5 years constitute 2.5% more than the city; children between 6 and 11 years constitute 12.0% more than the city; and children between 12 and 17 years constitute 7.6% more than the city. Only 91 residents in South Beacon Hill were not included in this question; thus, these figures are fairly accurate.

Age Bracket	City of Seattle	First Hill	South Beacon Hill
<i>percent population in poverty</i>	11.8%	25.7%	16.8%
under 5 years	5.2%	3.8%	7.7%
6 to 11 years	6.5%	3.8%	18.5%
12 to 17 years	6.4%	3.8%	14.0%
18 to 64 years	70.3%	75.2%	50.4%
65 to 74 years	4.8%	6.5%	4.8%
75 years and over	5.6%	5.4%	2.9%

Source: Census 2000, Poverty Status in 1999

Note: all figures rounded to nearest tenth.

SUMMARY AND FINDINGS

The above socioeconomic and demographic characteristics of First Hill and South Beacon Hill begin to describe the residents of each neighborhood. Both First Hill and South Beacon Hill are low-income, high poverty neighborhoods. Both are quite diverse as well. While First Hill is primarily made up of seniors 65 years of age and older, South Beacon Hill has a high percentage of youth 18 years of age and younger. When considering food policy and community access to food resources in these neighborhoods, policy makers should be aware that the most susceptible populations to food insecurity are children, elderly, disabled, minority and single parent households.⁸

⁸ Karlinsky, 2005.

PROFILE OF NEIGHBORHOOD FOOD RESOURCES

To understand the adequacy of community food resources, we began by creating a profile of all existing resources in First Hill and South Beacon Hill. The questions guiding this profile include⁹:

- *What resources are available in the community for purchasing food?*
- *Are emergency resources available in the event that residents do not have enough money to purchase food through normal channels?*
- *Are people in the community participating in food assistance programs?*
- *What food production resources exist in the community?*
- *Is affordable, low-income housing available?*
- *How is land used and what transportation options exist?*

This profile reveals how well equipped First Hill and South Beacon Hill are to meet the food-related needs of neighborhood residents. The following indicators were used to complete the profile of neighborhood food resources:

Indicator	Data Source
FOOD LOCATIONS	
Food Retail Locations	Hoovers Online
Eating & Drinking Places Locations	Hoovers Online
HOUSEHOLD FOOD SECURITY	
Emergency Food Assistance/Outreach Programs	Seattle Human Services Department
Government Food Assistance	2000 Census
NEIGHBORHOOD FOOD PRODUCTION	
Farmer's Markets/Community Agriculture Programs	Seattle Tilth Association, Department of Neighborhoods, Puget Sound Fresh Program
P-Patch Programs	Seattle Department of Neighborhoods, P-Patch Program
LOW-INCOME HOUSING	
Low-income Housing Units	Seattle Housing Authority
LAND USE AND TRANSPORTATION	
Land Use	Washington State Geospatial Data Archive
Public Transportation Access	Washington State Geospatial Data Archive
Sidewalks, Crosswalks, Bike Lanes	Washington State Geospatial Data Archive

⁹ <http://www.ers.usda.gov/publications/efan02013/>

FOOD LOCATIONS

A major factor in determining the food environment in First Hill and South Beacon Hill is the number of locations where residents can purchase groceries or prepared foods.

Using Hoovers Online, a business research company providing information on U.S. companies and industries, we searched all food retail and eating places in zip codes 98122, 98104, and 98101 for First Hill and zip codes 98118 and 98108 for South Beacon Hill. This search yielded names and phone numbers of food locations. We mapped each using GIS software to determine which addresses were located within the neighborhood boundaries of First Hill and South Beacon Hill. The points outside the neighborhood boundaries do not represent complete data.

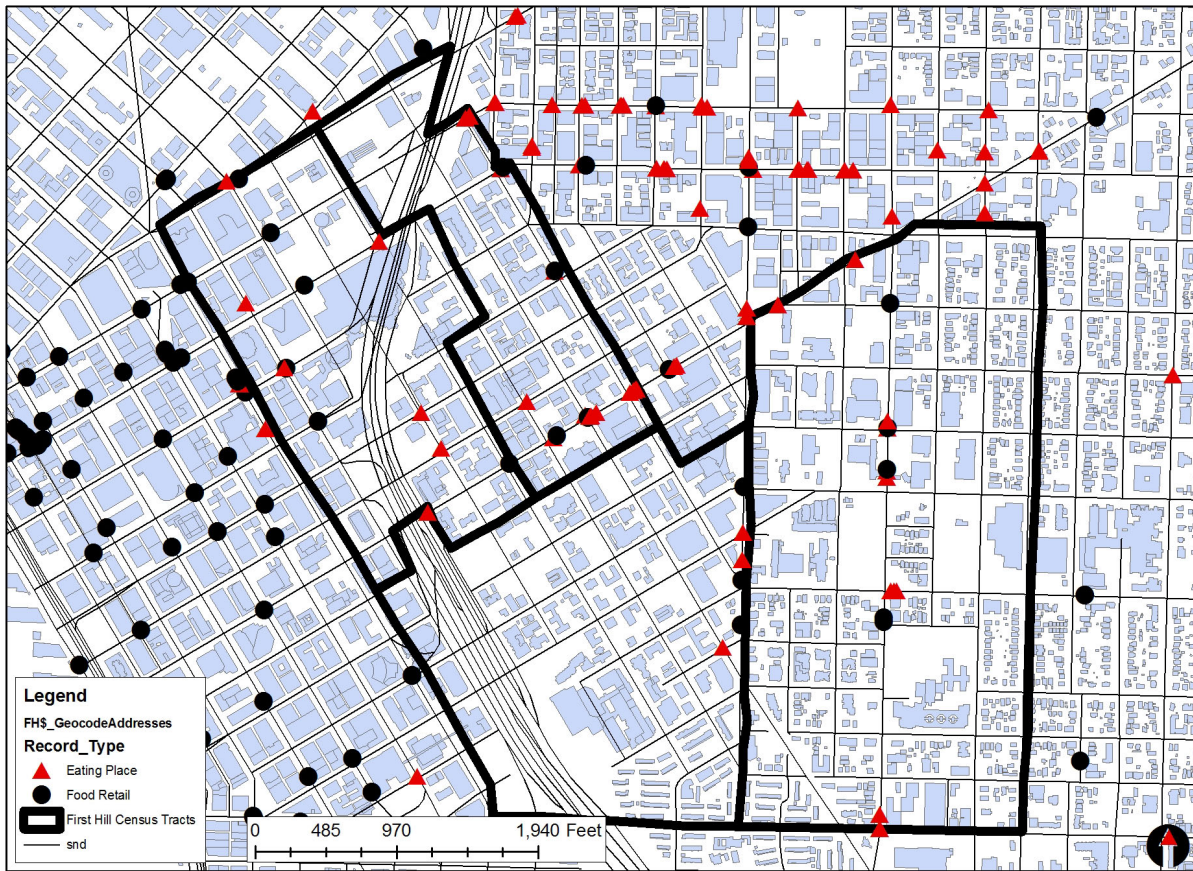
Food retail categories included in this study are specialty, supermarket, market, convenience, bakery, and distributor. Specialty food stores primarily sell herbs and spices for cooking or medicinal purposes. Supermarkets are different from markets on the basis of size or square footage but both sell a wide variety of food items including dairy, meats, produce, and packaged food. Convenience stores provide a limited variety of packaged food items and dairy products but little to no produce or meats. Bakeries sell baked goods. Distributors provide produce, meats, or dairy products to grocery stores, restaurants, or individuals. *Eating places* include restaurants, fast food, and delis. A restaurant provides prepared meals and service while dining sitting down. Fast food stores and delis prepare food to-go or for consumption on site, but may or may not provide seating.

The following indicators were used to help describe local residents' food resources in First Hill and South Beacon Hill:

Indicator	Source
Food Retail Locations	Hoovers Online
Eating Place Locations	Hoovers Online

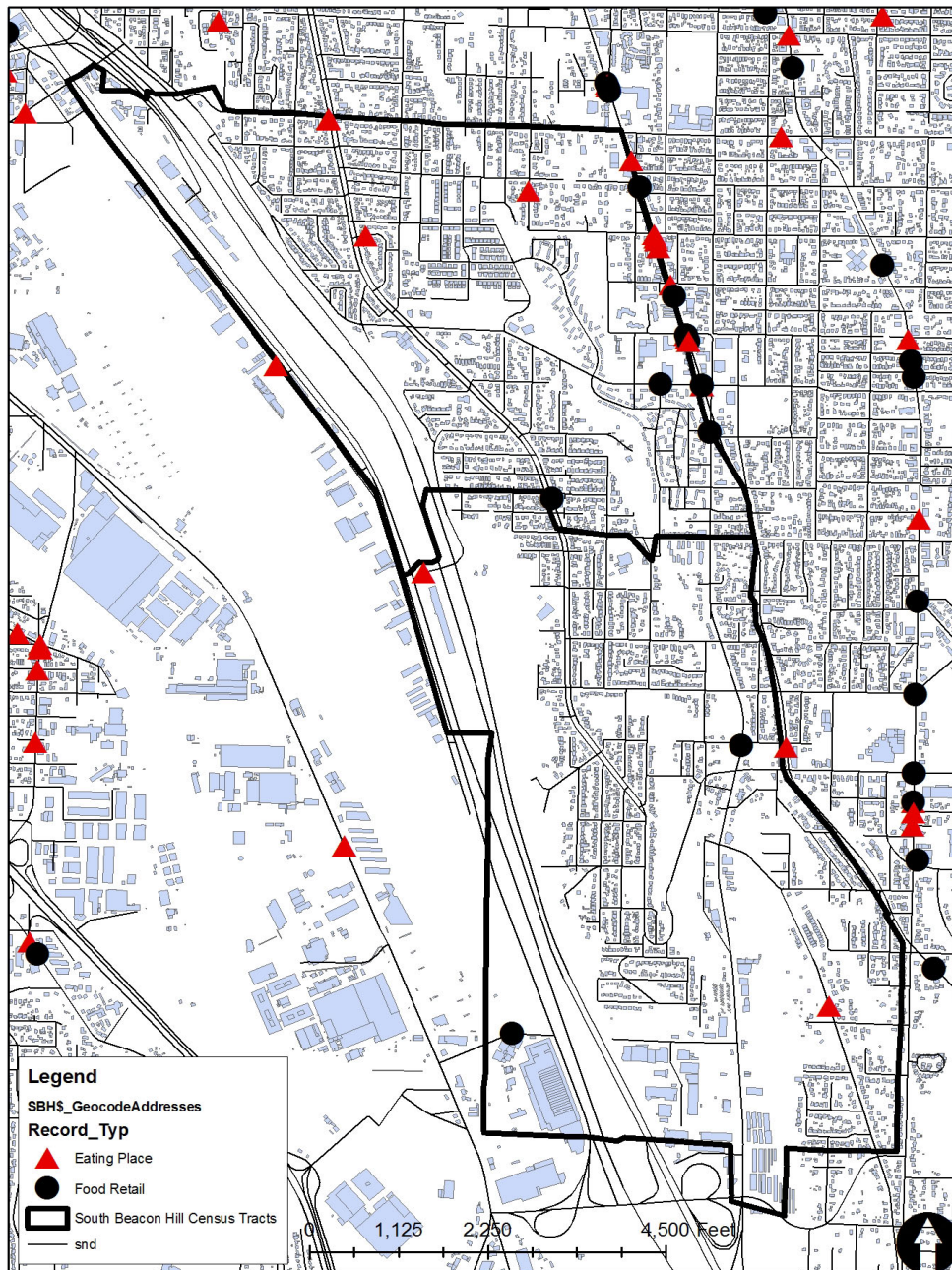
Map 1: Food Retail and Eating Places in First Hill

First Hill: Food Locations



Source: 2000 Census Tracts, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet. Food locations from Hoovers Online, www.Hoovers.com. Food locations outside First Hill are incomplete.

Map 2: Food Retail and Eating Places in South Beacon Hill
South Beacon Hill: Food Locations



Source: 2000 Census Tracts, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet. Food locations from Hoovers Online, www.Hoovers.com. Food locations outside South Beacon Hill are incomplete.

SUMMARY AND FINDINGS

First Hill has approximately 23 food retailers and 46 eating places located within neighborhood boundaries. There are approximately 12 food retailers and 21 eating places in South Beacon Hill. In both neighborhoods, most of the food locations are concentrated in commercial areas along busy arterials. Even though South Beacon Hill is roughly two and a half times the size of First Hill, it contains nearly half the food resources found in First Hill. Given that First Hill is centrally located to downtown and the International District, there does not appear to be a scarcity of food resources or significant access issues. South Beacon Hill on the other hand, is not widely covered in terms of food resources. There are several areas within the neighborhood where residents are 1 mile or more from the nearest grocery store.

Collecting data only about food locations in neighborhoods does not offer a complete profile of the ability of all residents to access food in First Hill and South Beacon Hill. What if residents cannot afford retailer's prices? What if these resources do not offer high-quality or culturally appropriate food? Identifying food security and production resources below will begin to offer a more complete picture of food access in these neighborhoods.

HOUSEHOLD FOOD SECURITY

Measuring the level of food security or food insecurity within neighborhoods is a necessary measure in identifying how well neighborhood food systems are meeting the needs of their residents. Community food security is generally defined as “all people in a community obtaining a culturally acceptable, nutritionally adequate diet through non-emergency (or conventional) food sources at all times”¹⁰. While we did not tackle the question of whether or not First Hill and South Beacon Hill are food insecure, we did consider the following measures in our analysis:

Indicator	Source
Emergency Food Assistance/Outreach Programs	Seattle Human Services Department
Government Assistance	2000 Census

Emergency Food Assistance/Outreach Programs

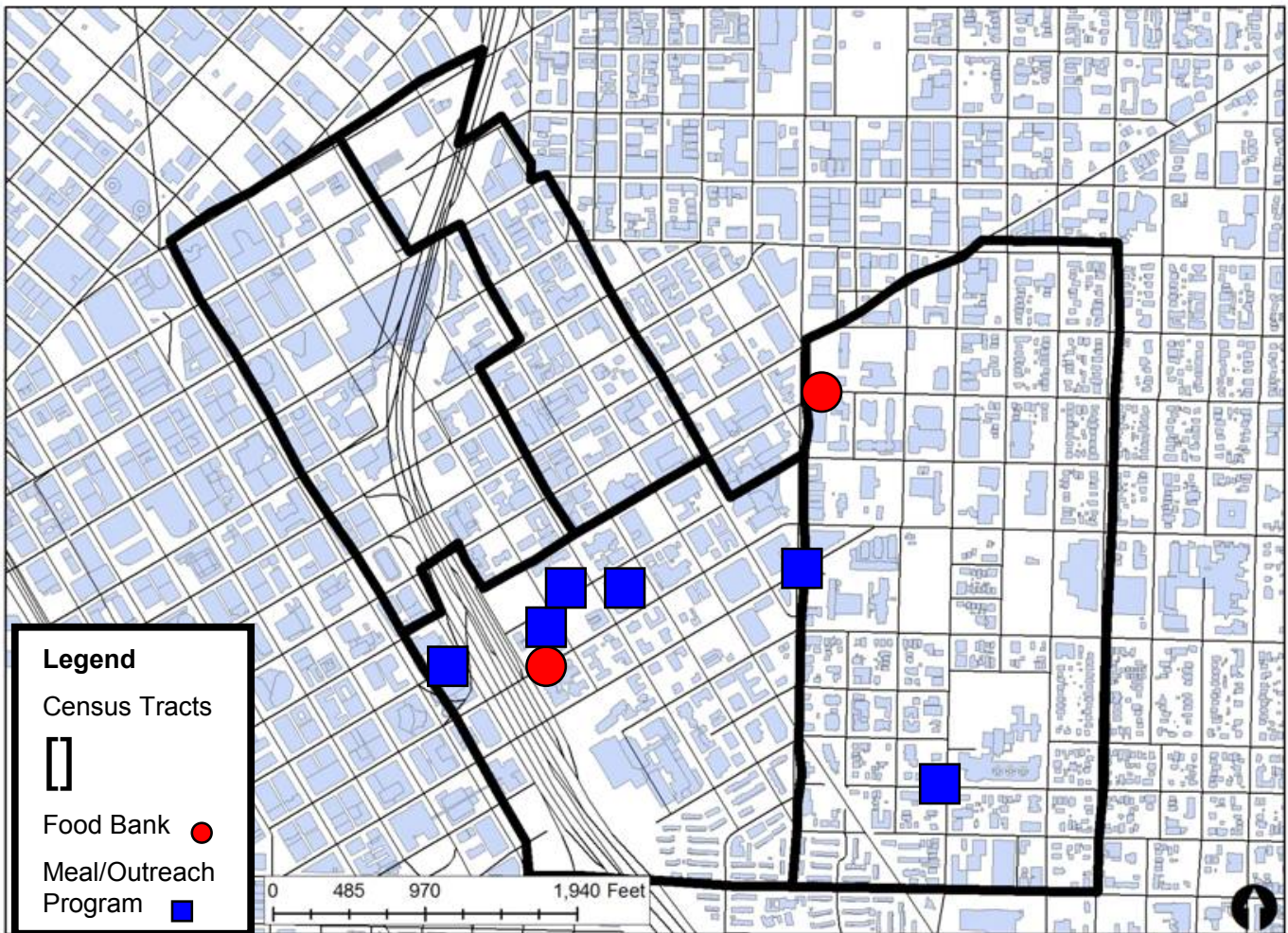
Our research demonstrates that First Hill has roughly 2 food banks within neighborhood boundaries and 6 more within roughly one mile (Map 3). Six food outreach programs were identified within First Hill, while 14 others are accessible within roughly one mile of the boundaries (see appendix #1 for full listing). South Beacon Hill has roughly 1 food bank and 0 food outreach programs within neighborhood boundaries (Map 4). Four food banks and 10 food outreach programs are accessible within roughly one mile of the boundaries (see appendix #2 for full listing)¹¹.

¹⁰ Community Food Security Coalition

¹¹ 2-1-1 Washington Information Network

Map 3: Emergency Food Locations in First Hill

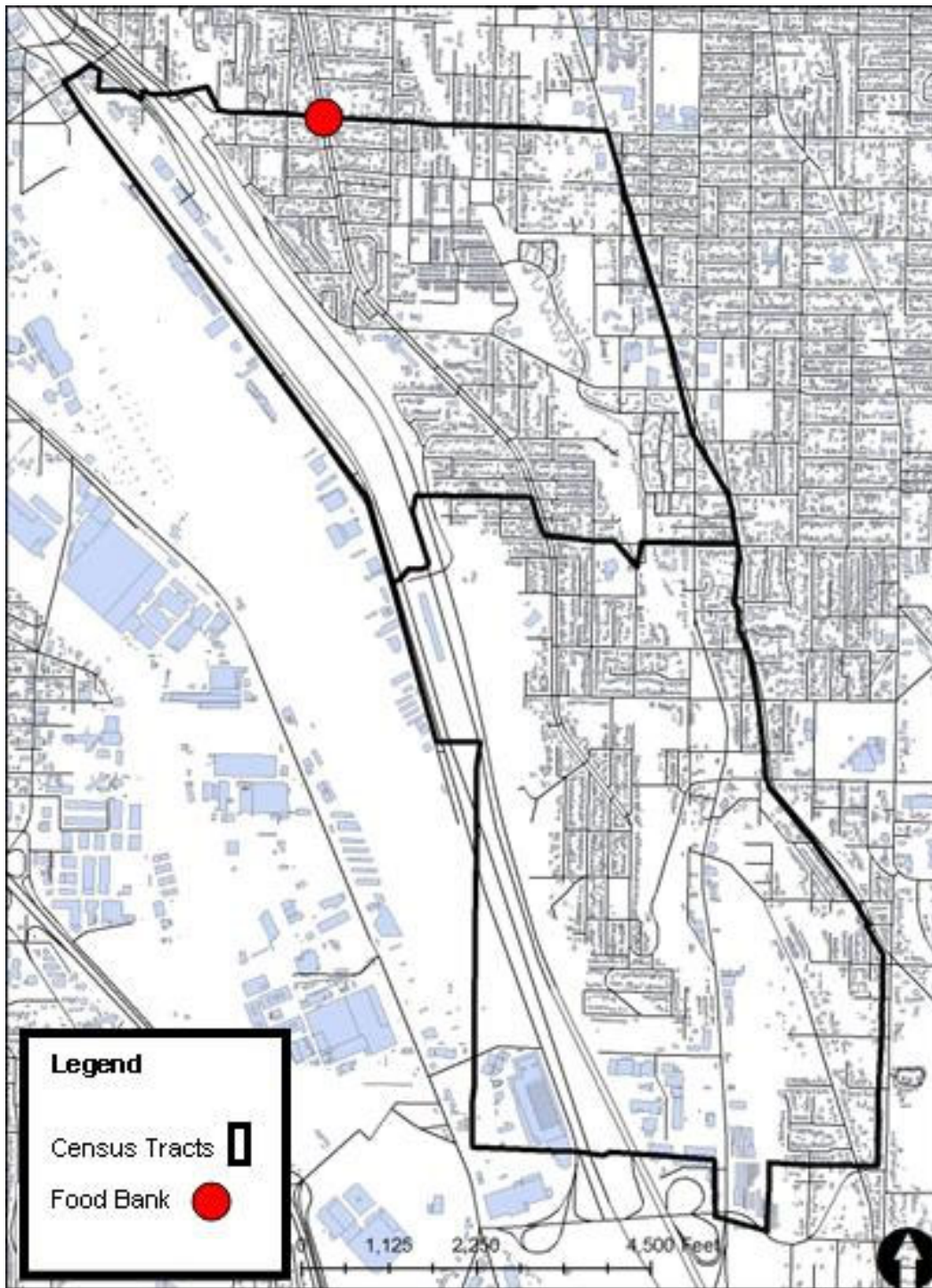
First Hill: Emergency Food Locations



Source: 2000 Census Tracts, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet. Food Bank data from 2-1-1 Washington Information Network.

Map 4: Emergency Food Locations in South Beacon Hill

South Beacon Hill: Emergency Food Locations



Source: 2000 Census Tracts, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet. Food Bank data from 2-1-1 Washington Information Network.

Government Food Assistance

Government assistance programs provide funds for households that cannot meet their basic needs given their income level. When considering the question of neighborhood food security, it is worth looking at the percentage of households receiving government assistance in the form of Supplemental Security Income and public assistance income. These indicators suggest the existence of households who cannot meet their food needs on their income alone.

Supplemental Security Income is a federally funded needs-based disability program for adults and children that provides a monthly stipend and, in most states, automatic Medicaid eligibility¹². Public assistance income includes general assistance and Temporary Assistance to Needy Families (TANF). This does not include Supplemental Security Income (SSI) or payments received for medical care¹³.

Table 1: Census 2000, Income Source for Households in 1999

Households	City of Seattle	First Hill	South Beacon Hill
With Supplemental Security Income	3.3%	7.1%	9.5%
With public assistance income	3.2%	4.9%	12.1%

Source: Census 2000, Income Source for Households in 1999

SUMMARY AND FINDINGS

Analysis of this data suggests that despite South Beacon Hill being more than twice as large as First Hill in terms of square miles (and nearly equal to First Hill in population), there are much fewer emergency food resources and residents may have to travel longer distances to get access to such resources. This is likely due to the fact that First Hill is closer to downtown Seattle and is a denser urban neighborhood than South Beacon Hill.

Generally, it seems there are emergency resources available for residents who face food insecurity or are hungry. However, this does not mean that residents are informed about or are able to access such resources, only that a sizable number of food resources exist.

While the percentage of households in poverty in South Beacon Hill (17%) is less than that of residents in First Hill (26%), it appears a greater percentage of South Beacon Hill households depend on emergency support, as suggested by the government food assistance data above. Focus groups also discussed using the Women, Infants, and Children (WIC) Program, which is a preventative health and nutrition program providing short-term assistance to young families in Washington State, though we did not investigate program usage rates specifically.

NEIGHBORHOOD FOOD PRODUCTION

¹² Social Security Administration (SSA), "SSA's Program Operations Manual System (POMS)", <https://s044a90.ssa.gov/apps10/poms.nsf/partlist>

¹³ U.S. Census Bureau - Census of Population & Housing, 2000 Summary File 3 Table P64

Community-based food production resources can include urban agricultural production, P-Patch programs, and farmers markets. Assessment of local food production includes answering the following questions¹⁴:

- *Do low-income communities have the opportunity to participate in community gardens or other food production processes?*
- *Is locally produced food sold through local farmers' markets?*

Utilizing local production resources can increase the availability of high quality food for residents, strengthen ties between farmers and local residents, and provide an affordable way to access nutritious food.

The following data for First Hill and South Beacon Hill was collected for the purpose of this assessment:

Indicator	Source
Farmer's Markets/Community Agriculture Programs	Seattle Tilth Association, Department of Neighborhoods, Puget Sound Fresh Program
P-Patch Programs	Seattle Department of Neighborhoods, P-Patch Program

Farmers' Markets

The Neighborhood Farmers Market Alliance manages seven markets throughout Seattle including markets on Capitol Hill/Broadway, Columbia City, Lake City, Magnolia, University District, and West Seattle. Seattle Market Places runs the Fremont and Ballard Sunday Farmers Market, Madison Friday Farmers Market and Wallingford's Wednesday Farmers Market.

These markets play a vital role in Seattle's food system by providing affordable, fresh, local produce to consumers, supporting local agriculture and farmers, and by donating leftover food items to local food banks, which totals nearly 40,000 pounds each year.

There are currently no farmers' markets in First Hill. However, there are two markets within roughly one mile of the neighborhood and are thus considered accessible to residents: the Broadway Sunday Farmers Market, and the Pike Place Market.

There are also no farmers' markets in the South Beacon Hill neighborhood. The nearest farmers' market is located in Columbia City.

Community Supported Agriculture (CSA)

Local farms strengthen community food security by delivering local and fresh produce, dairy, and meats to individuals, farmers markets, grocery stores, and restaurants. Seattle residents have many options when choosing to join a CSA. Farms offer "shares" to consumers, who are then entitled to weekly or biweekly deliveries of farm fresh products during harvest time. Products are picked up from the farm, delivered to a distribution center(s) in Seattle, or delivered directly to

¹⁴ USDA toolkit.

consumers at home. A list of CSAs serving the Seattle area including delivery and pick-up information specific to First Hill and South Beacon Hill residents is presented in Appendix 3¹⁵.

P-Patch Programs

Seattle's P-Patch Program was established by the Department of Neighborhoods and P-Patch Trust to provide community gardening opportunities to Seattle residents, with an emphasis on serving low-income and immigrant populations and youth. This program benefits over 6000 gardeners who till more than 2500 plots, covering 23 acres in 70 neighborhoods. All P-Patch gardens are organic and tons of produce each year is donated to local food banks.

First Hill has one P-Patch, which is the Squire Park Patch located at 14th and East Fir Street (Map 2). Established in 1995 on land that was previously an apartment building, this patch offers 30 plots and 5000 square feet of arable land. There is currently a waiting list to use this P-Patch.

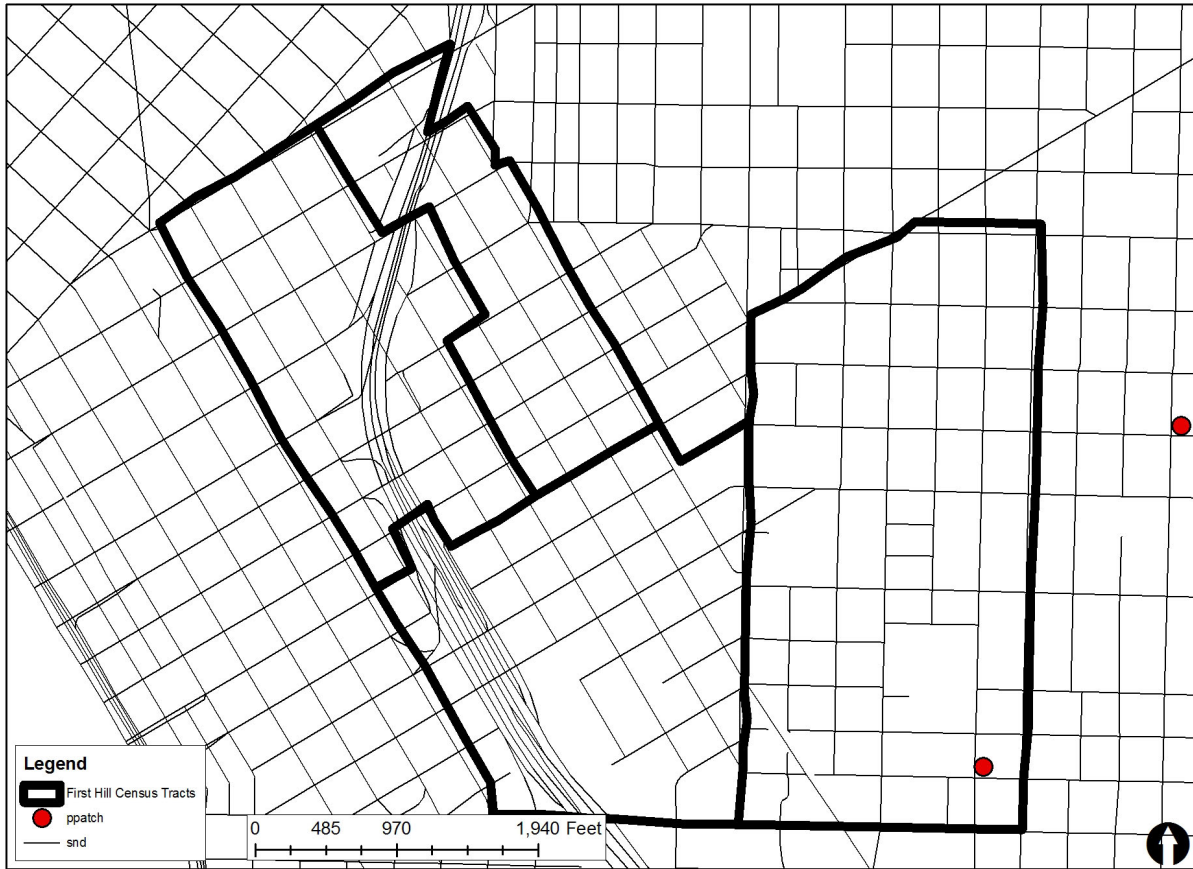
South Beacon Hill has several community gardening sites (Map 3). Thistle P-Patch, located at Martin Luther King Jr Way S and S Cloverdale, is sometimes referred to as the south-end farm. Though this patch was established in 1974, it took years to become the thriving community garden it is today. The turnaround is largely the work of immigrant and refugee families who settled in the area and who brought with them impressive gardening acumen. Today, more than 160 families cultivate this land. There is currently a waiting list for a plot at this site.

There are five additional community gardening sites in South Beacon Hill, which are developed and managed by the P-Patch Program but located in the New Holly Seattle Housing Authority community. These gardens include New Holly P-Patch (29th Ave S & S Brighton St), Lucky Garden (Shaffer Ave S & S Holly St), Youth Garden (32nd Ave E & S Holly St), Market Garden (37th Ave S & S Myrtle St), and Power Garden (Holly Park Dr S & S Myrtle Pl). Gardeners from this community are predominantly immigrants from Southeast Asia and East Africa.

¹⁵ King County Puget Sound Fresh, <http://dnr.metrokc.gov/wlr/farms/>

Map 5: P-Patch Locations in First Hill

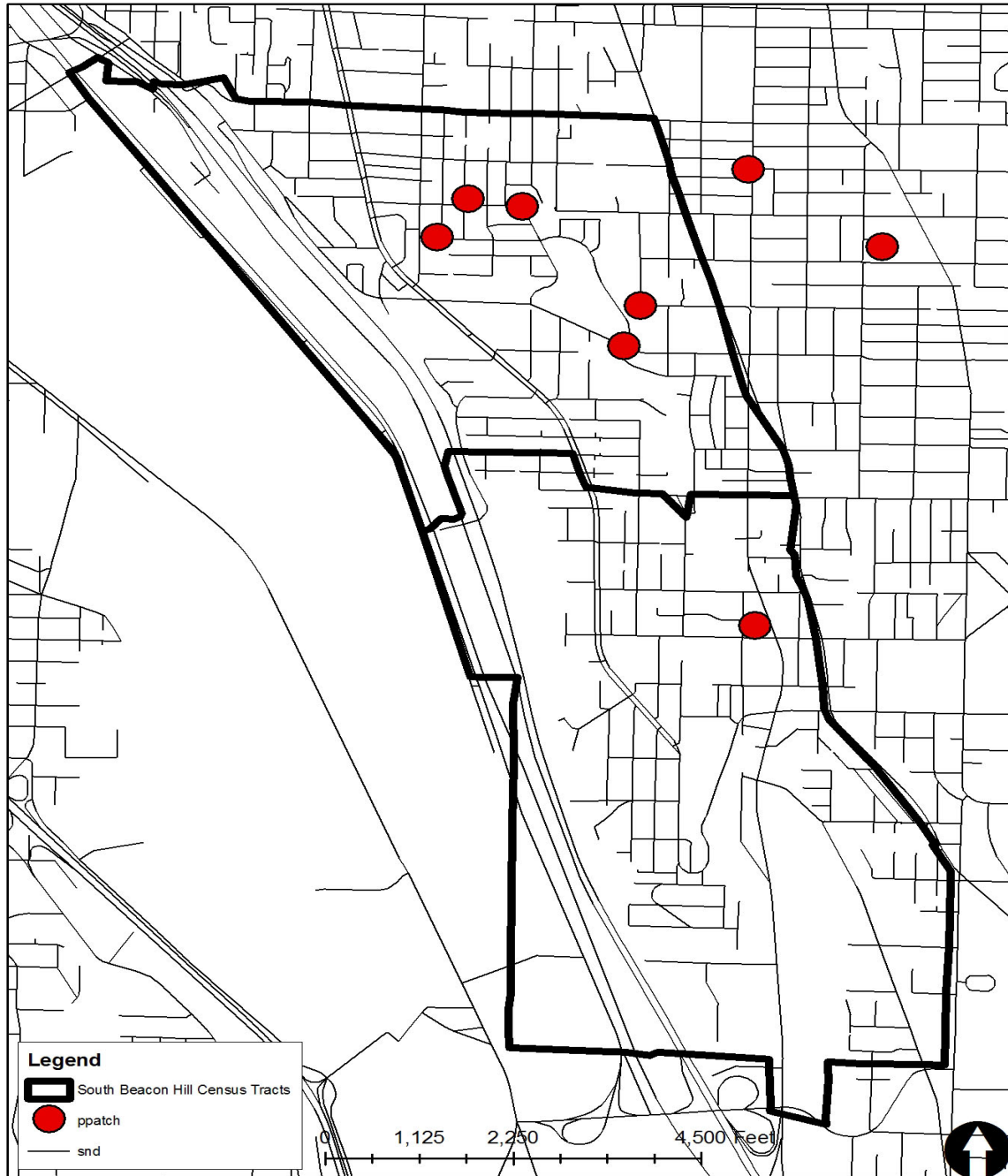
First Hill: P-Patch Locations



Source: 2000 Census Tracts, P-Patches, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet.

Map 6: P-Patch Locations in South Beacon Hill

South Beacon Hill: P-Patch Locations



Source: 2000 Census Tracts, P-Patches, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet.

SUMMARY AND FINDINGS

Although food production is often overlooked due to the dominance of industrial food production, it should not be underestimated as an important source of nutritional and culturally appropriate food in neighborhoods of low-income and diverse populations. Examining the level of food production resources in First Hill and South Beacon Hill suggests that both neighborhoods have room for improving community food production.

Neither First Hill nor South Beacon Hill have a farmers' market, which is a primary source for accessing fresh, local, and organic foods that are also affordable. This suggests residents either travel greater distances for these types of foods, or they go without. Not only does this make these foods more difficult for residents to access, but it also denies residents the opportunity to build community around these markets and connect with neighbors and local farmers.

Residents in First Hill have adequate access to Community Supported Agriculture programs due to their proximity to downtown Seattle, which has a concentration of pick-up locations. South Beacon Hill residents' however, do not have many options. There are only a few pick-up locations in this neighborhood and little to no home delivery options. Again this limits residents' access to fresh, local, and nutritious foods in these neighborhoods.

The P-Patch in First Hill is well used but the yearlong wait list suggests residents' high demand for space to garden and grow food exceeds supply. Also, Squire Park P-Patch is not centrally located in First Hill, so residents may have difficulty accessing this site and/or transporting produce home. While South Beacon Hill has six P-Patches, five of them are connected to New Holly and may not appear accessible or open to other residents. The southern region in this neighborhood not only has a scarcity of food locations, but is also quite far from the community gardens, suggesting somewhat of a food desert in this area.

LOW-INCOME HOUSING

Housing costs can account for a large percentage of the budget of low-income households, leaving less money to purchase other basic needs, like food. Between 1997 and 2002 Seattle experienced a double-digit real rent increase, which was above the rate of inflation during the same period¹⁶. This trend has placed tremendous pressure on low-income households to make ends meet. The availability of affordable housing is a valuable resource in communities with a high percentage of people living below the poverty line or unemployed. When doing a neighborhood food assessment, it's valuable to look at household income and poverty levels in conjunction with the availability of low-income housing units. This can be telling in terms of the strain placed on households to meet their basic needs, such as purchasing food.

We looked at the following indicator to assess the low-income housing situation in First Hill and South Beacon Hill:

¹⁶ Research Group of the National Association of Realtors, The 2002 Profile of Real Estate Markets: The USA, <http://www.realtor.org/intlprof.nsf>

Indicator	Source
Low-income Housing Units	Seattle Housing Authority

Seattle has more than 6000 Low-income Public Housing units, which are managed by Seattle Housing Authority. 2300 of these are designed for families, while the rest of the units are for singles and couples. The income limit for most of these units is 80 percent of area median income.

In First Hill there are two low-income housing areas. Jefferson Terrace (800 Jefferson St) has 299 units ranging in size from 0-2 bedrooms and serves bus routes 3, 4, 13, and 64. Yesler Terrace (102 Broadway) has 582 units ranging in size from 0-4 bedrooms, and serves bus routes 9, 25, 27, 60, and 205.

South Beacon Hill has one low-income housing area at Beacon Tower (1311 Massachusetts St), which has 108 single bedroom units and serves bus routes 36 and 60. New Holly is a mixed-income community with some Low-income Public Housing. For public housing units at New Holly the income limit is 30 percent of area median income, where income limit is related to family size.

SUMMARY AND FINDINGS

There are 5831 rented units in First Hill. Of the households occupying these units, 25% live below the poverty level, totally about 1450 households¹⁷. The number of low-income housing units available in this neighborhood is 881. This suggests a shortage of affordable, low-rent housing units in First Hill to accommodate those that qualify.

In South Beacon Hill, there was a reported 1308 renter occupied units in 2000. Of the households in these units, 35%, or 457, live below the poverty level. With only 108 low-income housing units available, plus units at New Holly, there appears to be a scarcity of affordable housing for those in need.

This data implies that low-income households in both neighborhoods are struggling to make ends meet. Rent expense for these households is likely paid with funds that would likely go to meeting other basic needs, like food consumption.

LAND USE AND TRANSPORTATION

Studies indicate a strong correlation between our physical and mental health and the built environment around us – or the places we live, work, and play. What’s sometimes harder to see is the connection between land use and food security. This issue is especially relevant in low-income neighborhoods, which often shoulder the negative impacts of poor planning and disinvestment. One article states that “These policies – whether intentional or through neglect – have resulted in the creation of “food deserts”: residential neighborhoods that lack ready access

¹⁷ 2000 Census Data, Occupied Housing Units: Renter occupied and Income in 1999 below poverty level

to the components of a fresh and healthful diet.”¹⁸ A neighborhood food assessment should look at land use, public transportation access, and walkability and bikeability in terms of how easy it is to access food resources in a particular neighborhood.

The following indicators were examined to better understand this question of food access:

Indicator	Source
Land Use	Washington State Geospatial Data Archive
Public Transportation Access	Washington State Geospatial Data Archive, Seattle Metro
Sidewalks, Crosswalks, Bike Lanes	Washington State Geospatial Data Archive

Land Use

The majority of land in First Hill is designated for multi-family housing and major institutions (Map 3). Most food locations in the neighborhood are concentrated along major arteries of Madison Avenue and 12th Avenue, which is designated for neighborhood/commercial use. In the neighborhood’s southeast corner, there are some single-family units. Though separated by I-5 freeway, the west and northwest boundaries of First Hill cross over into downtown Seattle.

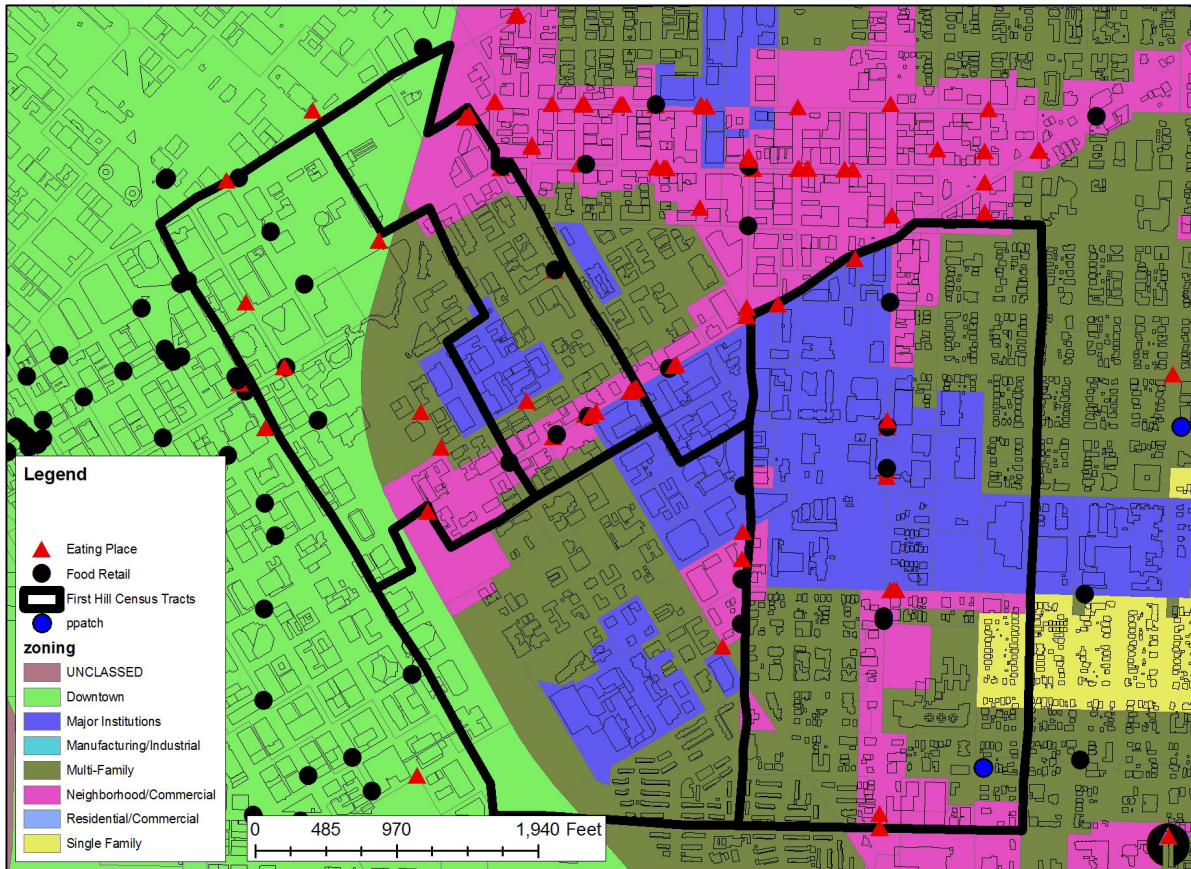
South Beacon Hill is predominantly residential, with mostly single family and some multi family units (Map 4). There are a few corridors of neighborhood/commercial land primarily along Martin Luther King Jr Way and Beacon Avenue S, where the majority of food locations are concentrated.

The maps below reveal existing land use in both First Hill and South Beacon Hill. The categories describing land use include downtown, major institutions, manufacturing/industrial, multi-family, neighborhood/commercial, residential/commercial, single family, and unclassified.

¹⁸ Feldstein, Lisa, “Linking Land Use Planning and the Food Environment”, Smart Growth Network, <http://icma.org/sgn/newsdetail.cfm?nfid=2666&id=>

Map 7: Land Use, food locations, and P-Patches in First Hill

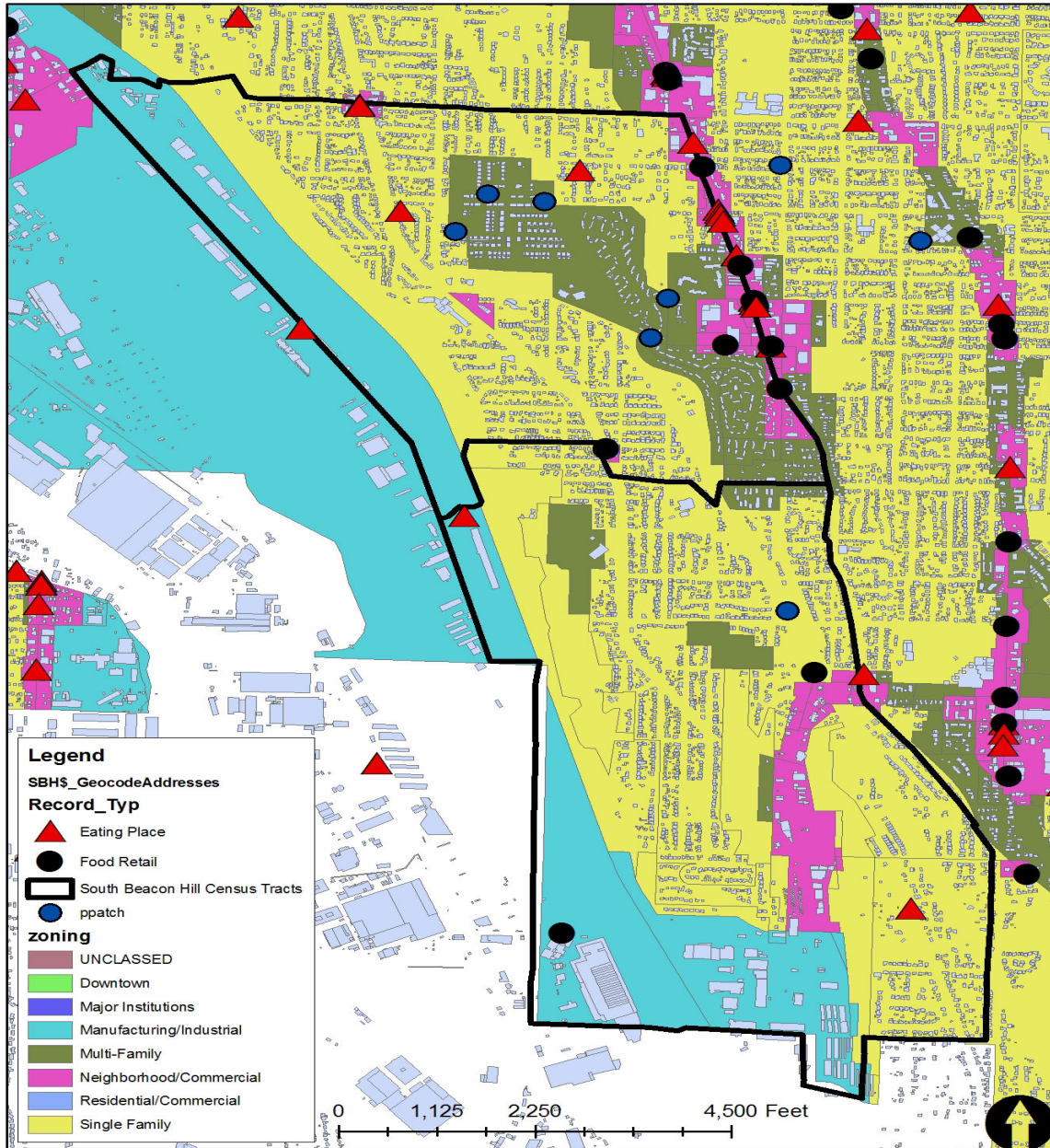
First Hill: Land Use, Food Locations, and P-Patches



Source: 2000 Census Tracts, Zoning, P-Patches, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet. Food locations from Hoovers Online, www.Hoovers.com. Food locations outside First Hill are incomplete.

Map 8: Land Use, food locations, and P-Patches in South Beacon Hill

South Beacon Hill:
Land Use, Food Locations, and P-Patches



Source: 2000 Census Tracts, Zoning, P-Patches, file date 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_FeetFood locations from Hoovers Online, www.Hoovers.com. Food locations outside South Beacon Hill are incomplete.

Public Transportation Access

Travel time to work for First Hill residents not working at home is 21.5 minutes on average. However for 70% of residents, commute time to work is 12.5 minutes on average. Nearly 44% of residents walk to work, while 30% drive and 20% use public transportation.

For residents in South Beacon Hill, average commute time to work is 27.7 minutes. However for 56% of residents, average commute time is 16.8 minutes and 31.9 minutes for nearly 30% of residents. Almost 80% of residents drive to work, while only 17% use public transportation. Less than 1% walks to work.

For Seattle residents in general, average commute time to work is 24.8 minutes. Nearly 68% of Seattle residents drive, 18% use public transportation, and 7% walk to work on average.

First Hill has fourteen Seattle Metro buses serving the neighborhood, while South Beacon Hill has five¹⁹. See appendix #4 for a full listing.

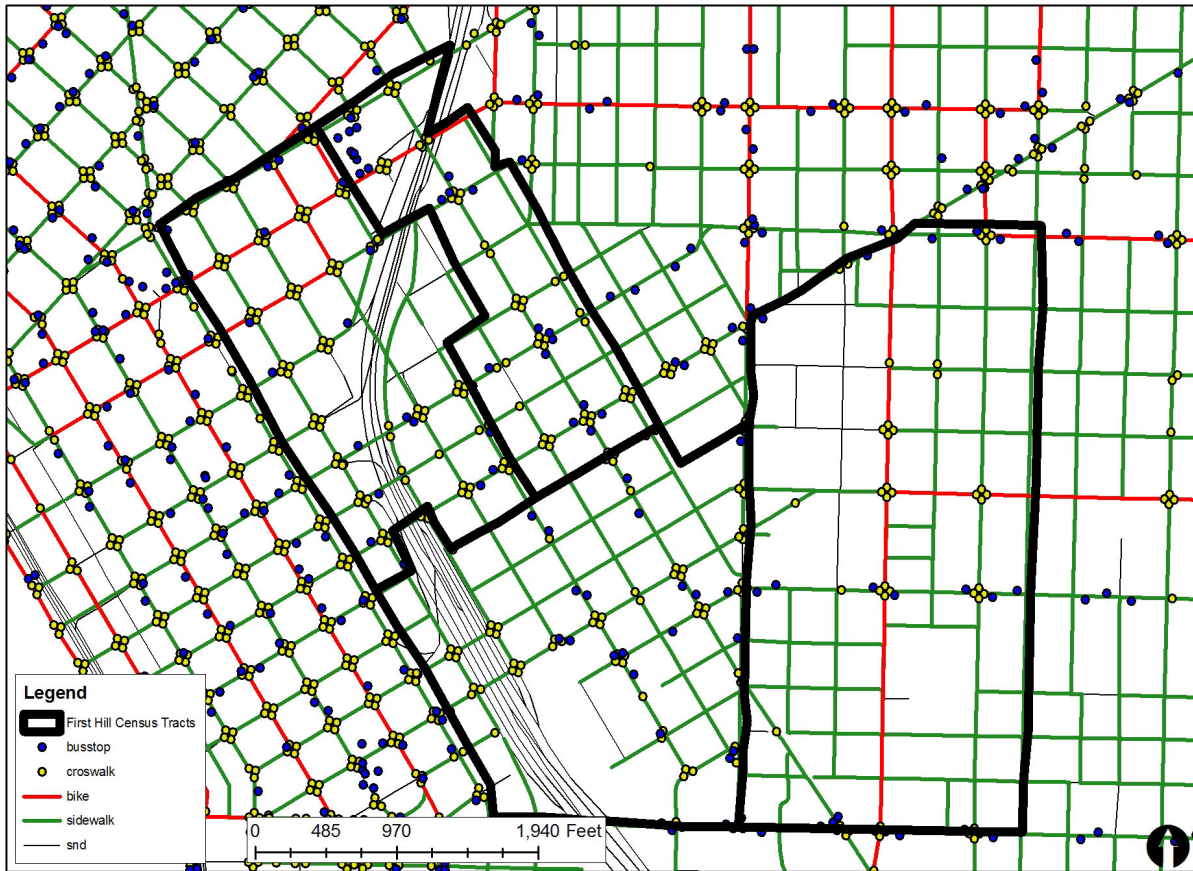
Sidewalks, Crosswalks, Bike Lanes

Lack of sidewalks or bike lanes, and/or the need to cross high-traffic streets without crosswalks can create barriers to accessing food resources. In addition to public transportation, the walkability and bikeability of the neighborhood affects access to food. The following neighborhood maps detail sidewalks, crosswalks, and bike lanes in First Hill and South Beacon Hill (Maps 5, 6).

¹⁹ <http://transit.metrokc.gov/>

Map 9: Bus stops, sidewalks, crosswalks, and bike lanes in First Hill

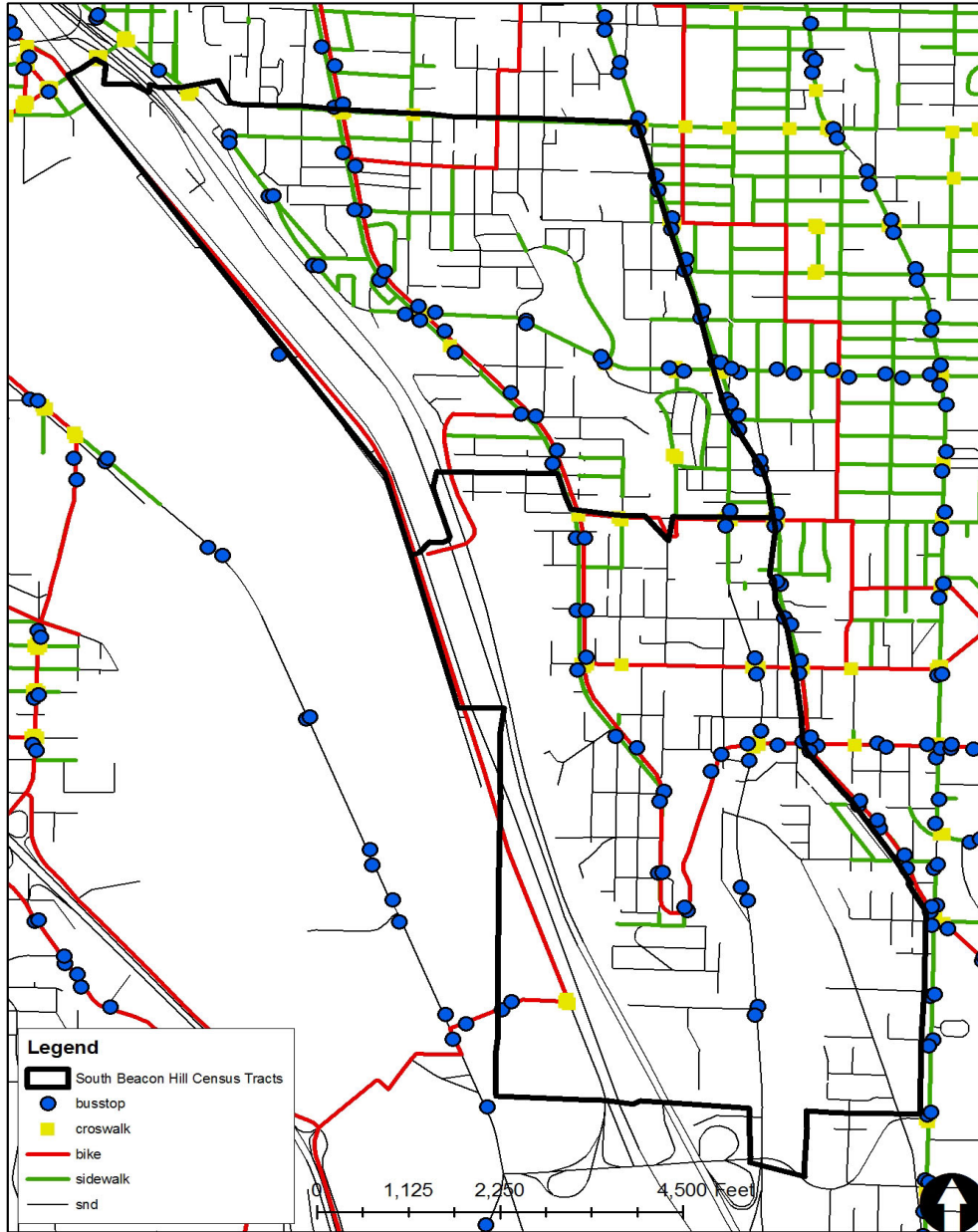
First Hill: Bus stops, Sidewalks, Crosswalks, and Bike Lanes



Source: 2000 Census Tracts, Bus stops, Sidewalks, Crosswalks, Bike lanes, file date 1999 and 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet. Food locations from Hoovers Online, www.Hoovers.com. Food locations outside First Hill are incomplete.

Map 10: Bus stops, sidewalks, crosswalks, and bike lanes in South Beacon Hill

South Beacon Hill:
Bus stops, Sidewalks, Crosswalks, and Bike Lanes



Source: 2000 Census Tracts, Bus stops, Sidewalks, Crosswalks, Bike lanes, file date 1999 and 4/2007, City of Seattle data, downloaded via Washington State Geospatial Data Archive, NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet. Food locations from Hoovers Online, www.Hoovers.com. Food locations outside South Beacon Hill are incomplete.

SUMMARY AND FINDINGS

While First Hill seems to lack a food center, there are several commercial land use areas with food locations. These areas are more or less well dispersed throughout the neighborhood. In addition, First Hill is surrounded by an abundance of food locations in downtown, Capitol Hill, and the International District. The close proximity to downtown provides residents with many transportation choices, including many bus routes. Nearly every block in First Hill is accessible by bus, foot, and/or bike. The street grid layout makes the neighborhood easy to traverse and navigate. With over 40% of residents walking to work, the walkability of this neighborhood appears quite good. These indicators suggest residents can access food with relative ease.

South Beacon Hill on the other hand, does not have widely distributed commercial land, which limits the number of food locations available to residents. And unlike First Hill, South Beacon Hill is not surrounded by neighborhoods with high food concentrations. In fact, to the west of the neighborhood is I-5 and beyond that, industrial land. South Beacon Hill does not have extensive access to Metro resources. Bus routes typically serve the major arteries, which are S Beacon Ave and Martin Luther King Jr Way S. However, getting to either artery can be a challenge for residents. Steep hills in South Beacon Hill, particularly in the area separating these arteries, can make walking and biking difficult. This neighborhood lacks a grid layout and sufficient sidewalks and bike lanes, which also makes the neighborhood more difficult to navigate. These factors suggest a highly car dependent neighborhood, which is supported by the fact that 80% of residents drive to work. This also suggests that residents experience difficulty accessing food resources.

THE EXPERIENCE OF RESIDENTS

The previous sections have profiled each neighborhood's socioeconomic and demographic characteristics as well as their community food resources. While this data is an essential component to any food system assessment, it only partially describes the experience of neighborhood residents in terms of their relationship with the food system. The data gathered does not tell us how residents feel about the food resources in their neighborhood, to what extent they are using these resources, and what barriers exist to accessing the food they need and want. We conducted five focus groups with First Hill and South Beacon Hill residents to hear about their neighborhood experiences. The qualitative information gathered from these discussions has brought to life the strengths and weaknesses of the food system in each neighborhood.

By measuring the present food resources, the food security of neighborhoods, the production levels of local food and the demographic and social characteristics of neighborhood residents, and then evaluating how these factors interplay to make up both the First Hill and South Beacon Hill food systems, one can begin to identify trends and policy opportunities in each neighborhood. Below are the analyses of the neighborhood food system in First Hill and South Beacon Hill per focus group discussions in each neighborhood.

FOCUS GROUPS

We wanted to gain input from neighborhood residents about two important issues regarding food systems:

- *what resources are residents using to acquire food*
- *how well are they able to access food (retail or other sources)*

Members of the city's IDT were interested in knowing about the experiences of neighborhood residents with regard to what resources residents are using to access food, and how well these resources currently serve residents. We organized five focus groups to gather this information, three in First Hill and two in South Beacon Hill. The focus group questions are presented in Appendix #5.

These focus groups were designed to solicit candid input from residents about the quality of their neighborhood food system. Individual participants were organized primarily through outreach to various community and neighborhood organizations in the two neighborhoods. One of the major challenges of the focus groups was bringing together neighborhood residents to participate in the groups. Focus groups lasted between 75 and 90 minutes in length, and participants were provided food and \$10 grocery gift cards as compensation for their time. Participation was voluntary and participants were informed that their responses would be anonymous. The locations of the five focus groups were Beacon Hill Library, Co Lam Pagoda, New Holly Neighborhood House, First Hill Neighborhood House, and Horizon House Continuing Care Retirement Community.

Focus groups were designed to provide residents a comfortable environment to express their opinions about how their neighborhood food system was working. Focus group questions attempted to gain information regarding residents' satisfaction with the methods residents use in acquiring food, the perceived quality of existing food resources, the transportation options they

use to access to food, what kinds of foods they purchase, and any barriers they face in accessing food.

Data Analysis Methodology

We utilized thematic coding to analyze focus group data. This methodology is an approach to transforming qualitative data by way of thematic analysis and code development. Through the process of content analysis, we created five categories (codes) in relation to the data that serve as over-arching themes under which we can organize the data as ‘of the same type’. The six thematic outcomes identified are Availability, Quality, Affordability, Access, Food Security, and Other. ‘Other’ is for responses that don’t appropriately fit under another category. Two students independently coded responses, recorded by notes from the focus groups taken by a student note taker, under one or more of the categories. The data was organized and identified based on the resulting codes and themes.

FOCUS GROUPS WITH RESIDENTS OF FIRST HILL

1) Horizon House Continuing Care Retirement Community

The first focus group in First Hill took place at the Horizon House Community Care Retirement Community located at 900 University Street. Residents at Horizon House have the option of taking meals on-site from a fully operational restaurant provided for resident use or getting food from outside resources and preparing meals in their individual kitchen facilities. Focus group participants consisted of 12 residents of the retirement community and one First Hill resident who did not live at Horizon House. The group offered the following responses to different issues of food access in First Hill:

Availability

Residents do not necessarily like to shop at one location for all their food needs. Instead they prefer to shop at different locations for different products, as different stores provide different products well, and this benefit outweighs the convenience of one-stop shopping.

The majority frequents local restaurants between one and three times a week.

Quality

In terms of nutrition, and healthy foods, there is a divide between residents who feel they have lived this long on “regular” food and do not think much about issues like organic food and residents who claim they try to eat healthy.

Most residents desire brand name food because it’s what they know.

Affordability

Coupons, taking advantage of sales, and buying in bulk are the preferred method for residents in stretching their “food dollar”. Although these residents are fairly economically advantaged, issues regarding money and food are still sensitive topics, as many residents grew up during the depression, when there was not always enough food.

Access

Transportation could be a major challenge for older residents in accessing food. Most of the residents suffer health conditions or physical limitations that make walking, driving, and carrying groceries difficult. Horizon House offers a free shuttle, however it is limiting in how far it travels. If this shuttle service were not provided, residents would have a hard time accessing food.

Residents agree that it became more difficult to access food after the Thriftway was closed on Madison and 8th. It was at this time that Horizon House started the grocery shuttle service.

Many residents are excited about an in-house, single-vendor produce market coming to Horizon House this summer and would like a farmers' market to be within walking distance.

Another issue that surfaced on several occasions was the layout of grocery stores. High food and freezer shelves make it difficult to reach food, and stores like Costco are difficult to navigate for some seniors.

A common theme among this group was the desire to access food sold in smaller quantities. Residents referenced Trader Joe's as a grocery store where they can find smaller quantities.

Food Security

The participants in this focus group do not receive food stamps or access emergency food services. They feel they don't need to make tradeoffs between rent, utilities, and food.

2) First Hill Neighborhood House

The second focus group held in First Hill was at the Neighborhood House at 825 Yesler Way. Neighborhood House is a nonprofit organization with the mission of helping diverse communities of people with limited resources attain their goals for self-sufficiency, financial independence and community building. The focus group consisted of 14 participants representing three languages. Translation was provided for Vietnamese and Somali participants.

Availability

In general, First Hill residents shop for groceries in First Hill or surrounding neighborhoods, like the International District. Most get on a bus to grocery shop. Even though food retail location might be in walking distance to residence, residents will travel to food retail location with best prices and or sales. Produce markets and grocery stores in the near-by International District are frequented often, as is the Red Apple Market north of First Hill in Yesler Terrace. Food also purchased at ethnic stores and drug stores that take food stamps.

Again, most people shop at multiple locations. Somali markets might provide dry foods and goat meat, but not high quality produce. Asian markets might sell produce and spices, but not steak or milk. Participants felt that produce at Asian markets was less expensive than American chain stores. Asian markets take food stamps as well.

Several participants garden and produce food that way. Others are excited about the P-patch going in.

Quality

Nutrition concerns impact decisions at the grocery store. Many face health issues, like Diabetes, which demand attention. Desire for more education on nutrition. It was also mentioned, and backed, that the goal is to “fill the belly” and so nutrition concerns aren’t always relevant.

Participants unanimously agreed that the quality of grocery stores in First Hill is not as high as the same store in other neighborhoods. There were wide complaints about the cleanliness, sanitation, odor, and appearance of grocery stores in their neighborhood. If there were one message to send to the City, it would be to improve quality of grocery stores. Participants would like to see stricter monitoring and regulation of stores to ensure proper hygiene is maintained.

Participants care about brand name food because taste is guaranteed under a brand name.

Affordability

The primary determinant in choosing which food to purchase is price. Sales also impact food purchasing decisions.

Residents seek out sales, use coupons, or buy in bulk to reduce cost of groceries. Somali participants mentioned strategy of purchasing an entire goat and splitting it up several ways to reduce costs.

Residents agreed nutrition was a relative term. Some felt nutritious food was expensive and a luxury, while others commented it could often be cheaper than processed foods.

Participants seemed to be familiar with and prefer organic food, but agreed price detracts from their ability to eat it often. They believe that it tastes better. Local food was also touted as tasting better and appearing more fresh.

Access

Most residents take the bus to grocery shop and express that this system works well. Those that walk often bring back a grocery cart to avoid carrying heavy bags. It was also mentioned that residents in this neighborhood would benefit from a shuttle to take people grocery shopping. Some mentioned the Access Shuttle but that you need to be at least 60 to ride it.

Majority agreed that First Hill used to have more food retail options. Most fondly recalled having a shopping center on 12th and Weller that was convenient and nice. That closed, as well as a Safeway. It took a long time for the Red Apple Market in Yesler Terrace to open. Most agree the quality has changed for the worse and that there are less deals. It was also mentioned that there are now more Asian grocery stores and that has made it convenient for all people to access food.

Most participants agreed that First Hill needs another large grocery store around Yesler Way and Broadway. There aren’t any options in that area for grocery shopping. They agreed that a large store with both American and international food would be ideal, so that you could do a one-stop shop.

Food Security

The possession of food stamps determines when residents go grocery shopping. When food stamps run out, you either pay out of pocket or visit the food bank. Most plan out their meals very carefully so that they don't run out of food stamps. But others don't get enough food stamps for what they need. But residents agreed they get enough food and do not go hungry.

Meals on Wheels carry fresher produce than local markets because they receive fruit and vegetables directly from farmers. Other emergency food resources are believed to be all over Seattle and accessible to all age groups. Several food programs designed for new moms were mentioned and a few residents mentioned using these programs when they were raising their children.

It was generally agreed that residents seek free food opportunities offered at events, community organizations, or churches. Food resources are easy to find and it is widely understood where one can go for breakfast, lunch, dinner, and snacks. When asked about young kids going hungry, participants agreed this was a concern for kids whose parents were checked-out but that many families take advantage of the free meals offered at school. One participant commented that "you can't concentrate on an empty stomach".

All residents agreed that the order of priorities is rent, utilities, and then groceries and stressed the importance of budgeting. It was mentioned that if anything gets cut out it's food. One person mentioned splitting up rent payment when finances are strapped.

FOCUS GROUPS WITH RESIDENTS OF SOUTH BEACON HILL

1) Beacon Hill Library

The first focus group was held in North Beacon Hill at the Beacon Hill Library, which is located at 2821 Beacon Ave S., Seattle, Washington. While the focus group provided interesting results, most of the participants were residents of North Beacon Hill, which is outside our scope of study. Therefore, the findings below have been limited to the comments put forth by a resident of South Beacon Hill who attended the focus group. We are making the assumption that the participant would not have given dramatically different responses about how he or she utilizes food resources had he or she been in a focus group of South Beacon Hill residents.

Availability

One stop shopping is less preferable than going to different food retail locations that can offer higher quality goods.

Growing your own vegetables seems to be a viable option for some food production in South Beacon Hill

Quality

Quality of food items is a motivating factor for frequenting several grocery stores rather than a one-stop shop.

Store cleanliness and safety are factors in deciding which grocery stores to avoid and which to patronize.

Affordability

No option but to spend money on large quantities and so food is often wasted.

Access

Access to food sold in smaller quantities is preferred and factored into shopping decisions.

There are few restaurants and grocery stores in South Beacon Hill, so residents will travel to Columbia City to dine and shop. There is a desire to have a “Columbia City Strip” in South Beacon Hill.

Food Security

If money were tight, the tradeoff would be to purchase fewer groceries.

Other

There was a general feeling that South Beacon Hill lacks a vibrant community feel and that it is difficult to build relationships with neighbors.

2) Co Lam Pagoda

The second focus group in South Beacon Hill was held at Co Lam Pagoda, a Buddhist temple located at 3503 South Graham Street. This temple serves predominantly Buddhists from

Vietnamese origin and offers a variety of community services. We had five participants at the focus group, all of who could speak English.

Availability

Participants primarily shop at Asian grocery stores, including Viet Wah on Martin Luther King Way. Most supplement their grocery needs with Western products from non-Asian grocery stores.

In general, participants don't shop at farmers' markets, mostly because they are not easy to locate.

Quality

Nutrition is a concern for participants and a factor in deciding which groceries to buy. Health concerns, like high cholesterol, impact food purchasing decisions. Most feel they have received some nutrition education.

Participants agreed that there should be stricter regulation on food codes, safety, and expiration dates. These issues detract residents from shopping at particular stores.

Affordability

Participants mentioned willingness to drive farther to locate fresh and affordable food.

Methods for "stretching the food dollar" include better planning, coupons, and purchasing smaller portions to avoid wasting food. Also, participants might limit dining out to save money for groceries.

Most like the idea of buying organic but agree it is too expensive. Also, there are not many organic options at Asian markets and this is too bad. Food at Asian markets is not well marked like it is in Western stores.

This group was mostly indifferent toward locally produced food. However, they proposed that the government subsidize local farmers, so that organic foods would be more readily available and affordable. It was also mentioned that there be no tax on food.

Access

Traffic, parking, and crowds detract residents from shopping on weekends. So most prefer to shop during the week. All participants drive their cars to grocery stores to shop. Several participants mentioned having to take several buses and that it was just easier to drive. Biggest access issue mentioned was time – that it was often difficult to find time to shop.

Food Security

Nobody in this group received food stamps. While this group did not seem disadvantaged, participants did mention the benefits of receiving free food at Temple or from friends. Tradeoffs between rent, utilities, and food were not expressed. Participants agreed all of these bills need to be paid, and that they are.

It's worth noting that all participants receive a free lunch at the Temple on Sundays and that Asian grocers donate more than half of the Temple's food.

Other

The participants agreed that South Beacon Hill has changed a lot in the last several years, especially demographically. This has affected food selection so that there are a wider variety of small stores that cater to ethnic groups. More options has led to greater competition among stores, which has moved the prices down – all of which are believed to be positive changes.

3) New Holly Neighborhood House

Our third focus group in South Beacon Hill was at the New Holly Neighborhood House, 7058 32nd Ave S, Seattle, Washington. Neighborhood House is a nonprofit organization with the mission of helping diverse communities of people with limited resources attain their goals for self-sufficiency, financial independence and community building. The focus group consisted of 6 participants representing 3 languages. Two interpreters were present at this discussion.

Availability

Participants shop at a variety of food stores including chain stores, like Safeway, ethnic stores, and drugstores. Since Safeway does not have a pharmacy, which is inconvenient, some shop at Walgreens where they can pick up prescription and food items. Most participants get some food items at Safeway but purchase specialty items, like particular meat, at an ethnic store. Others seek out deals on produce at ethnic stores. Most of the participants do some grocery shopping outside the neighborhood. They will go a distance to find affordable prices or buy in bulk. Whole Foods was mentioned as a desirable grocery store but too expensive and far away.

Everyone mentioned the WIC program as providing a \$20 annual coupon for purchasing vegetables. They like this program but it only happens once a year.

Even though there are several P-Patch's in the neighborhood, the participants were unfamiliar with them and did not know where they were located. They believe people do not know about the community gardens because they aren't advertised well to residents. Participants also said there used to be more gardening spaces in the neighborhood but re-construction has reduced that space. One participant does garden in her backyard and grows produce for consumption.

It was also mentioned that stores on every corner would make it easier to get the food they want. There has been both an increase in ethnic stores and variety of foods available over the several years, but the appearance of big stores, like Safeway, has put several small stores out of business. There was some mention that the grocery stores they like to shop at are not located in South Beacon Hill, like Albertsons. Most of the big chain stores are down in the Rainier Beach Area.

Quality

All participants consider nutrition in their purchasing decisions. Several mentioned that they limit consumption of food high in fat. Others consider organics to be more nutritious and safer because they aren't grown with pesticides or raised with hormones. Many consider quality of food item and health ramifications of consuming the item. Several participants mentioned

wanting to make a nutritious choice about which food to purchase but feel price is a barrier (i.e. olive oil) or location of the store is inconvenient (Whole Foods for organics).

Almost all the participants have received nutrition classes either through the WIC program or Neighborhood House. Several people mentioned asking doctors or health clinics for nutrition information. Others watch Oprah or talk to family and friends. All desire more nutrition education.

Poor quality of grocery stores was mentioned as a barrier to accessing food. For instance, the Safeway in South Beacon Hill can feel unsafe or unpleasant. There are often police who are there responding to a call.

About half the participants agreed that brand name is important when grocery shopping. A good brand is associated with high quality, better tasting food. Also if a food is connected to culture (i.e. basmati rice), then brand name is important – it's what's been used for a long time and can be depended on. The other half did not feel brand names, but rather freshness of the product, determined purchasing decisions.

Affordability

Most all participants mentioned that they budget each week/month for food expenses. Most buy in bulk from Costco or Sam's Club, although Costco does not accept food stamps and this is difficult. Stores with club cards, like Safeway and QFC, also offer lower prices. When food goes on sale, that's when several people shop.

Organic foods are desirable but considered more expensive and difficult to locate. Local foods also hold appeal with this group and are believed to be fresher and last longer. Most do not know where they would go to get locally produced foods.

Several people mentioned that food prices have gone up in recent years, making it more difficult to access the food they want.

Access

Across all participants, cost was cited as biggest barrier to accessing food. But overall people don't have problems getting the food they want. Childcare can be an issue and forces some to drive when they could have walked. Topography of South Beacon Hill was not mentioned as a barrier to accessing food.

Distance to store, price of food items, and variety of food available were all reasons for choosing a particular grocery store. The Columbia Farmers' Market was also mentioned as having fresh, affordable produce. Customer service is also important to shoppers.

Most people in the group drive to grocery stores. Even if store is within walking distance, driving seems to be preferred mode of transportation. Nobody mentioned taking the bus.

The traffic and construction in the neighborhood has made it more difficult to access groceries. It has made the streets less safe. There are now more cars on what were once quiet streets.

Food Security

Four of the participants agree that rent expense comes first, then food, then utilities. If there isn't enough money to cover all three expenses, utilities are compromised first. Two of the participants' prioritized rent expense first, then utilities, then food. If money is tight, then they spend less on food or buy cheaper, less desirable items. All felt strongly that rent was the greatest priority. You have to pay rent (fixed cost) and then conserve water and energy, and spend less on food.

Most of the participants use food stamps to cover basic food needs. Several said they make sure to budget their food stamps so that they last the entire month. If they are running low on food stamps, they will buy cheaper, and less desirable products to make them last longer. Others frequent the local food bank to stock up on additional food items. Some of the ethnic stores accept food stamps, while others do not. Since Safeway accepts food stamps, many participants go there to shop.

REPORT FINDINGS

The analysis tool we selected for examining what's working and not working so well in the neighborhood food systems is SWOT analysis ((Strengths - Weaknesses - Opportunities - Threats). This tool is often used in planning and policy formation in both the public and private sector because it combines the study of the strengths and weaknesses of a system, an organization, a geographical area, or a sector, with the study of the opportunities and threats to their environment.²⁰ The table below depicts the rationale of SWOT analysis:

	<i>Positive aspect</i>	<i>Negative aspect</i>
<i>Internal factors</i>	Strengths	Weaknesses
<i>External factors</i>	Opportunities	Threats

Using SWOT analysis, we identified strengths, weaknesses, opportunities, and threats in First Hill and South Beacon Hill per the research gathered in this report, including 1) demographic and socioeconomic characteristics, 2) profile of community food resources, and 3) data from the focus groups. Below are our findings.

²⁰ "SWOT analysis for the participatory research in the Pacific". Tellus Consultants. [EN] (189kb)

First Hill	
STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Proximity to downtown, Capitol Hill, and International Districts – all of which contain variety and multitude of food locations • Condensed neighborhood with relatively easy access to food locations and emergency services • Access to culturally-appropriate food • Adequate walking and biking access • Active participation in Squire P-Patch • Emergency food sources are known and frequented 	<ul style="list-style-type: none"> • Lacking food retail core • Topography (steepness of hills) can be a challenge for transporting groceries by foot • Southern First Hill lacks food locations, making it somewhat of a food desert • Shortage of affordable housing units • Design/location of grocery stores make shopping difficult for large senior population • Lacking First Hill Farmers’ Market (but access to Broadway Farmers’ Market and Pike’s Place Public Market) • Quality concerns at some food retailers
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Wide access to Metro • M Street Grocery coming soon • More than 40% of residents walk to work 	<ul style="list-style-type: none"> • I-5 divides neighborhood and makes it difficult for residents to access downtown food resources • Senior population dependent on public transportation for accessing food • Population pressures intensifying (new construction of multi-family units)
South Beacon Hill	
STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Has five P-Patches, but they are concentrated in northern region • Nutrition classes have been made available through community organizations • New Holly has proximity to concentration of food locations on Martin Luther King Way 	<ul style="list-style-type: none"> • Lacking food retail core • Food locations are not evenly dispersed and concentrated along eastern boundary • No food banks within neighborhood boundaries • Shortage of affordable housing units • Lacking Farmers’ Market (but relative access to Columbia City Farmers’ Market) – inadequate access to fresh and healthy locally grown food • Quality/safety concerns at some food retailers
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Access to WIC Program • Potential for development of food retail and eating places in southern region (see land use – commercial) • Residents’ have interest in food nutrition classes and info 	<ul style="list-style-type: none"> • Large youth population vulnerable to poverty and hunger • Language/cultural barriers to educating residents’ about food resources • Residents’ unaware of community gardening opportunities • Some ethnic grocers do not accept food stamps • Limited Metro access • Car dependent neighborhood • Light rail construction has complicated residents’ access to food • Proximity to Superfund site west of I-5 54

REPORT RECOMMENDATIONS

Based on our research, we recommend the following enhancement opportunities in Seattle’s food system:

- 1) *Develop strategies to increase resident access to quality food resources.*
- 2) *Identify opportunities for educating residents about health and nutrition, as well as the environmental impacts of their food selections.*
- 3) *Support and promote alternative food resources and programs.*

The extent to which the City can be involved in these efforts is unclear, however we attempted to scope the recommendations in terms of policy suggestions that we believe the City can impact. These recommendations are thus broadly defined, allowing the City to determine its own role as appropriate.

Rather than making recommendations for both First Hill and South Beacon Hill, we believe there were enough parallels in the findings that we could justly make these broader recommendations without discounting the unique characteristics of each neighborhood. However, we do see food policy playing out differently in each neighborhood. In First Hill, for instance, food policy will need to account for the large senior population and the unique challenges it faces in terms of accessing food. In South Beacon Hill, the large number of families and children will likely influence the types of food resources made available.

Our recommendations follow in more detail below.

PROVIDE ACCESS

Recommendation #1:

Develop strategies to increase resident access to quality food resources.

Sound Food Report

The 2006 *Sound Food Report* highlighted a variety of issues that suggested Seattle resident access to quality food resources could be improved.²¹ Specifically the report recommended that the City partner with grocery stores to institute a shopper shuttle, study changes in metro transit routes to serve food deserts, and develop and fund a grocery store ‘lite’ model. These findings suggested that some Seattle residents’ access to food resources could be improved.

Neighborhood Food System Findings

These findings were supported through the research conducted on the First Hill and South Beacon Hill food systems. Results from both the profile of neighborhood food resources and the five focus groups suggest that transportation and cost concerns provide barriers in preventing residents from accessing high quality food.

Transportation

²¹ These recommendations are found in issue evaluation sheets #17 and #18 of the *Sound Food Report*.

Through the focus groups with neighborhood residents, the issue of how residents accessed food resources was always a lively point of discussion. Residents in both neighborhoods highlighted the importance of having cars to access grocery stores. For example, at Horizon House in First Hill, residents who had cars talked very little about having trouble accessing the food they wanted, however those who did not own a car stressed the importance of the free shuttle provided by Horizon House that transported residents to locations within a certain radius of the building. In South Beacon Hill, almost everyone drove to grocery stores and reported that they almost never thought about walking or taking public transportation. The most interesting trend was that for the few people in each neighborhood who did not use a car, they strongly preferred shopping at places where they could do “one-stop” shopping, however if one had a car, they preferred shopping at multiple stores, going to different places to get the highest quality products possible for the most reasonable prices.

In addition to the focus groups, the profile of food resources suggested there were areas of both First Hill and South Beacon Hill which had few quality food resources. The southern half of First Hill has very few food retail shops and is dominated by areas not zoned for retail businesses. Neighborhood residents’ access to farmer’s markets and locally produced food is also limited as there are no centrally located markets, p-patches or other resources to provide quality food. South Beacon Hill also appears to have areas with few food resources. There are no farmer’s markets in South Beacon Hill and almost all of the food retail outlets are located in Rainier Valley, with few places to access nutritious food along Beacon Avenue which sits atop a steep hill above Rainier Valley.

Cost

In both neighborhoods cost was a perceived barrier to obtaining organic food products. Residents repeatedly mentioned that they would like to eat healthy, nutritious food, but that often they could not shop at Whole Foods because it was both too far away, but more importantly too expensive. In South Beacon Hill and First Hill there was acknowledged health benefits from organic food, but such food was simply too expensive. Residents generally perceived food shopping to be a more discretionary payment than other types of bills (such as rent), and reported that they choose lower quality food when they feel heavier financial constraints.

Recommendations

Taking into consideration the above findings, the City should consider the following opportunities to improve resident access in First Hill and South Beacon Hill.

- 1) Improving and promoting alternatives methods to cars to shop at grocery stores**
 - a) Working with King County to assure transit routes support access to food resources.
 - b) Considering offering incentives to shoppers who do not use an automobile to travel to a store.
- 2) Considering economic incentives or rezoning for retail stores in areas of neighborhood with less food resources**
- 3) Considering programs that offer incentives for buying nutritious food**

- a) Consider programs like WIC that offer a one-time coupon to promote healthy food access.

4) Educating residents about the environmental impacts to using cars to access food resources

In all of these recommendations that promote quality food access, the City should strive to offer incentives that will encourage residents to think about how they access food. The City may not have the funding to offer ideal alternative transportation arrangements or to offer a 50% subsidy on local food, but small incentives can be valuable in starting to shape consumer behavior. Countless residents at one focus group spoke of the value of the WIC coupon not only because it provided them free food, but because it introduced them to nutritious food they had not otherwise known about. These recommendations aim to offer residents incentives for making better decisions about the options they have to access quality food in their neighborhoods.

EDUCATE

Recommendation #2:

Identify opportunities for educating residents about health and nutrition, as well as the environmental impacts of their food selections.

Sound Food Report

The 2006 *Sound Food Report* made the connection between low income, poor diet, and obesity. While these issues have a harmful impact on community health, productivity, and development, education programs on health and nutrition can offset these negative effects. Specifically, the report identified P-Patches and school gardens as particularly valuable educational tools.²²

Neighborhood Food System Findings

Results from both the profile of neighborhood food resources and the five focus groups suggest that education is a key component in enhancing Seattle's food system. In each of the five focus groups we conducted, there was a general feeling that residents did not have enough information to guide their selection of healthy and environmentally friendly foods.

Health and Organics

In the focus groups, many residents indicated that while they are health conscious and try to eat well-balanced nutritious food, they do not feel they have enough information at their disposal to make the best possible decisions for their health. One resident, for example, described her frustrations selecting food as a diabetic. She indicated that she found it challenging to know what types and amounts of food she could eat with her health condition. Many other residents expressed similar frustrations and a desire to gain more knowledge about the health affects of consuming particular food items. Organic food was a common point of discussion during the focus group discussions. Most residents knew very little about the difference between conventional and organic food, both with regard to their respective impacts on health and the environment.

²² *Sound Food Report*, 72.

Environmental Stewardship

In discussions with neighborhood residents, it was clear that the vast majority did not connect local food to environmental stewardship. Local food was connected to fresh produce, and in some occasions, to supporting the local economy. While most focus group participants connected organic food to health and the environment, virtually nobody referenced the environmental benefits of sourcing locally produced food items.

Recommendations

The City has an opportunity to promote beneficial changes in residents' food values by providing them with more information on health and nutrition. Based on our research, we've identified the following recommendations connected to education around food and nutrition.

- 1) Collaborate with community organizations to provide education programs on health and nutrition related to food**
 - a) Providing information at the neighborhood level that is culturally and demographically appropriate in content is an important criterion for success in this endeavor.

- 2) Help residents make the connection between local food and environmental stewardship**
 - a) Presenting and making available the findings of the "Green House Gas Study" might be a worthwhile place to begin. The City could disseminate this information through various mediums of publication and types of presentations and events.

In these recommendations, it is important to create channels through which neighborhood residents can create their own food education tools and thereby promote health and organic values from the ground-up. Thus, the City could assume a primary role in the provision of resources (i.e., financial, personnel, knowledge, and space) and facilitation of community building. The demand for neighborhood involvement and leadership therein underscores the point that education must be paired with values change for it to have a meaningful impact on residents' experience with the food system.

SUPPORT AND PROMOTE

Recommendation #3:

Support and promote alternative food resources and programs.

Sound Food Report

The 2006 *Sound Food Report* highlighted a variety of issues that suggested ways the City could be more involved in supporting and promoting alternative food resources and programs.²³ Specifically the report recommended expanding farmers' markets into neighborhoods, increasing funding for perishable food transportation/storage, and filling gaps in food access information.

Neighborhood Food System Findings

Results from the profile of neighborhood food resources and the five focus groups suggest that residents could benefit from both a wider variety of alternative food resources and programs and the promotion and marketing of these resources and programs.

²³ These recommendations are found in issue evaluation sheets #19 and #21 of the *Sound Food Report*.

Alternative Food Resources

Both the profile of neighborhood food resources and the data gathered in the focus groups revealed that residents could benefit from increased access to alternative food resources, such as farmers' markets and community gardens. Residents mentioned limited access to fresh, healthy, and affordable food and related this to the lack of farmers markets in First Hill and South Beacon Hill. Many of the focus group participants prefer to shop at ethnic food stores but commented that many refuse food stamps.

Information

While most focus group participants were familiar with but did not garden at the P-Patches in their neighborhoods, several participants did not know about this service or where the gardens were located. In First Hill, participants seemed very familiar with emergency food resources. However in South Beacon Hill, where emergency food resources are scarce, residents' were unfamiliar with the location of these services and/or expressed difficulty in getting there.

Recommendations

Taking into consideration the above findings, the City should consider the following opportunities to support and promote alternative food resources and programs in First Hill and South Beacon Hill.

- 1) Support the proliferation of farmers' markets, P-patch programs, and other alternative food resources in low-income and food-scarce neighborhoods.**
 - a) These programs increase residents' access to fresh, healthy, and affordable food, and are a mainstay in a local, sustainable food system.

- 2) Promote and market food resources and programs at a local level and in a culturally-competent way.**
 - a) To help build community and empower local residents around these issues, it will be important to tailor and position promotional and marketing campaigns to residents' unique benefit requirements, which will vary for seniors, low-income residents, immigrant or refugee populations, youth, etc.

- 3) Develop funding criteria for food banks, etc. that focus on progressive services (i.e. health education and cooking classes), the sourcing of organic and local food, and offering food with higher nutritional value.**
 - a) Collaborate with local agencies to implement food system enhancement goals and opportunities. The folks on the ground have established contact and relationships, through which to channel information and services to residents.

APPENDIX

Appendix #1: Emergency Food Assistance and Meal and Outreach Programs in First Hill. Listings in BOLD indicate that location is within neighborhood boundaries of First Hill.

First Hill Emergency Food Assistance
<p>1. Food Pantry and Hot Meal Program Asian Counseling and Referral Service 720 8th Ave S Suite 200, Seattle, WA 98104 Provides culturally specific emergency food to the Asian-Pacific Islander community; hot meal program 10:30am, F. Contact: (206) 695-7522 Website: http://www.acrs.org</p>
<p>2. Baby Cupboard Northwest Harvest 711 Cherry St, Seattle, WA 98104 Provides baby food, formula and diapers when they are available; 9am-5pm, Th; baby or identification required. Contact: (206) 625-0755 Website: http://www.northwestharvest.org</p>
<p>3. Cherry Street Food Bank Northwest Harvest 711 Cherry St, Seattle, WA 98104 Distributes food bags to anyone need; 9am-5pm, M W; bread and produce only, 9am-5pm, Tu F; baby day 9-5pm Th. Clients may visit once per day. Contact: (206) 625-0755 Website: http://www.northwestharvest.org</p>
<p>4. Food Pantry And Commodities CAMP - Central Area Motivation Program 722 18th Ave, Seattle, WA 98122 Serves clients living in zip codes 98102, 98112 and 98122. See hours field for food pantry hours and special hours for seniors. Contact: (206) 812-4970 Website: http://www.cityofseattle.net/camp/</p>

5. Morris Polack Food Bank
Jewish Family Service
1601 16th Ave, Seattle, WA 98122
Operates a food pantry for ZIP codes 98101, 98112, 98121 and 98122; also for all Jewish people in King County; limited home delivery; occasional pet food; each client may visit once per month.
Contact: Main at (206) 461-3240
Website: <http://www.jfsseattle.org>

6. Chicken Soup Brigade Food Program
Lifelong AIDS Alliance
1002 E Seneca St, Seattle, WA 98122
Provides food distribution and meal/grocery home delivery for people living with HIV/AIDS and other diseases and illnesses.
Contact: (206) 957-1726
Website: <http://www.lifelongaidsalliance.org>

7. Food Bags And Commodities
Food Bank @ St. Marys
611 20th Ave S, Seattle, WA 98144
Provides food pantry for Seattle residents, no-cook bags for homeless individuals; commodities for east half of 98144; 10am-1pm, Tu Th Sa.
Contact: (206) 324-7100X18

8. Baby Cupboard
Food Bank @ St. Marys
611 20th Ave S, Seattle, WA 98144
Offers baby food and supplies for Seattle residents 1st week of each month; clients must prove they have a baby.
Contact: (206) 324-7100X18

First Hill Meal and Outreach Programs

1. Meal Program

Archdiocesan Housing Authority - Lazarus Center
416 2nd Ave Ext S, Seattle, WA 98104

Serves pastries and snacks at 11am, daily; serves soup and sandwiches from noon-2pm, daily; clients must be age 50 and older and homeless or marginally housed.

Contact: (206) 623-7219

Website: <http://www.ccsww.org/lazarus/index.php>

2. Hot Meal Program

Family Kitchen

803 Terry St St. James Cathedral Hall, Seattle, WA 98104

Provides free hot meals for women, families, and men ages 55 and older; 4:30-5pm, M-F.

Contact: (206) 322-2447

3. Congregate Meal Program

Emerald City Community Seventh Day Adventist Church
801 25th Ave S, Seattle, WA 98122

Provides free breakfast to anyone in need, with focus on Central Seattle area residents; served 8-9:30am, Sa.

Contact: (206) 322-0717

Website: <http://www.emeraldcitysda.net/>

4. Gethsemane Community Services

911 Stewart St Gethsemane Lutheran Church, Seattle, WA 98101

Serves a hot meal followed by a movie for homeless and low-income individuals; 11am each Saturday, September through May; tickets available at 9:30am, Sa.

Contact: (206) 682-3620

Website: <http://www.urbanfaith.org>

5. Congregate Meal

Mount Zion Baptist Church - Feeding Program

4th Ave and Yesler Underneath the Overpass, Seattle, WA 98101

Provides a free hot meal in downtown Seattle to anyone in need; Location is underneath the overpass at 4th Ave and Yesler; 3pm, 1st, 3rd, and 5th Sa.

Contact: (206) 322-6500

Website: <http://www.mountzion.net>

6. Church of Mary Magdalene
424 Columbia St First United Methodist Church, Seattle, WA 98104
Holds a Saturday worship, which includes breakfast and lunch for women who are homeless and their children.
Contact: (206) 621-8474
Website: <http://www.churchofmarymagdalene.org>

7. Clearinghouse
Northwest Harvest
711 Cherry St, Seattle, WA 98104
Coordinates food donations and distributes food to food banks locally and statewide.
Contact: (800) 722-6924 .
Website: <http://www.northwestharvest.org>

8. Hot Lunch
Operation Sack Lunch
6th Ave and Columbia St NW Corner, Seattle, WA 98104
Serves free hot lunches to those in need; 1pm, M-F, until all food is served; no ID required.
Contact: (360) 341-1309
Website: <http://www.opsacklunch.org>

9. Food Bags
Salvation Army - Social Services Department - Seattle
1101 Pike St, Seattle, WA 98101
Provides emergency food bags limited to 3 times per year.
Contact: Main at (206) 447-9944

10. The Shared Breakfast
Seattle First Methodist Church
811 5th Ave, Seattle, WA 98104
Serves a community breakfast on the 2nd and 4th Su of each month to anyone who is hungry; guests are served at tables.
Contact: (206) 622-7278
Website: <http://www.firstchurchseattle.org>

11. Congregate Meal Program

Seattle Chinatown International District Preservation and Development Authority
409 Maynard Ave S Suite 200, Seattle, WA 98104

Provides Asian meals for low-income Asian older adults; also offers home delivery to program participants.

Contact: Main at (206) 624-8929

Website: <http://www.scidpda.org>

12. VIP Feeding

Seattle International Church

3rd Ave and Yesler Way City Hall Park, Seattle, WA 98104

Offers hot pizza and juice, along with packaged snacks, 7pm every Thursday; food distribution is outdoors, and begins and ends with a prayer; serves anyone.

Contact: (206) 256-0100

Website: <http://www.seattlechurch.com>

13. Outdoor Meals

Trinity Christ Memorial Baptist Church

4th Ave and Cherry St Public Safety Building Plaza ("The Wall", Seattle, WA 98104

Provides a free outdoor meal; 3-5pm, every 4th Sa of the month; Public Safety Building Plaza, 4th Ave & Cherry St, Seattle.

Contact: (206) 323-6160

14. United Indian Elders

United Indians of All Tribes Foundation

1011 S Weller St Leschi House - Community Center, Seattle, WA 98104

Provides hot lunches; coordinates weekend activities, health services, arts and crafts, and exercise classes to Native American seniors 55 years and older.

Contact: (206) 228-1410

Website: <http://www.unitedindians.com>

15. Hot Meal Program

Community Lunch on Capitol Hill

1710 11th Ave Central Lutheran Church, Parish Hall, Seattle, WA 98122

Provides a full, free hot meal for anyone in need; served noon-1pm, Tu and F; also provides toiletries (soap, shampoo and lotion), dog and cat food, peanut butter and jelly sandwiches and a book exchange.

Contact: (206) 322-7500

Website: <http://www.communitylunch.org>

16. Hot Meal - Breakfast
First Covenant Church
400 E Pike St, Seattle, WA 98122
Provides free breakfast the last Sa of each month for anyone in need; 9-10am.
Contact: (206) 322-7411
Website: <http://www.seattlefirstcovenant.org>

17. Hot Meal - Teen Feed Burrito Friday
First Covenant Church
400 E Pike St, Seattle, WA 98122
Provides a free, hot meal for street youth, ages 23 and under; 6:30-8:00pm, F.
Contact: (206) 322-7411
Website: <http://www.seattlefirstcovenant.org>

18. Drop-In Center
Our Lady of Mt. Carmel Center
508 Broadway, Seattle, WA 98122
Provides a daily drop-in center, with soup, sandwich and dessert meal from 9-11am. Offers computer classes, telephone, mail pick-up services and a library.
Website: <http://www.seattlemtcarmel.org>

19. Emergency Food
St. Francis House
169 12th Ave, Seattle, WA 98122
Provides food in emergencies only; AGENCY IS NOT A FOOD PANTRY; snacks and socialization are available.
Contact: (206) 621-0945

20. Recreational Activities For Youth
Catholic Community Services - Lao Communities Center
1531 Bradner Pl S, Seattle, WA 98144
Offers a summer sack lunch program and year-round recreational activities for Laotian, Hmong, and Khmer youth.
Contact: (206) 328-2644
Website: <http://www.stpatsseattle.org/outreach/mtvirgin.html>

21. Hot Meal Program
Kawabe Memorial House
221 18th Ave S, Seattle, WA 98144
Japanese and American style lunch is served at 11:30am, M-F for seniors, ages 60 and older.
Contact: (206) 322-4550

Appendix #2: Emergency Food Assistance and Meal and Outreach Programs in South Beacon Hill. Listings in BOLD indicate that location is within neighborhood boundaries of South Beacon Hill.

Emergency Food Assistance Serving South Beacon Hill Residents
<p>1. Food Pantry El Centro De La Raza 2524 16th Ave S, Seattle, WA 98144 Operates a food pantry for low-income residents of ZIP codes 98108 and 98144 and all Chicano/Latino individuals regardless of where they reside. Contact: (206) 957-4634 Website: http://www.elcentrodelaraza.com</p>
<p>2. Food Pantry Seattle Indian Center 611 12th Ave S Leschi Center #300, Seattle, WA 98144 Offers free food bags and/or sack lunches, depending on food supply; ZIP codes 98104, 98122 and 98144 only, except also serves current Seattle Indian Center and Seattle Indian Health Board clients from other ZIP codes. Contact: Office at (206) 329-8700 Website: www.seattleindiancenter.org</p>
<p>3. Food Pantry And Baby Cupboard Beacon Avenue Food Bank 6230 Beacon Ave S Bethany Church of Christ, Seattle, WA 98108 Provides food for anyone in need, including limited diapers, baby food and formula; noon-2pm, W F. Contact: (206) 722-5105</p>
<p>4. Marketplace Food Pantry And Clothing Center For Empowerment 7930 Rainier Ave S, Seattle, WA 98118 Provides food weekly in Rainier Valley; works to offer food consistent with the diets of an ethnically diverse area; offers some clothing. Contact: (206) 722-7310 Website: http://www.centerforempowerment.org</p>
<p>5. Food Pantry Northwest Community Services Food Bank 4205 Rainier Ave S, Seattle, WA 98118 Operates food pantry for anyone in need; general public, 9:30am-2pm, Sa; seniors and disabled, 9:30am-2pm, W. Contact: (206) 723-4105</p>

South Beacon Hill Meal and Outreach Programs

1. El Centro De La Raza

2524 16th Ave S, Seattle, WA 98144

Provides a meal program; hot meals can be delivered to eligible seniors, ages 60 and older.

Contact: (206) 329-9442

Website: <http://www.elcentrodelaraza.com>

2. Latino Hot Meal Program

El Centro De La Raza

2524 16th Ave S, Seattle, WA 98144

Provides a hot meal for anyone in need 12-1pm M-F. Clients are allowed a second dish if they want it.

Contact: (206) 329-9442

Website: www.elcentrodelaraza.org

3. Hot Meal Program

Seattle Indian Center

611 12th Ave S Leschi Center #300, Seattle, WA 98144

Serves free hot lunches noon-12:45pm, M-F; for anyone in need.

Contact: Office at (206) 329-8700

Website: www.seattleindiancenter.org

4. Seniors Lunch And Social

Somali Community Services of Seattle

3320 Rainier Ave S, Seattle, WA 98144

Serves all seniors, ages 60 and older, lunch on Saturdays.

Contact: (206) 760-1181

5. Food Bags

Northwest Community Services Food Bank

4205 Rainier Ave S, Seattle, WA 98118

Prepares food bags for homebound or people with disabilities; pick up by chore workers or caregivers; no home delivery.

Contact: (206) 723-4105

6. Lao And Hmong Congregate Meals
Pacific Asian Empowerment Program
6721 51st Ave S Brighton Presbyterian Church, Seattle, WA 98118
Congregate meals for low income Hmong, Lao and Mien seniors, 60 and older, refugees and others in need.
Contact: (206) 324-0236
Website: <http://www.paep-seattle.org>

7. Senior Services of Seattle/King County - Southeast Seattle Senior Center
4655 S Holly St, Seattle, WA 98118
Offers lunches at noon M-F for adults, ages 60 and older; a \$3.50 donation is suggested.
Contact: (206) 722-0317
Website: <http://seniorservices.org>

8. Senior Nutrition Project
Filipino Community of Seattle
5740 Martin Luther King, Jr Way S, Seattle, WA 98118
Senior Nutrition Project meets for hot meals and socializing for seniors; operated by Pacific Asian Empowerment Program.
Contact: (206) 722-9372
Website: <http://www.filcomseattle.org/>

9. Senior Nutrition Project - Food Bags
Filipino Community of Seattle
5740 Martin Luther King, Jr Way S, Seattle, WA 98118
Emergency food bags are available for older adults; coordinated by the Pacific Asian Empowerment Program.
Contact: (206) 722-9372
Website: <http://www.filcomseattle.org/>

10. Hot Meal Program
Kline Galland Home
7500 Seward Park Ave S, Seattle, WA 98118
Serves kosher hot lunch on Tuesdays, primarily for adults ages 60 and over.
Contact: (206) 725-8800
Website: <http://www.klinegalland.org>

Appendix #3: Community Supported Agriculture in Seattle/King County

Community Supported Agriculture in Seattle/King County
Boistfort Valley Farm – on-farm pick up – Curtis, WA
Cultivating Communities CSA – distribution in North Seattle
Full Circle Farm – distribution in Seattle including Beacon Hill and Capitol Hill
Growing Things – distribution in Seattle or pick up at Columbia City Farmers Market
Jubilee Farm – on-farm pick up – Carnation, WA
Lake Cavanaugh Farm – distribution in Seattle
Moonshadow Farm – distribution in South Seattle
Natures Last Stand – home delivery in King County
Ninety Farms – distribution in Seattle
Oxbow Farm – pick up in Central District
The Root Connection – distribution in Seattle
Stoney Plains Organic Farm – distribution in Seattle or pick up at Columbia City Farmers Market
Whistling Train Farm – distribution in Seattle
Willie Green’s Organic Farm – distribution in Seattle
Zestful Gardens – distribution in South King Counties

Appendix #4: Metro Bus Routes Serving First Hill and South Beacon Hill

First Hill Neighborhood Bus Routes
12 (Weekdays, Saturday, Sunday)
2 (Weekdays, Saturday, Sunday)
205 (Weekdays)
27 (Weekdays, Saturday, Sunday)
3 (Weekdays, Saturday, Sunday)
303 (Weekdays)
4 (Weekdays, Saturday, Sunday)
60 (Weekdays, Saturday, Sunday)
64 (Weekdays)
84 (Nightly)
9 (Weekdays)
941 (Weekdays)
942 (Weekdays)
984 (Weekdays)
Beacon Hill Neighborhood Bus Routes
32 (Weekdays)
36 (Weekdays, Saturday, Sunday)
38 (Weekdays, Saturday, Sunday)
39 (Weekdays, Saturday, Sunday)
60 (Weekdays, Saturday, Sunday)

Appendix #5: Focus Group Questions

Focus Group Questions
What neighborhood do you live in and how long have you lived there?
What grocery stores do you use and why?
Where would you like to shop for groceries - do you have a preference?
How often do you shop for groceries?
What determines how often you shop? (need food, have money, got time, etc)
When do you shop for groceries? (both when in the week/month, and what time of day)
Who do you shop for - just yourself, or your family? (friends, others?)
Where else besides grocery stores do you get your food (farmers' markets, P-Patches, food banks, etc)
Do you have experience with food stamps?
Do you do things to get food that doesn't involve buying it? (food banks, gardening, etc)
Can you walk to a grocery store from where you live? Do you walk there to shop?
How do you feel about the grocery stores within walking distance?
How do you get to where you shop for food? (bike, car, walk, etc)
Do you have any problems getting food? What are they? (cost, childcare, access, time)
In what order do you pay these bills: rent, groceries, utilities? Do you make tradeoffs between them?
How do you stretch your food dollar? (plan meals in advance, buy in bulk, use coupons)
Do you consider nutrition/health when you shop for groceries or dine out?
Have you received nutrition/food education? Where? What did you think about it?
Is buying organic food important to you? Why? What about locally produced food?
Are name brands important to you? Why?
Has your neighborhood changed in ways that affect your access to food?

**Seattle Food
System
Enhancement
Project:
Greenhouse Gas
Emissions Study**

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INTRODUCTION

The goal of this study is to compare the greenhouse gas impact of two similar plates of food by completing a Life Cycle Assessment (LCA) for all of the individual items on each plate. The two plates will have the same items of food on them, but the food will be sourced differently. One plate will consist of items that are produced in Washington State and then transported to Seattle, while the other plate will include items that are produced internationally or out of state and then shipped to Seattle. To further consider the greenhouse gas impacts of specific farming techniques, we examined the potential benefits of organic farming methods over conventional farming methods.

There will be four items on each plate: a 0.5 pound apple, 0.25 pounds of asparagus, 0.5 pounds of potato, and a 0.5 pound fillet of salmon. We chose these items to represent a typical wholesome meal easily available in Seattle. For the local plate of food, the apple and asparagus will come from Yakima, WA because Yakima County is the largest producing county for apples¹ and asparagus in the state.² The potato will come from Prosser because it is the county seat of Benton County, which produces the most potatoes in the nation.³ The salmon for the local plate will be a wild-caught Copper River salmon from south-central Alaska.

For the imported plate of food, the items will come from the highest producing region in the country that the US imports the most of the specific item from. The apple will come from Hawkes Bay, New Zealand,⁴ the asparagus will come from Ica, Peru,⁵ and the potato will come from Blackfoot, Idaho because the US does not import many potatoes and Bingham County, ID is the largest potato producing county outside of Washington State.⁶ The imported salmon will be farm-raised Norwegian salmon.⁷

¹ Anonymous, 2002.

² Laurie Wishkoski, Washington Asparagus Commission, Personal Communication.

³ USDA, 2006c.

⁴ Patterson, 2006.

⁵ USDA, 2005.

⁶ USDA, 2006c.

⁷ Harvey, 2006.

The reason for carrying out this study is to quantify the greenhouse gas (GHG) impact of specific food items that are typical of the Northwest. It is often asserted that buying locally produced food must create fewer GHG emissions, but few studies have been done in the United States to directly quantify this relationship. Previous studies have been done comparing conventional and organic apples in Washington State, but they have focused on total energy requirements,⁸ or on economic factors.⁹

The scope of this study has been defined by the members of the Seattle Food System Enhancement Project in conjunction with the IDT and members of OSE. The LCA for all food items will follow the food from initial production and harvest, and up through delivery for purchase in Seattle. We assume that there will be no differences in GHG emissions between the two plates of food after purchase as preparation and disposal will be similar for each.

Results from this study should be considered as a benchmark for examining the greenhouse gas impact of cultivating and transporting specific items of food into the city of Seattle. Every effort has been made to characterize “typical” or “average” farming practices, but there is a large variety in the way that crops are managed due to the range in soils, climates, and technology available. Furthermore, the manner in which food is transported into the city is a complex web of options and in this study, direct shipping routes have been selected. However, the assumptions made apply to both the locally grown plate and the imported plate equally, so the differences seen between these plates are real and significant.

This report is intended for use by the City of Seattle, and specifically the Interdepartmental Team and the Office of Sustainability and Environment (OSE). Another potential audience is the Seattle-King County Acting Food Policy Council. It is hoped that the results in this report will be used as educational material for the general public to illustrate the link between the food system and greenhouse gas emissions.

⁸ e.g. Reganold, Glover, Andrews, & Hinman, 2001.

⁹ e.g. Mon & Holland, 2006.

METHODS

To quantify the greenhouse gas emissions related to producing and transporting food to Seattle, we will use a tool called a Life Cycle Assessment (LCA) which is an internationally standardized method of assessing environmental impacts. The general ISO 14040 defines LCA as the “compilation and evaluation of the inputs, outputs and the environmental impacts of a product system throughout its life cycle.”¹⁰ An LCA allows us to identify the environmental impacts of an item from the acquisition of raw materials, through production, and up through its use and disposal. In this study we will use the LCA framework to cultivate the food items we selected and transport them to Seattle. For specific details on the calculations behind the LCA methodology, please see the Appendix.

Identification of the initial system boundaries

The system boundary defines the processes which will be modeled in this LCA. For the apple, asparagus, and potato, farm activities that produce greenhouse gases will be included in this study. The farm activities included in this model are the production, delivery, and application of fertilizers, herbicides, and insecticides, as well as the fuel used in farm equipment to carry out farm activities.

Also included in this study are the emissions associated with extracting fossil fuels from the Earth, refining them, and transporting them to the gas station pump or to the point-of-use (POU). These are referred to as the “Well-to-Pump” or “Well-to-POU” emissions. The difference between these two types of emissions is that the Well-to-Pump emissions have included within them the average distance to gas stations from oil refineries. The Well-to-POU emissions have an additional distance included within them that is an average distance to deliver the fuel its point of use. In general, the Well-to-POU fuel is used for engines that are either stationary (e.g. a wind turbine at an apple farm), or do not fill up at a gas station (e.g. trains, container ships, fishing boats).

¹⁰ ISO, 1997.

For the salmon, the fishing activities included in this study are the burning of diesel fuel in a fishing boat as well as the Well-to-Pump and Well-to-POU emissions. The sources of emissions for the farmed salmon include the production, delivery, and use of fish feed.

For the transportation of the food, the emissions for the Well-to-Pump and Well-to-POU of the needed fuels, as well as the emissions associated with burning these fuels in various modes of transport (light-truck, semi-truck, rail, and container ship) is included in this study.

Not included in the scope of this study are the greenhouse gas emissions associated with the manufacturing of farm equipment, farm buildings, vehicles used for transportation, or the distribution and retail buildings. Simply stated, we are not including the production of the vehicles, buildings, roads, or any infrastructure in this study. Also, we are not examining emissions related to wholesaling, retailing, packaging materials, the consumer's food preparation, or waste treatment. Furthermore, greenhouse gases are the only environmental impact examined in this study. We are not looking at other environmental impacts associated with farming, such as water use, energy use, runoff of farm effluent, land use, or the use of human labor.

Identification of criteria for inclusion of inputs and outputs

To determine which data categories are important to this study, we studied typical farm practices from various sources. We examined the publications from the United States Department of Agriculture (USDA) such as the Fruit and Vegetable Agricultural Practices – 1999¹¹ and the Agricultural Chemical Usage: 2005 Fruit Summary¹² to identify chemical application and machine use that will contribute to the emission of GHGs during apple cultivation. Various publications from Washington State University were useful in determining the fuel use at farms. Contacts with state commissions for apples, asparagus, and potatoes were useful in verifying typical farm practices.

¹¹ USDA, 2001.

¹² USDA, 2006b.

Identification of the data categories/impact assessment methodology

Data will be collected from databases, published reports, and other sources. Information was gathered from the United States Department of Agriculture, published journal articles, websites, the United States Environmental Protection Agency, and from the Greenhouse Gases, Regulated Emissions, and Energy use in Transportation (GREET). Table 1 shows the data categories defined and collected to complete the study. A detailed description of the sources used in this study can be found in the Appendix and the References.

Data Categories	Components	Units
Raw Materials	Fertilizers (Nitrogen, Phosphate, and Potash)	Pounds/acre
	Herbicide	Pounds/acre
	Insecticide	Pounds/acre
Equipment	Farm equipment	Annual hours/acre
	Farm equipment	Fuel use/hour
	Fuel use	British Thermal Units
Environmental (Greenhouse Gas Emissions)	Carbon Dioxide (CO ₂)	Grams
	Methane (CH ₄)	Grams
	Nitrous Oxide (N ₂ O)	Grams
Transportation	Distance	Kilogram-Kilometer
	Fuel Use	British Thermal Units

Table 1. Data categories used in this study.

Impact Assessment – Global Warming Potential

The three main greenhouse gases (carbon dioxide, CO₂, methane, CH₄, and nitrous oxide N₂O) are quantified in this study. However, these three gases possess different abilities to influence the climate, so we have converted them to a common scale so that they are comparable. The scale in common use is to convert all of the gases into grams of carbon dioxide equivalent.

To convert each of these gases into grams of carbon dioxide equivalents, we used the Global Warming Potential (GWP) from the Intergovernmental Panel on Climate Change¹³ for the 100-year time frame, which is the standard time frame to use. The scaling factor for methane is 23, and the scaling factor for nitrous oxide is 296. This means that one gram of methane is equivalent to 23 grams of carbon dioxide, and 1 gram of nitrous oxide is equivalent to 296 grams of carbon dioxide. Table 2 shows the greenhouse gases followed in this study and the conversion to grams of CO₂ equivalent.

Greenhouse Gas	Global Warming Potential Scaling Factor	1 gram of this gas equals how many grams of CO₂ equivalent?
Carbon Dioxide (CO ₂)	1	1
Methane (CH ₄)	23	23
Nitrous Oxide (N ₂ O)	296	296

Table 2. The Global Warming Potential (GWP) for the three greenhouse gases examined.

¹³ <http://www.ipcc.ch/>

RESULTS

GUIDE TO RESULTS

The results of the LCA for each plate of food are shown in the following pages. First we present the findings for the local and imported plates, and then we present the results for each individual food item. The general format for the results is to show the findings for the local plate or food item, then the imported plate or item, then present the findings for organic farming techniques (when possible), and then compare all of the emissions scenarios. An attempt was made to make these sections as independent readings, so some information contained within this section is repeated in other sections of this paper.

In order to assess which processes emit the most greenhouse gases, the contributions from each process was calculated. These are shown in the following pages under the “Cultivation” section. For simplification, the sources of emissions were categorized into three sources: Chemical Production, Fuel Used at Farm/Boat, and Fuel Used in Transportation.

“Chemical Production” includes the production and delivery of fertilizers (nitrogen, phosphate, and potash), herbicides, and insecticides, as well as the emissions from the fields that are emitted after these chemicals are applied. “Fuel Used at Farm/Boat” includes the burning of diesel, gasoline, and/or propane at the farm to perform farm activities, or on the fishing boat for fishing activities. The specific activities modeled for each farm can be found in the Appendix. Included in this category are the emissions associated with extracting the fossil fuels, refining them, delivering them to the gas station pump or to the point-of-use at the farm/boat. “Fuel Used in Transportation” includes the burning of gasoline, diesel, non-road diesel (for rail transport), and/or bunker fuel (for container ship transport) to deliver the food to Seattle. Included in this category are the emissions attributable to extracting the fossil fuels, refining them, delivering them to the gas station pump or to the point-of-use for the transportation vehicles.

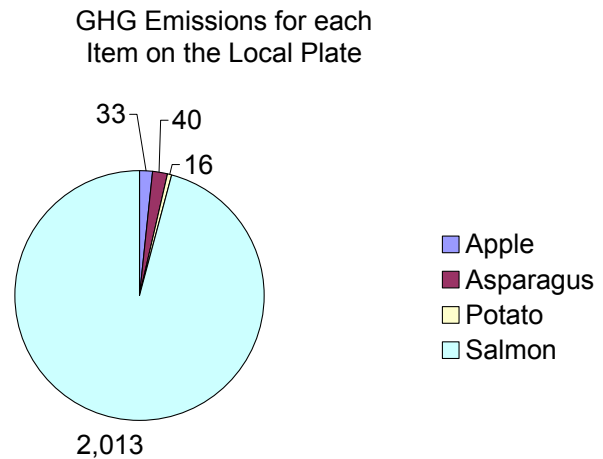


LOCAL PLATE – WASHINGTON STATE

How did we choose where the food on the local plate came from? All of the food on the local plate was sourced from the county in Washington State that grows the most of each item. To represent the general area of each county, the exact point of origin was simply selected as the county seat. The apple¹ and asparagus² came from Yakima, and the potato came from Prosser.³ The salmon is wild-caught salmon from the Copper River in south-central Alaska.

LOCAL PLATE EMISSIONS

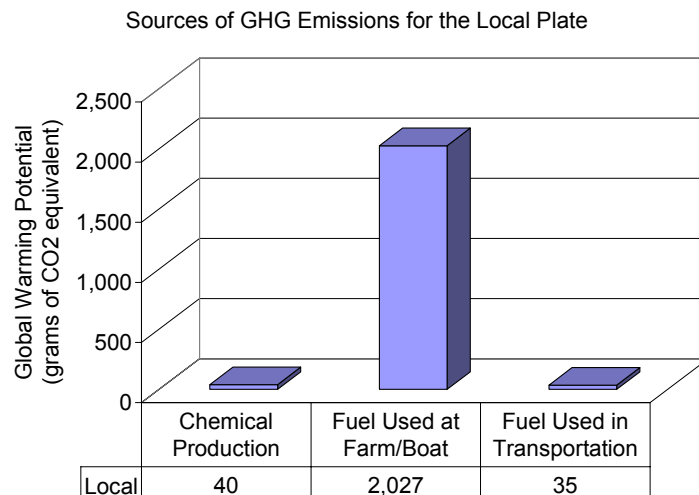
What are the emissions for each item on the local plate? The salmon dominates the emissions scenario for this plate and emits 2,013 grams of CO₂ equivalent (96%). The apple emits 33 grams of CO₂ equivalent, the asparagus emits 40 grams of CO₂ equivalent, and the potato emits 16 grams of CO₂ equivalent.



EMISSIONS CATEGORIES

What is the biggest source of greenhouse gases from the local plate of food? The burning of fuel at the farm and on the fishing boat is the biggest source of greenhouse gases. However, this is due to salmon dominating the emissions scenario and the main source of greenhouse gases is different for every food item.

How many greenhouse gases are emitted to transport the food to Seattle? Transportation adds an additional 35 grams of CO₂ equivalent.



TOTAL EMISSIONS

What are the total emissions for the local plate? 2,102 grams of CO₂ equivalent.

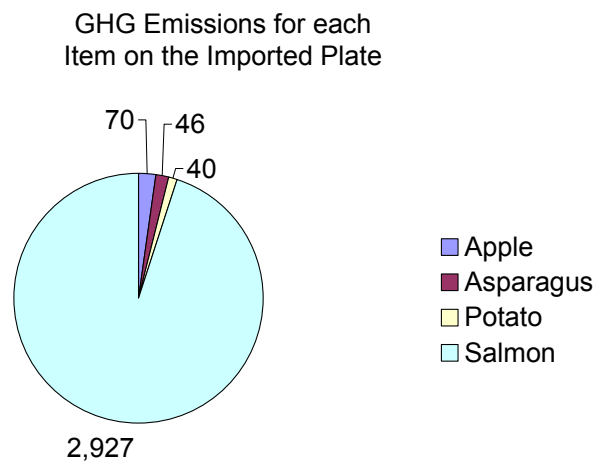


IMPORTED PLATE – NEW ZEALAND, PERU, IDAHO, NORWAY

How did we choose where the food on the local plate came from? Most of the food on the imported plate was sourced from the country that the US imports the most from. The apple came from Hawkes Bay, New Zealand,⁴ the asparagus will come from Ica, Peru,⁵ and the potato will come from Blackfoot, Idaho because the US does not import many potatoes and Bingham County, ID is the largest potato producing county outside of Washington State.⁶ The imported salmon will be farm-raised Norwegian salmon.⁷

LOCAL PLATE EMISSIONS

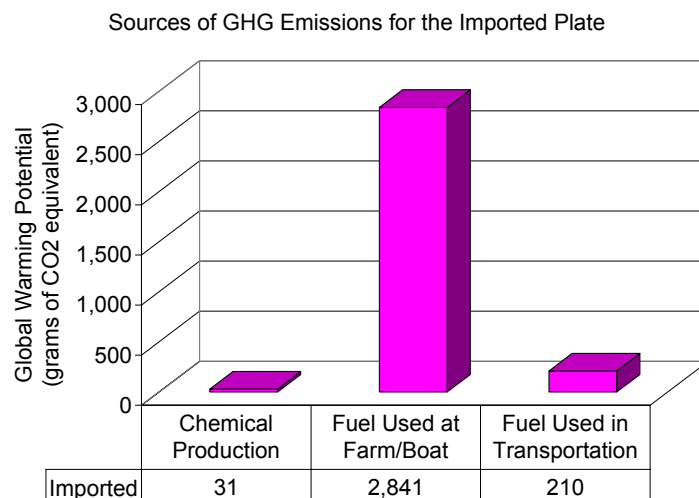
What are the emissions for each item on the local plate? The salmon also dominates the emissions scenario for this plate and emits 2,927 grams of CO₂ equivalent (95%). The apple emits 70 grams of CO₂ equivalent, the asparagus emits 49 grams of CO₂ equivalent, and the potato emits 40 grams of CO₂ equivalent.



EMISSIONS CATEGORIES

What is the biggest source of greenhouse gases from the imported plate of food? The burning of fuel at the farm and on the fishing boat is the biggest source of greenhouse gases. However, this is due to salmon dominating the emissions scenario and the main source of greenhouse gases is different for every food item.

How many greenhouse gases are emitted to transport the food to Seattle? Transportation adds an additional 213 grams of CO₂ equivalent.

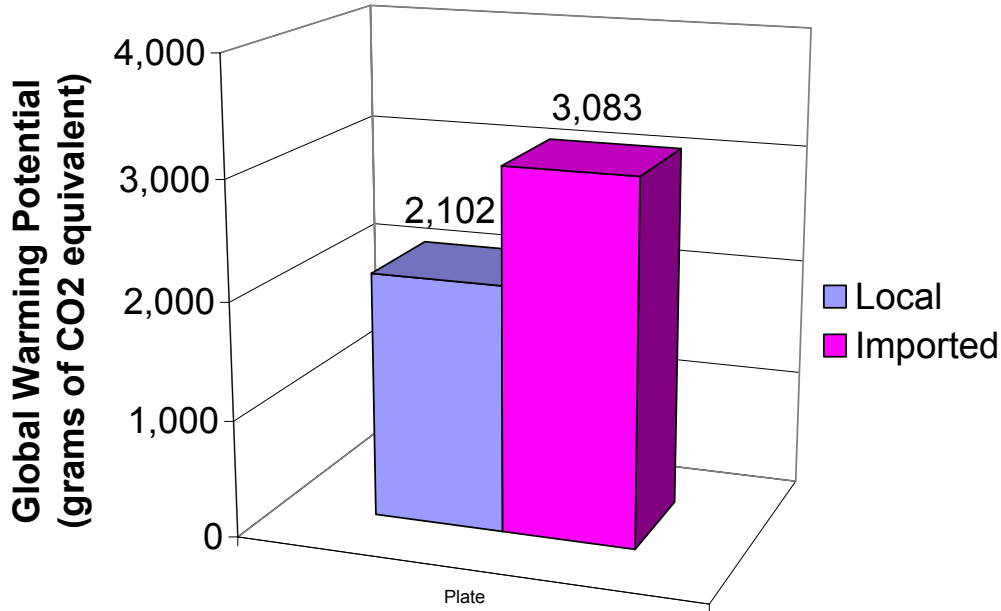


TOTAL EMISSIONS

What are the total emissions for the imported plate? 3,083 grams of CO₂ equivalent.



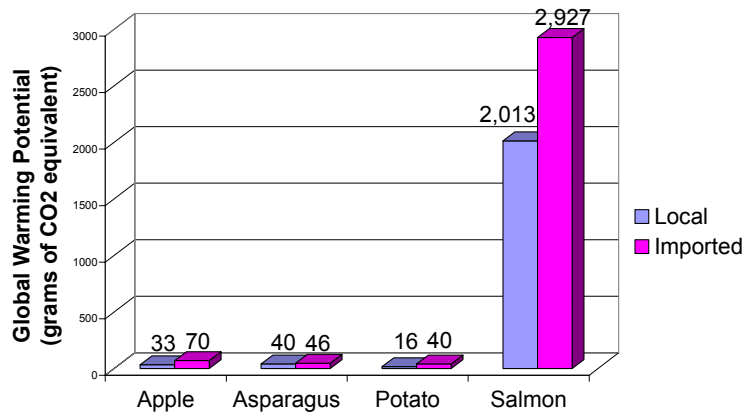
Total Global Warming Potential for Each Plate



ANALYSIS

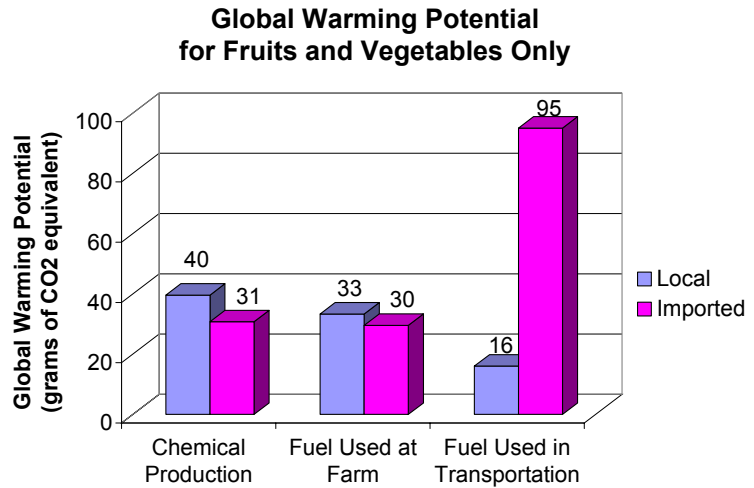
The total greenhouse gas emissions for the local plate are about 33% less than the total emissions for the imported plate. The majority of the total savings comes from the wild-caught salmon. However, every item shows a slightly different story when comparing the local and imported items. For example, the local apple and potato emits less than half of the emissions that the imported apple and potato do, while the local asparagus shows only a 20% benefit over the imported asparagus.

Global Warming Potential for Each Item



The salmon also dominate the source of the emissions in this analysis. Fuel used on the fishing boats to catch the wild salmon and the emissions from producing, delivering, and administering the fish feed at the fish farm in Norway are between 80-90% of the total emissions for the

salmon, and the salmon are over 95% of the emissions for each plate. Thus, the results for “Fuel Used at the Farm/Boat” are heavily influenced by the salmon. If we examine the greenhouse gas emissions for just the fruits and vegetables alone (apple, asparagus, and potato), then we see that fuel used in transporting the imported food is the highest source of emissions. The next figure shows the breakdown of sources of greenhouse gases for the fruits and vegetables only.



It is important to note that every item of food tells a slightly different story, so it is important to analyze them each individually. The next sections will show the results for each of the food items individually.

¹ Anonymous, 2002.

² Laurie Wishkoski, Washington Asparagus Commission, Personal Communication.

³ USDA, 2006c.

⁴ Patterson, 2006.

⁵ USDA, 2005.

⁶ USDA, 2006c.

⁷ Harvey, 2006.



CONVENTIONAL APPLE – YAKIMA, WA

What is a conventional apple? A conventional apple is cultivated by using farming techniques which apply synthetic fertilizers, herbicides, and insecticides.

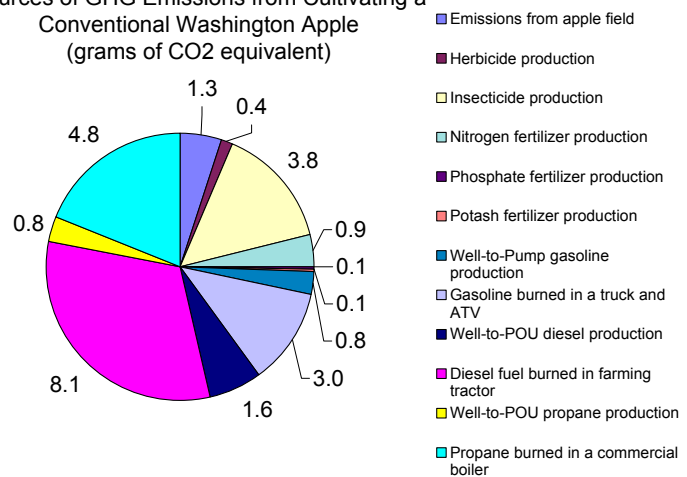
Where do most conventional apples in Washington State come from? We selected Yakima as the origin of the conventional apple because it is the largest apple producing region in Washington.¹

CULTIVATION

How many greenhouse gases are emitted during the cultivation of a 0.5 pound conventional apple? 25 grams of CO₂ equivalent.

What are the main sources of greenhouse gas emissions in cultivating a conventional apple? The diesel fuel burned in a farming tractor contributes to the largest share of global warming potential during the phase of our LCA (32%).

Sources of GHG Emissions from Cultivating a Conventional Washington Apple (grams of CO₂ equivalent)

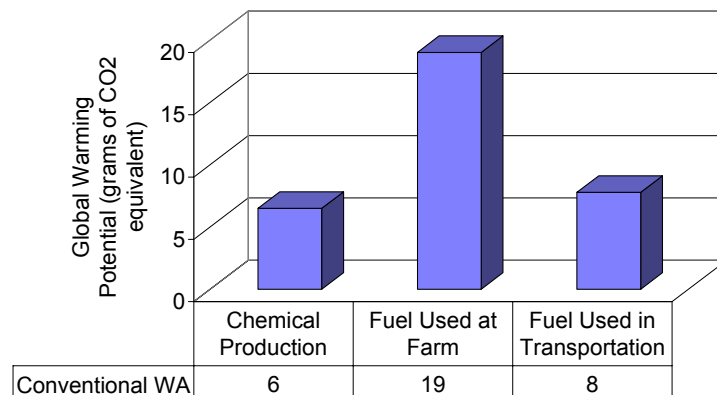


TRANSPORTATION

Once the conventional apple is harvested, how does it get to Seattle? In our study, the conventional apple is transported from Yakima to Stemilt Growers, Inc.² in Wenatchee (106 miles) and then to Seattle in a semi-truck (148 miles).

How many greenhouse gases are emitted to transport the apple to Seattle? Transportation adds an additional 8 grams of CO₂ equivalent.

Sources of GHG Emissions from Cultivating and Transporting a Conventional Apple from Yakima to Seattle (via Wenatchee)



TOTAL EMISSIONS

What are the total emissions for cultivating a 0.5 pound conventional apple in Yakima, WA and transporting it to Seattle? 33 grams of CO₂ equivalent.



IMPORTED APPLE – HAWKES BAY, NEW ZEALAND

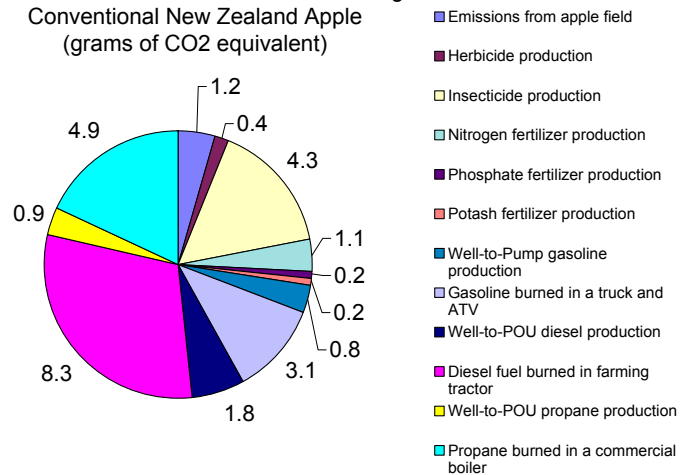
Where do most imported apples into the US come from? The US imports the most apples from New Zealand, and the Hawkes Bay region on the north island is the largest apple producing region in New Zealand.³

CULTIVATION

How many greenhouse gases are emitted during the cultivation of a 0.5 pound conventional apple in New Zealand? 28 grams of CO₂ equivalent.

How is this different from cultivating an apple in Washington State? The yield of apples harvested per acre of land in New Zealand is 33,300 pounds of apples per acre,⁴ while in Washington the average yield is 34,200 pounds of apples per acre.⁵ It is assumed that fuel use and chemical use (fertilizers, herbicides, insecticides) at an apple farm in New Zealand are the same as fuel and chemical used at an average apple farm in the US.

Sources of GHG Emissions from Cultivating a Conventional New Zealand Apple (grams of CO₂ equivalent)

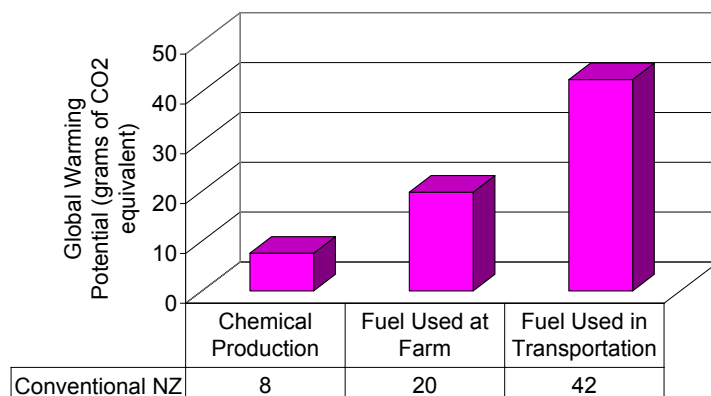


TRANSPORTATION

Once the imported apple is harvested, how does it get to Seattle? The apple is grown in Hawkes Bay, NZ and shipped on a refrigerated semi-truck to Auckland (263 miles). From Auckland, the apple is shipped on a refrigerated container ship from Auckland to Seattle (6,183 nautical miles).

How many greenhouse gases are emitted to transport the apple to Seattle? Transportation adds an additional 42 grams of CO₂ equivalent.

Sources of GHG Emissions from Cultivating and Transporting a Conventional Apple from Hawkes Bay, NZ to Seattle (via Auckland)



TOTAL EMISSIONS

What are the total emissions for cultivating a 0.5 pound conventional apple in Hawkes Bay, NZ and transporting it to Seattle? 70 grams of CO₂ equivalent.



ORGANIC APPLE – YAKIMA, WA

What is an organic apple? An organic apple is cultivated using farming methods which avoid the use of synthetic chemicals, but does use approved organic fertilizers, such as poultry manure.

CULTIVATION

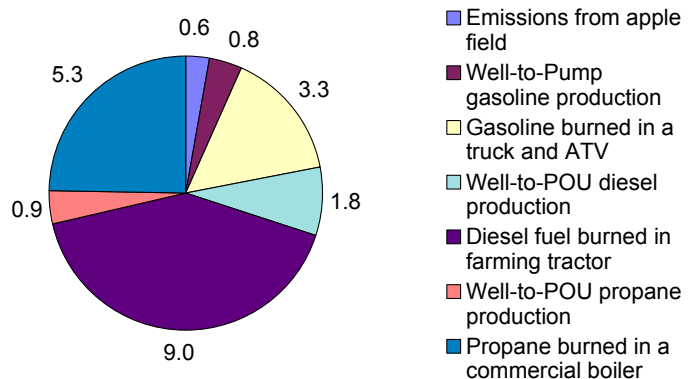
How many greenhouse gases are emitted during the cultivation of a 0.5 pound organic apple?

21 grams of CO₂ equivalent.

How is this different from cultivating a conventional apple?

It is assumed that the amount of fuel used to run the farm equipment is the same for an organic apple farm as they are for a conventional apple farm.⁶ It is also assumed that the yield of apples per acre at an organic farm is 90% as much as it is at a conventional farm,⁷ so the yield of organic apples in this study is set at 30,800 pounds per acre.

Sources of GHG Emissions from Cultivating an Organic Washington Apple (grams of CO₂ equivalent)

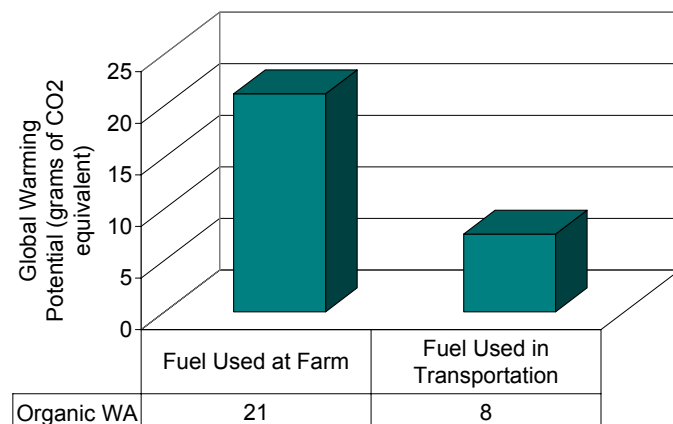


TRANSPORTATION

Once the organic apple is harvested, how does it get to Seattle? The organic apple is transported to Seattle for sale at a farmer's market in a light-truck.

How many greenhouse gases are emitted to transport the apple to Seattle? Transportation adds an additional 8 grams of CO₂ to the atmosphere. A light-truck is not as fuel efficient as a semi-truck, so the emissions for transporting an apple to Seattle from Yakima in a light-truck are the same as they are for transporting an apple from Yakima to Wenatchee and then to Seattle in a semi-truck.

Sources of GHG Emissions from Cultivating and Transporting an Organic Apple from Yakima to Seattle



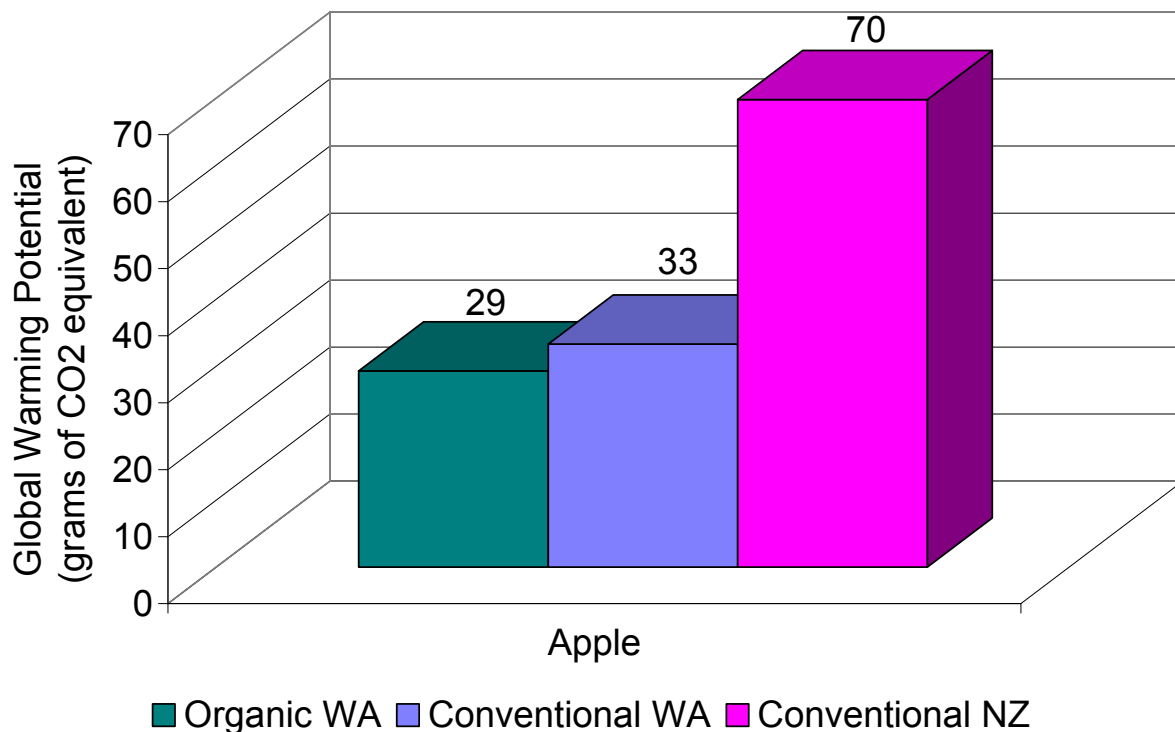
TOTAL EMISSIONS

What are the total emissions for cultivating a 0.5 pound organic apple in Yakima, WA and transporting it to Seattle? 29 grams of CO₂ equivalent.



COMPARISON OF GLOBAL WARMING POTENTIAL

Total Emissions for all Three Apple Sources



ANALYSIS

The locally grown apples show a significant savings of greenhouse gas emissions over the imported apple from New Zealand. The majority of these savings are a direct result of the extra cost of transporting the apple from New Zealand to Seattle, though there is some savings from the higher yield of apples per acre in Washington over New Zealand. The benefits seen from the organic apple versus the conventional apple are small because the organic yields are lower than the conventional yields, and because chicken manure is still applied to most organic apple farms and there are significant nitrous oxides from this type of manure.

¹ Anonymous, 2002.

² John Reganold, Washington State University, personal communication, 3/2/2007.

³ Patterson, 2006.

⁴ Ibid.

⁵ USDA, 2006a.

⁶ David Granatstein, Washington State University, personal communication, 2/26/2007.

⁷ Ibid.



CONVENTIONAL ASPARAGUS – YAKIMA, WA

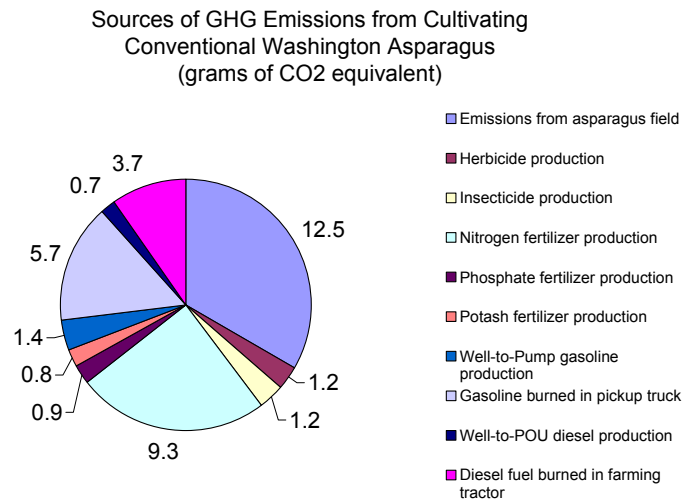
What is a conventional asparagus? Conventional asparagus is cultivated by using farming techniques which apply synthetic fertilizers, herbicides, and insecticides.

Where does most conventional asparagus in Washington State come from? Yakima is the largest asparagus producing region in the state, so Yakima is the origin of the asparagus.¹

CULTIVATION

How many greenhouse gases are emitted during the cultivation of a 0.25 pound conventional asparagus? 38 grams of CO₂ equivalent.

What are the main sources of greenhouse gas emissions in cultivating a conventional asparagus? The emissions from the asparagus field contribute the largest share of global warming potential (33%). This is due to the nitrogen fertilizers applied to the asparagus fields, which results in the emission of nitrous oxide.

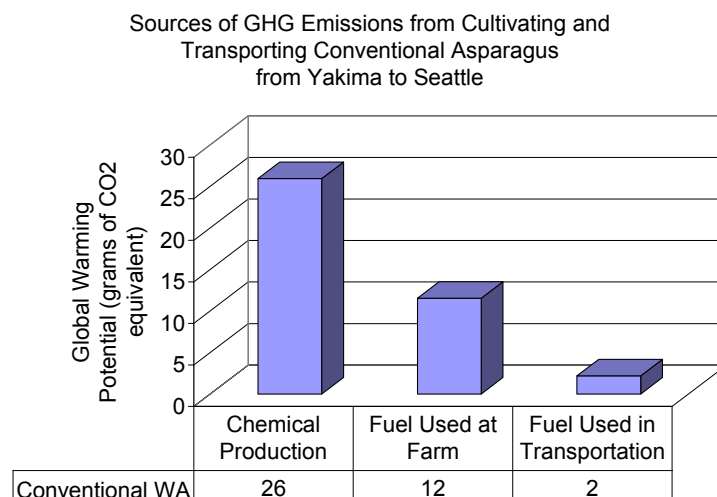


TRANSPORTATION

Once the conventional asparagus is harvested, how does it get to Seattle? The asparagus is brought by semi-truck directly to Seattle where it is taken to a distributor where it is washed, sorted, and packed.² This direct shipping method emits few greenhouse gases.

How many greenhouse gases are emitted to transport the asparagus to Seattle?

Transportation adds an additional 2 grams of CO₂ equivalent.



TOTAL EMISSIONS

What are the total emissions for cultivating 0.25 pounds of conventional asparagus in Yakima, WA and transporting it to Seattle? 42 grams of CO₂ equivalent.



IMPORTED ASPARAGUS – ICA, PERU

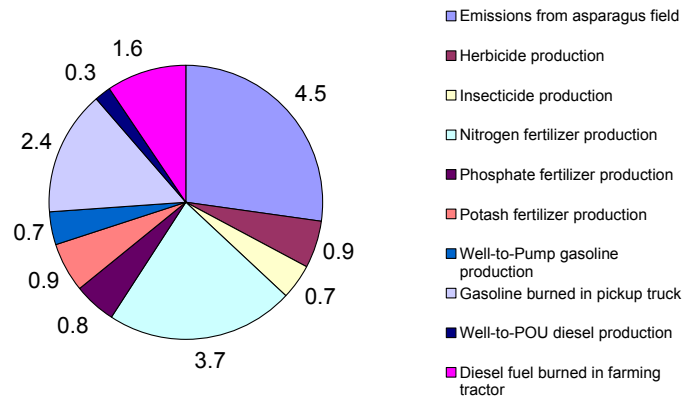
Where does the US import the most asparagus from? The US imports the most asparagus from Peru, and Ica, Peru produces the most green asparagus for fresh export in Peru.³

CULTIVATION

How many greenhouse gases are emitted during the cultivation of a 0.25 pound conventional asparagus in New Zealand? 17 grams of CO₂ equivalent.

How is this different from cultivating an asparagus in Washington State? The yield of asparagus harvested per acre of land in Peru is 9,200 pounds of asparagus per acre because they grow asparagus year-round there.⁴ In Washington the average yield is only 3,900 pounds of asparagus per acre⁵. It is assumed that fuel use and chemical use (fertilizers, herbicides, insecticides) at an asparagus farm in Peru is the same as fuel and chemical use at an average asparagus farm in the US. This is a weak assumption given that asparagus operations are year-round in Peru.

Sources of GHG Emissions from Cultivating Conventional Peruvian Asparagus (grams of CO₂ equivalent)

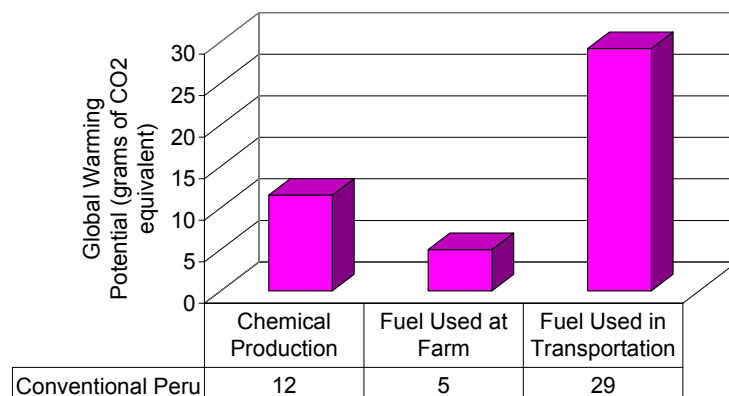


TRANSPORTATION

Once the imported asparagus is harvested, how does it get to Seattle? The asparagus is grown in Ica, Peru and shipped on a refrigerated semi-truck to Lima (186 miles). The port in Lima is Callao, and from Callao the asparagus is shipped on a refrigerated container ship to Seattle (6,183 nautical miles).

How many greenhouse gases are emitted to transport the asparagus to Seattle? Transportation adds an additional 32 grams of CO₂ equivalent.

Sources of GHG Emissions from Cultivating and Transporting Conventional Asparagus from Ica, Peru to Seattle (via Lima, Peru)



TOTAL EMISSIONS

What are the total emissions for cultivating 0.25 pounds of conventional asparagus in Ica, Peru and transporting it to Seattle? 46 grams of CO₂ equivalent.



ORGANIC ASPARAGUS – YAKIMA, WA

What is an organic asparagus? Organic asparagus is cultivated using farming methods which avoid the use of synthetic chemicals. In this study, no fertilizers, herbicides, or insecticides are applied to the organic asparagus farm.

CULTIVATION

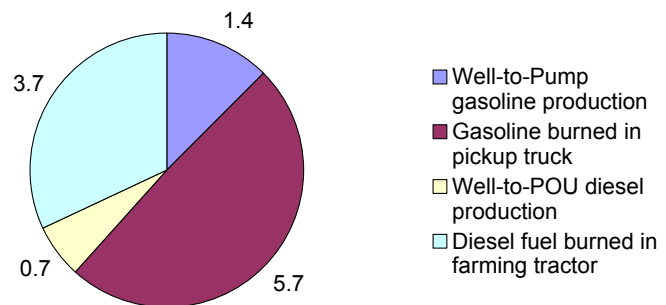
How many greenhouse gases are emitted during the cultivation of 0.25 pounds of organic asparagus?

12 grams of CO₂ equivalent.

How is this different from cultivating a conventional asparagus?

It is assumed that the yield of asparagus per acre at an organic farm is the same as it is for a conventional farm. It is also assumed that the amount of fuel used to run the farm equipment is the same at an organic asparagus farm as it is for a conventional asparagus farm.⁶

Sources of GHG Emissions from Cultivating Organic Asparagus (grams of CO₂ equivalent)



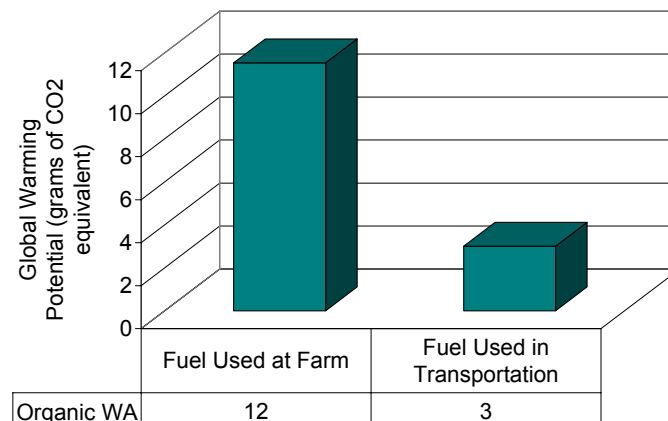
TRANSPORTATION

Once the organic asparagus is harvested, how does it get to Seattle? The organic asparagus is transported to Seattle for sale at a farmer's market in a light-truck.

How many greenhouse gases are emitted to transport the asparagus to Seattle?

Transportation adds an additional 3 grams of CO₂ equivalent to the atmosphere. A light-truck is not as fuel efficient as a semi-truck, so the emissions are higher for transporting organic asparagus directly to Seattle than they are for transporting conventional asparagus directly to Seattle.

Sources of GHG Emissions from Cultivating and Transporting Organic Asparagus from Yakima to Seattle



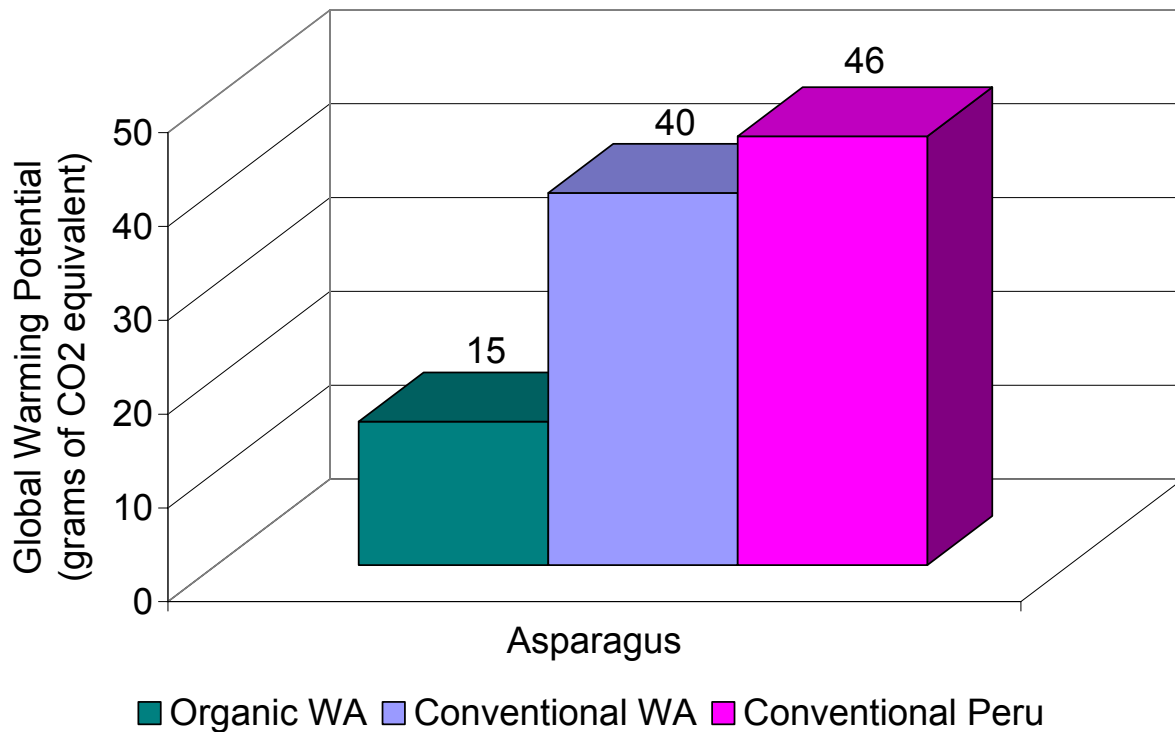
TOTAL EMISSIONS

What are the total emissions for cultivating 0.25 pounds of organic asparagus in Yakima, WA and transporting it to Seattle? 15 grams of CO₂ equivalent.

COMPARISON OF GLOBAL WARMING POTENTIAL



Total Emissions for all Three Asparagus Sources



ANALYSIS

Asparagus grown locally in Yakima, WA shows only a 15% savings in greenhouse gas emissions over asparagus imported from Ica, Peru. This is because yields of asparagus in Peru are more than double that for Washington because asparagus does not enter a dormant stage there and can be grown year-round. However, in this study, it is assumed that fuel use at a farm in Peru is the same as fuel use at a farm in Washington, where asparagus does not grow year-round. This assumption should be examined further because it is highly likely that fuel use at an asparagus farm in Peru is higher than it is in Washington. The greenhouse gas emissions from transporting the asparagus from Ica, Peru to Seattle are ten times that of transporting asparagus from Yakima, WA to Seattle.

¹ Laurie Wishkoski, Washington Asparagus Commission, Personal Communication.

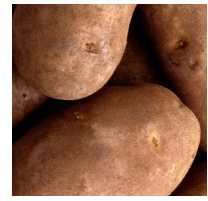
² Raymond Fowler, Washington State University, personal communication, 3/29/2007.

³ USDA, 2005.

⁴ Nolte, 2006.

⁵ USDA, 2006d.

⁶ Raymond Fowler, Washington State University, personal communication, 3/29/2007.



CONVENTIONAL POTATO – PROSSER, WA

What is a conventional potato? A conventional potato is cultivated by using farming techniques which apply synthetic fertilizers, herbicides, and insecticides.

Where do most conventional potatoes in Washington State come from? Benton County is the largest potato producing county in the country¹, so we selected Prosser as the origin of the conventional potato because it is the seat of Benton County.

CULTIVATION

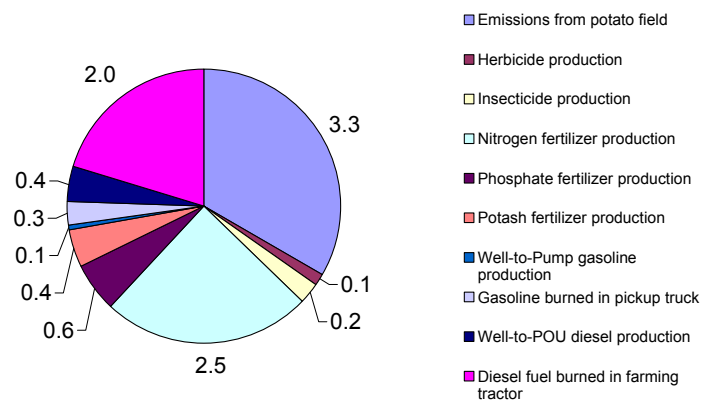
How many greenhouse gases are emitted during the cultivation of a 0.5 pound conventional potato?

10 grams of CO₂ equivalent.

What are the main sources of greenhouse gas emissions in cultivating a conventional potato?

The emissions from producing the nitrogen fertilizer and the nitrous oxide emissions from the potato field are the largest sources of greenhouse gases at a potato farm.

Sources of GHG Emissions from Cultivating a Conventional Washington Potato (grams of CO₂ equivalent)

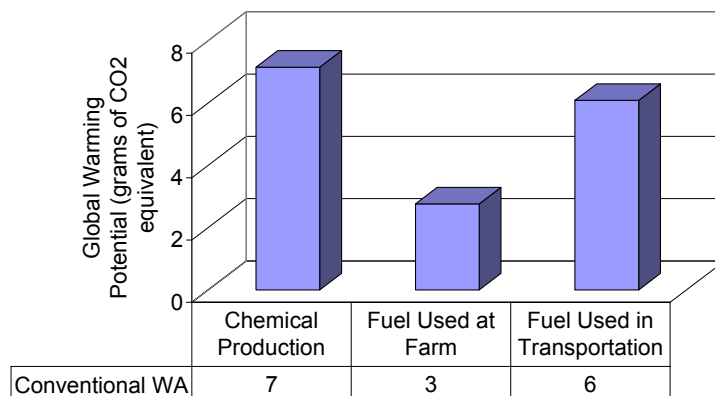


TRANSPORTATION

Once the conventional potato is harvested, how does it get to Seattle? The potato is brought by semi-truck directly to Seattle (199 miles) where it is taken to a distributor where it is washed, sorted, and packed.²

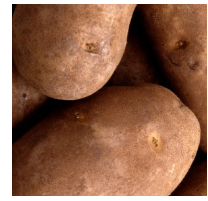
How many greenhouse gases are emitted to transport the potato to Seattle? Transportation adds an additional 6 grams of CO₂ equivalent.

Sources of GHG Emissions from Cultivating and Transporting a Conventional Potato from Prosser, WA to Seattle



TOTAL EMISSIONS

What are the total emissions for cultivating a 0.5 pound conventional potato in Prosser, WA and transporting it to Seattle? 16 grams of CO₂ equivalent.



IMPORTED POTATO – BLACKFOOT, ID

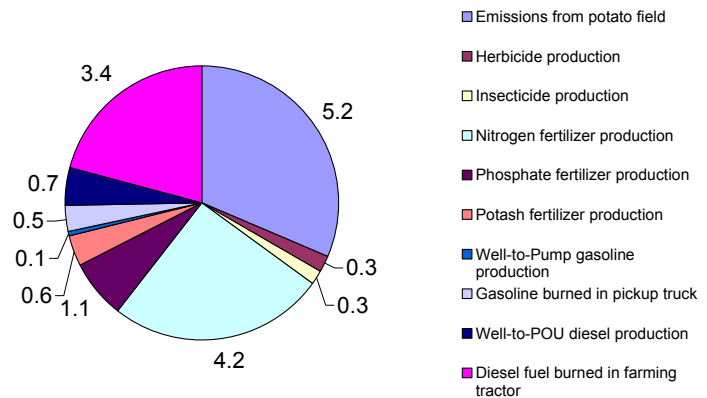
Where do most imported potatoes into the US come from? The US does not import many potatoes so we selected Blackfoot, ID as the origin of the potato because it is the county seat of Bingham County, which is the largest potato producing county outside of the state of Washington.³

CULTIVATION

How many greenhouse gases are emitted during the cultivation of a 0.5 pound conventional potato in Idaho? 17 grams of CO₂ equivalent.

How is this different from cultivating a potato in Washington State? The average yield of potatoes harvested per acre of land in Bingham County, ID is only 34,600 pounds of potatoes, while in Benton County, WA the average yield is 62,000 pounds of potatoes per acre.⁴ Fertilizer, herbicide, and insecticide use at the Idaho farm is based on Idaho averages, but it is assumed that fuel use at a potato farm in Idaho is the same as fuel used at a potato farm in Washington.

Sources of GHG Emissions from Cultivating a Conventional Idaho Potato (grams of CO₂ equivalent)

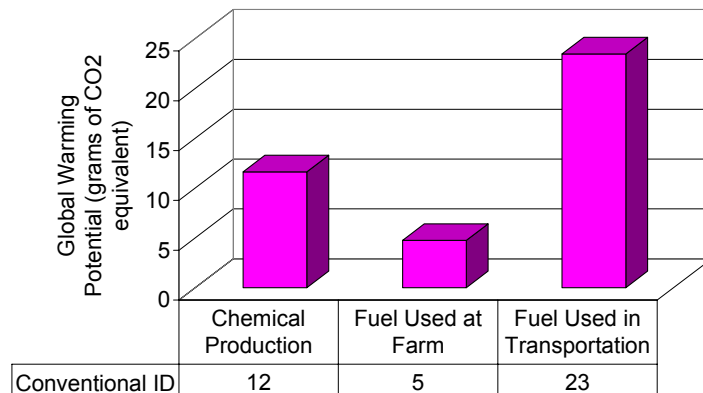


TRANSPORTATION

Once the imported potato is harvested, how does it get to Seattle? The potato is brought by semi-truck directly to Seattle (756 miles) where it is taken to a distributor where it is washed, sorted, and packed.⁵

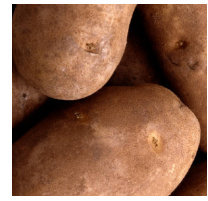
How many greenhouse gases are emitted to transport the potato to Seattle? Transportation adds an additional 23 grams of CO₂ equivalent.

Sources of GHG Emissions from Cultivating and Transporting a Conventional Potato from Blackfoot, ID to Seattle



TOTAL EMISSIONS

What are the total emissions for cultivating a 0.5 pound conventional potato in Blackfoot, ID and transporting it to Seattle? 40 grams of CO₂ equivalent.



ORGANIC POTATO – PROSSER, WA

What is an organic potato? An organic potato is cultivated using farming methods which avoid the use of synthetic chemicals, but does use approved organic fertilizers, such as poultry manure.

CULTIVATION

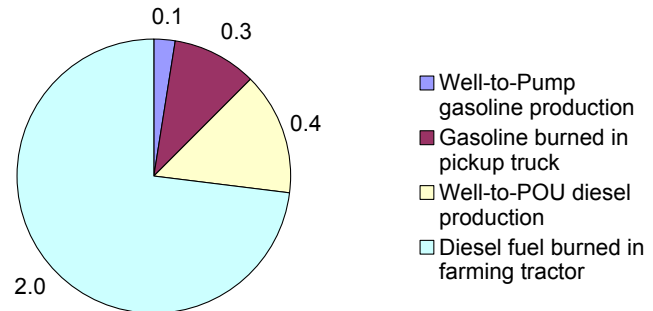
How many greenhouse gases are emitted during the cultivation of a 0.5 pound organic potato?

3 grams of CO₂ equivalent.

How is this different from cultivating a conventional potato?

It is assumed that the yield of potatoes per acre at an organic farm is the same as it is for a conventional farm. It is also assumed that the amount of fuel used to run the farm equipment is the same for an organic potato farm as they are for a conventional potato farm.

Sources of GHG Emissions from Cultivating an Organic Washington Potato (grams of CO₂ equivalent)

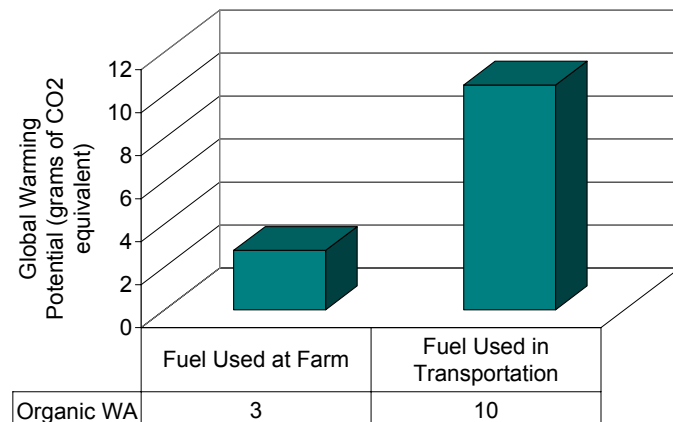


TRANSPORTATION

Once the organic potato is harvested, how does it get to Seattle? The organic potato is transported to Seattle (199 miles) for sale at a farmer's market in a light-truck.

How many greenhouse gases are emitted to transport the potato to Seattle? Transportation adds an additional 10 grams of CO₂ to the atmosphere. The light-truck is not as fuel efficient as a semi-truck, so the emissions for transporting a potato to Seattle from Prosser in a light-truck are higher than they are for transporting the same potato in a semi-truck.

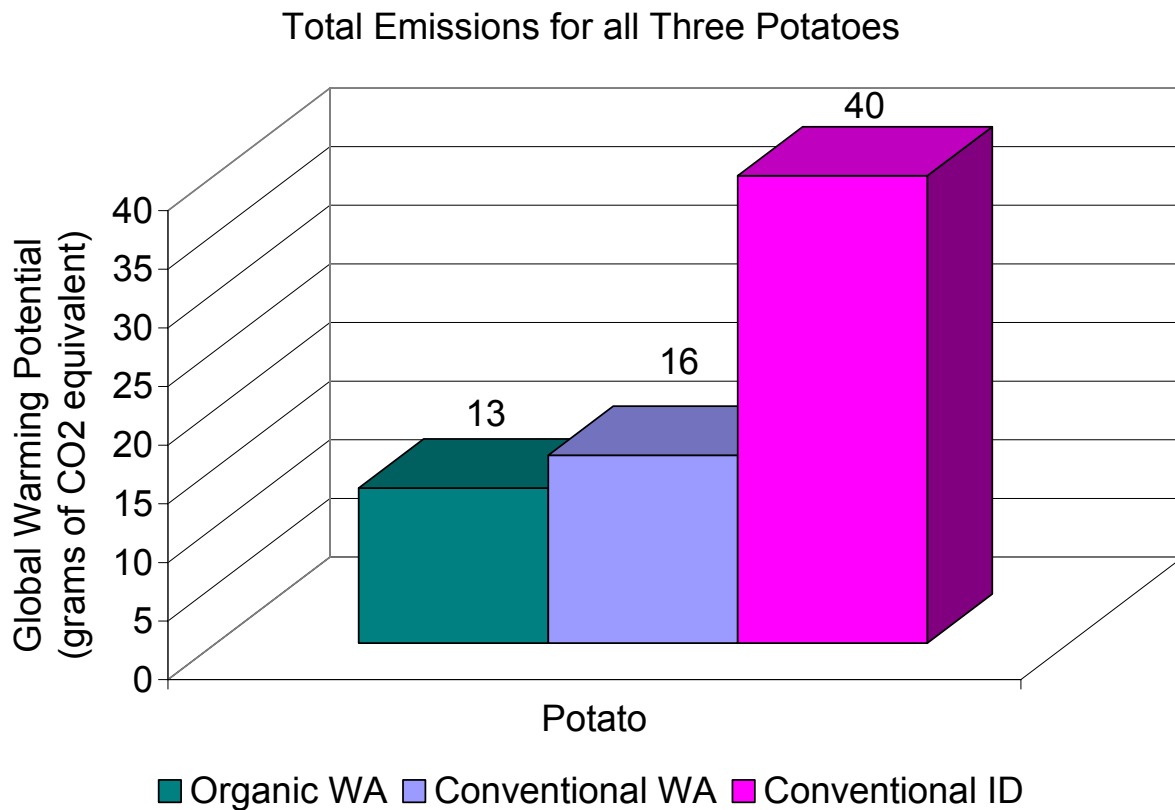
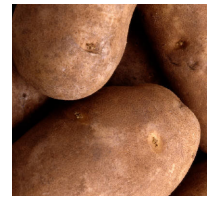
Sources of GHG Emissions from Cultivating and Transporting an Organic Potato from Prosser, WA to Seattle



TOTAL EMISSIONS

What are the total emissions for cultivating a 0.5 pound organic potato in Prosser, WA and transporting it to Seattle? 13 grams of CO₂ equivalent.

COMPARISON OF GLOBAL WARMING POTENTIAL



ANALYSIS

The locally grown potatoes emit less than half of the greenhouse gases than the Idaho potato. The reasons for this are two-fold: higher yields of potatoes in Washington and fewer miles traveled to transport the potato to Washington. First, the yield of potatoes per acre in Benton County, WA is nearly twice that for Bingham County, ID. Thus, for the same amount of fuel used per acre, and nearly the same amount of fertilizers applied, the greenhouse gas emissions attributable to cultivating a 0.5 potato in Benton County, WA is nearly half of that in Bingham County, ID. The potatoes in either case are both shipped by semi-truck, but the Idaho potato has nearly four times as far to travel, so the emissions from transporting the Idaho potato are nearly four times greater. These findings are significant because Idaho potato farming practices are well-characterized in this study and we do expect that fuel use at a Washington potato farm and an Idaho potato farm are equivalent.

¹ USDA 2006c.

² David Granatstein, Washington State University, personal communication, 3/29/2007.

³ USDA, 2006c.

⁴ Ibid.

⁵ David Granatstein, Washington State University, personal communication, 3/29/2007.



WILD-CAUGHT ALASKA SALMON

How are fish caught in Alaska? There are many types of fishing boats used to catch salmon in Alaska, including purse-seiners, trollers, and gillnetters.¹

Where did the salmon come from in this study? In this study, the salmon came from the Copper River in south-central Alaska.

FISHING FOR WILD SALMON

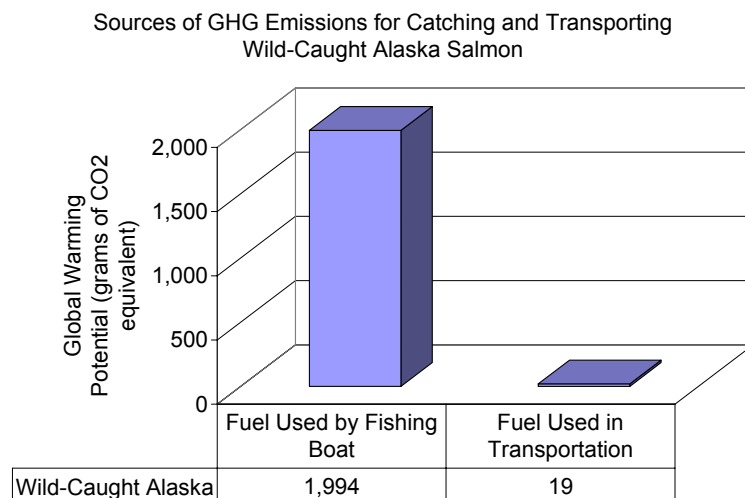
How much fuel is used to catch salmon? In this study, the fuel used to catch salmon is based on a study of Canadian salmon fisheries that examined multiple types of salmon fishing boats and came up with an industry average fuel use of 0.13 gallons of diesel fuel burned per pound of salmon caught.²

How much salmon do you need to make a 0.5 fillet? To make a fillet of fish you need to catch a larger piece of fish that can be cut down into a fillet. The ratio of the weight of fish caught to weight of a fillet is called the fillet factor and we used a fillet factor of 2.3.³ Thus, in order to produce a 0.5 pound fillet, 1.2 pounds of wild salmon needs to be caught.

TRANSPORTATION

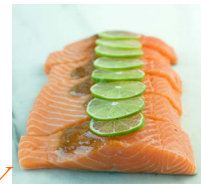
Once the salmon is caught, how does it get to Seattle? The wild-caught salmon is shipped on a refrigerated container ship from Anchorage, AK to Seattle (1,427 nautical miles) for sale at the Pike Place Market. It is assumed that the salmon is filleted in Seattle by the retailer.

How many greenhouse gases are emitted to transport the salmon to Seattle? Transportation adds an additional 19 grams of CO₂ equivalent.



TOTAL EMISSIONS

What are the total emissions for catching a wild salmon in the Copper River, AK and transporting the 1.2 pound salmon (for a 0.5 pound fillet) to Seattle? 2,013 grams of CO₂ equivalent.



NORWEGIAN FARMED SALMON – BERGEN, NORWAY

Where does the US import the most salmon from? The US imports the most frozen salmon from Norway.⁴ Bergen, Norway was selected as the origin for the farmed salmon.

What are the salmon fed at a fish farm? The salmon in this study are fed a mixture of the four most common fish feeds available in France. The fish feed is a mixture of fish meal, wheat, corn various vegetable oils, and other supplements. A recent study assessing the environmental impacts of making fish feed⁵ was used to assess the greenhouse gas emissions from producing, delivering, and administering the feed to the salmon at the farm.

SALMON FARMING

What are the main sources of emissions from farming fish? The main sources of greenhouse gases in a salmon farming operation comes from the production, delivery, and use of the fish feed.

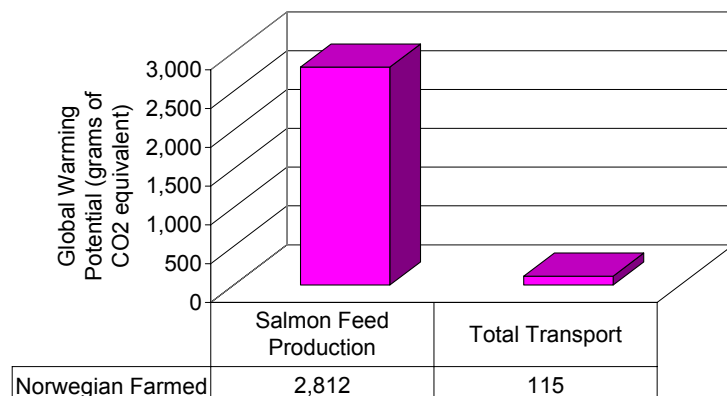
What are the emissions from fish feed? The emissions from producing, delivery, and applying the fish feed are 611 grams of CO₂ equivalent for one pound of fish feed.⁶ A feed factor of four was used in this study. Thus, a farmed salmon needs to eat four pounds of feed to put on one pound of weight. The fillet factor of 2.3 also applies to farmed salmon. So, to obtain a 0.5 pound fillet of salmon, we need 1.2 pounds of salmon which requires 4.8 pounds of fish feed. The emissions from producing, delivering, and applying 4.8 pounds of fish feed are 2,812 grams of CO₂ equivalent.

TRANSPORTATION

Once the farmed salmon is harvested, how does it get to Seattle? It is assumed that the salmon is filleted at the fish farm in Norway. Then, the salmon is shipped on a refrigerated container ship from Bergen, Norway to New York City (3,365 nautical miles). From there the salmon is shipped by rail to Seattle (3,353 rail miles).

How many greenhouse gases are emitted to transport the farmed salmon to Seattle? Transportation adds an additional 115 grams of CO₂ equivalent.

Sources of GHG Emissions for Raising and Transporting Norwegian Farmed Salmon from Bergen, Norway to Seattle (via New York City)



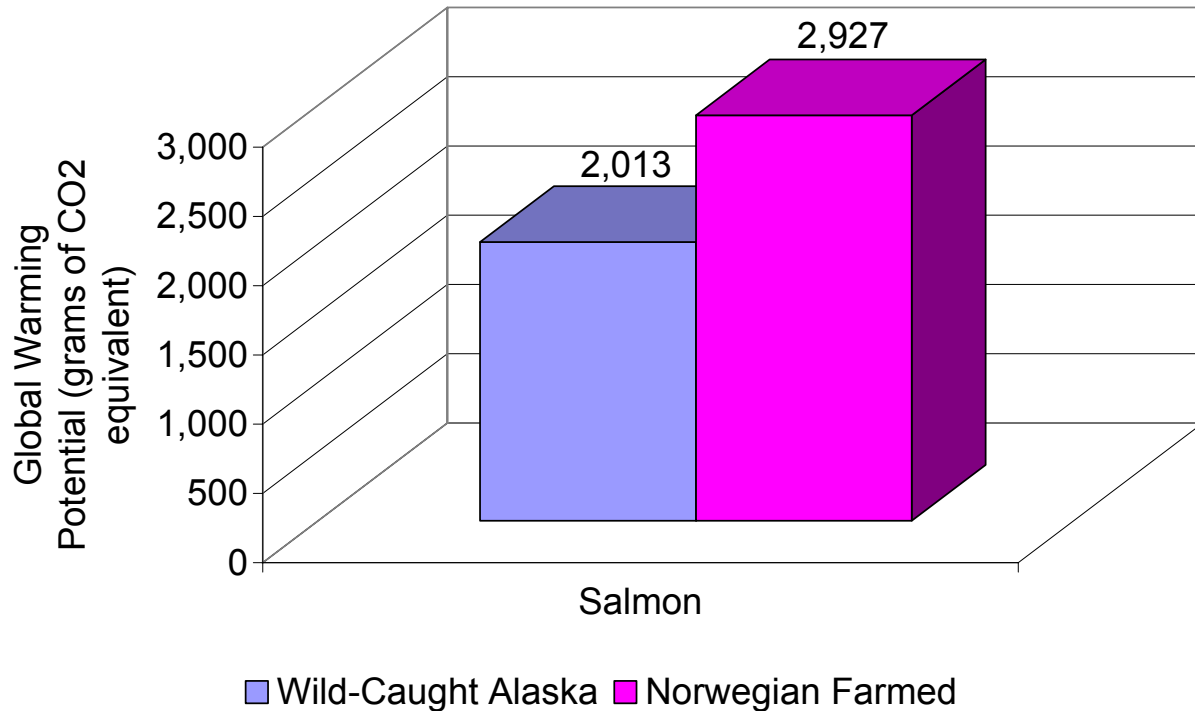
TOTAL EMISSIONS

What are the total emissions for raising a 1.2 pound Norwegian farmed salmon and transporting a 0.5 pound fillet to Seattle? 2,927 grams of CO₂ equivalent.

COMPARISON OF GLOBAL WARMING POTENTIAL



Total Emissions for the Two Salmon Fisheries



ANALYSIS

Like many other sources of meat, salmon is a high energy, and high source of greenhouse gases. Compared to the other fruits and vegetables in this study, the salmon emits about 50 times more carbon dioxide to deliver one serving to Seattle. Capture fisheries that catch wild salmon use more fuel by weight than the weight of salmon that they catch. Farmed salmon will always pass some of the food that they eat as waste (feed factor), so they always need to be fed more food than you will get back out of them. Salmon farms that actively capture smaller fish to feed their salmon are usually even less efficient than the farms that give their salmon a pre-made feed.

In this study, the wild-caught Alaska salmon emits 33% less greenhouse gas emissions than the Norwegian farmed salmon because the fishing boat is more efficient than the fish farm. The transportation costs of delivering a salmon from Norway are about six times the transportation cost of the wild-caught salmon.



¹ Alaska Department of Fish and Game, 2005.

² Henderson & Healey, (1993).

³ Ellingsen & Aanondsend, 2006.

⁴ Harvey, 2006.

⁵ Papatryphon et al, 2004.

⁶ Ibid.

RECOMMENDATIONS

Based on the findings of our research we make the following recommendations:

1. Promote local food because it does have environmental benefits over imported food.
2. Educate the public about the environmental benefits of local food.
3. Further study should look at the greenhouse gas impact of how people transport themselves to get their food.

1. Promote local food

The results of the LCA show in all cases that local food emits less greenhouse gases for cultivation and delivery to Seattle. There are two main reasons for this. First, local food has to traveled less to get to the city and secondly because Washington State is a highly productive agricultural region.

The distance that food travels to get to the city is a main source of emissions for the food items studied here, but differences in harvest yields and cultivation practices can play an even larger role in the emission of greenhouse gases. Thus, the miles that food travels to get to the city are an inadequate measure of the greenhouse gas impact of food. The LCA analysis performed here shows that harvest yields can greatly affect the total greenhouse gas emissions. Considering the Washington State potato and the Idaho potato, yields in Washington are almost twice that for Idaho, and yet a similar amount of fertilizers, herbicides, and insecticides are applied to these farms. However, for asparagus, the difference between the local and the imported food is small because Peru is much more efficient than Washington at growing asparagus. Thus it is important to consider every crop individually.

2. Educate about the environmental benefits of local food

One finding from the Neighborhood Study focus groups is that people are aware of the environmental benefits of organic food, but they don't often take into consideration the source of their food when they select it. Also, many people expressed an interest in having more farmers' markets, but this was mostly because they thought that the food available there was fresher, and did not make the connection that there are environmental benefits for selecting locally grown food. If people were more aware of the environmental benefits of local food, this could further

increase the demand for local food, which would also boost the community and economic benefits that local food can bring.

3. Further study

If we look at the greenhouse gas emissions for just the fruits and vegetables alone, the emissions are very low, especially compared to driving a car. For the fruits and vegetables alone, the total emissions for the local plate is only 89 grams of CO₂ equivalent, and the imported fruits and vegetables total is only 159 grams of CO₂ equivalent. Burning one gallon of gasoline in a passenger car emits 9,250 grams of CO₂ equivalent. Cultivating and delivering the fruits and vegetables is only like driving a quarter to a half mile in a passenger car. Even if we look at the entire plates of food with the salmon, the plates are similar to burning a quarter to a third of a gallon of gas, or driving 4-8 miles in a passenger vehicle.

If we were to look at the entire food system for Seattle, it is possible that people driving to get their food could be a larger source of greenhouse gases than the emissions created from cultivating and delivering the food to Seattle. This might seem implausible, but the main reason for this is that commercial vehicles (semi-trucks, rail cars, container ships) are much more efficient at moving cargo than passenger cars are.

A few other ideas have been raised as possible avenues for further study from this project. One way to lower the greenhouse gas emissions from burning fuel at the farm would be to use biodiesel at the farm instead of conventional diesel. This could make the emissions from burning fuel at some farms essentially carbon neutral. Also, many farm by-products might be readily available for use as a bio-fuel.

Another idea for further research would be to do a full cost-benefit analysis comparing local and imported food items. This study did not look at the economic issues surround agricultural practices, but many of the references cited here did and it might not be too difficult to combine these studies to examine the full economic impacts of local and imported food.

APPENDIX – GREENHOUSE GAS STUDY

CROP YIELDS

Data on crop yields (pounds harvested per acre) in Washington State, Idaho, New Zealand, and Peru have been collected from various branches of the US Department of Agriculture. These include the Washington State Field Office, the National Agricultural Statistics Service, the Foreign Agricultural Service, and the Global Agriculture Information Network. The following is a detailed description of the data used to determine crop yields for apples, asparagus, and potatoes.

Apples

To determine the pounds of apples harvested per acre in Washington State, data on historical yields were used, and a five-year average was used as a representative yield in this study. This five-year average was used as the yield for the conventional apple farm in this study. Table 1 shows the apple yields in Washington State¹ for the last five years and the average used in this study.

Year	Apple Yield (Pounds per acre)
2001	31,600
2002	32,900
2003	29,400
2004	39,700
2005	37,400
5-year average	34,200

Table 1. Apple yields in Washington State.

For the organic apple farm, it was assumed that the yield was 10% lower than at a conventional apple farm,² which gives a yield of 30,800 pounds per acre at the organic apple farm.

¹ USDA, 2006a.

² David Granatstein, Washington State University, personal communication, 2/26/2007.

Apple yields in New Zealand were obtained from the Foreign Agricultural Service, and the Global Agriculture Information Network.³ The New Zealand yield used in this study came from the 2004 revised data because the 2005 data was only estimated and the 2006 data was a forecast. This article listed the area planted in New Zealand as 13,500 hectares, with a yield of 504,000 metric tons. This converts to a yield of 33,300 pounds per acre.

Asparagus

To determine the pounds of asparagus harvested per acre in Washington State, data on historical yields were used, and a five-year average was used as a representative yield in this study. This five-year average was used as the yield for the conventional and organic asparagus farm in this study, because it was not determined if yields at organic asparagus farms is different from conventional farms. Table 2 shows the asparagus yields in Washington State⁴ for the last five years and the average used in this study.

Year	Asparagus Yield (Pounds per acre)
2001	3,600
2002	3,700
2003	3,800
2004	4,300
2005	4,100
5-year average	3,900

Table 2. Asparagus yields in Washington State.

Asparagus yields in Peru were determined from another Foreign Agricultural Service, and the Global Agriculture Information Network.⁵ For the three years spanning 2003-2005, asparagus yields in Peru were 10.3 metric tons per hectare, which converts to 9,200 pounds per acre, which was the value used in this study. Asparagus yields in Peru are much higher than they are in

³ Patterson, 2006.

⁴ USDA, 2006d.

⁵ Nolte, 2006.

Washington State because the climate is conducive to growing asparagus year-round and the asparagus does not enter a dormant stage.

Potatoes

Potato yields were determined from a report by the National Agricultural Statistics Service.⁶ This report listed potato yields for the year 2005 by state. In Washington State in 2005, the average yield of potatoes per acre as 62,000 pounds per acre, and in Idaho the average yield was only 36,600 pounds per acre. For the organic potato farm, the same yield was used as reported for the Washington State average because it was not determined if organic potato farms yield a different amount than conventional potato farms.

⁶ USDA, 2006c.

FERTILIZERS, HERBICIDES, INSECTICIDES

Data on fertilizer (nitrogen fertilizers, phosphate fertilizers, and potash fertilizers), herbicide, and insecticide application have been collected from the US Department of Agriculture reports on *Agricultural Chemical Usage*. The data comes from various years because all forms of data are not reported each year, but every effort has been made to use the most recent data available that overlap with the year from the crop yields. The only data found were for US farming practices, and fertilizer, herbicide, and insecticide use in New Zealand and Peru was not found. For these two countries, chemical application was assumed to be equivalent to the average for the US. For Washington and Idaho farms, state-wide averages were used.

Emissions from the manufacturing the fertilizers, herbicides, and insecticides, and for transporting them to the farm come from the GREET model. Table 3 shows the greenhouse gas emissions (in grams) for manufacturing one gram (which was converted to pounds for the analysis) of the chemicals modeled by GREET.⁷ GREET was used to determine the greenhouse gas emissions from manufacturing and delivering the chemicals used at each farm.

Greenhouse Gas	Fertilizer (per gram of nutrient)			Herbicides: Average for Crop Type	Insecticides: Average for Crop Type
	Nitrogen	Phosphate	Potash		
CO ₂ (grams)	2.44312	0.99243	0.67147	20.8524	24.3409
CH ₄ (grams)	0.00289	0.00177	0.00097	0.0298	0.03524
N ₂ O (grams)	0.00163	1.8E-05	9.9E-06	0.00024	0.00031

Table 3. Greenhouse gas emissions (in grams) from the manufacturing and delivery from the manufacturing plant to the farm of one gram of fertilizers, herbicides, and insecticides.

Below, we show the fertilizers (nitrogen, phosphate, and potash), herbicides, and insecticides applied at a farm for each crop and for each location used in this study.

⁷ University of Chicago, 1999.

Apples

Farm Site	Nitrogen Fertilizer (lbs/acre)⁸	Phosphate Fertilizer (lbs/acre)⁸	Potash Fertilizer (lbs/acre)⁸	Herbicide (lbs/acre)⁹	Insecticide (lbs/acre)⁹
Washington	51	N/A ¹⁰	N/A ⁹	3.482	30.64
New Zealand	55	33	48	3.049	25.16

Table 4. Fertilizer, herbicide, and insecticide data used in this study. Washington State data are from the state averages and New Zealand data are from the average US application.

For the organic apple farms in Washington State, organic poultry manure is the most common fertilizer applied.¹¹ An application rate of manure in this study is set at 1.0 ton per acre.^{12,13} The nitrogen content of chicken manure is 22 pounds of nitrogen per ton of manure¹⁴ (D. Granatstein, personal communication 2/26/2007). In this study, no other fertilizers, herbicides, or insecticides are applied at an organic apple farm.

Asparagus

Farm Site	Nitrogen Fertilizer (lbs/acre)¹⁵	Phosphate Fertilizer (lbs/acre)¹⁵	Potash Fertilizer (lbs/acre)¹⁵	Herbicide (lbs/acre)¹⁶	Insecticide (lbs/acre)¹⁶
Washington	116	41	66	2.5	2.3
Peru	99	66	109	3.4	2.2

Table 5. Fertilizer, herbicide, and insecticide data used in this study. Washington State data are from the state averages and Peru data are from the average US application.

In this study, no fertilizers, herbicides, or insecticides are applied at an organic asparagus farm.

⁸ USDA, 2004

⁹ USDA, 2006b.

¹⁰ David Granatstein, Washington State University, personal communication, 2/26/2007

¹¹ David Granatstein, Washington State University, personal communication, 2/26/2007.

¹² USDA, 2001.

¹³ Glover et al, 2001.

¹⁴ David Granatstein, Washington State University, personal communication, 2/26/2007.

¹⁵ USDA, 2003.

¹⁶ USDA, 2005b.

Potatoes

Farm Site	Nitrogen Fertilizer (lbs/acre)¹⁷	Phosphate Fertilizer (lbs/acre)¹⁷	Potash Fertilizer (lbs/acre)¹⁷	Herbicide (lbs/acre)¹⁷	Insecticide (lbs/acre)¹⁷
Washington	245	201	269	2.2	3.5
Idaho	225	178	134	2.4	1.6

Table 6. Fertilizer, herbicide, and insecticide data used in this study. Washington and Idaho data are based on their respective state averages.

In this study, no fertilizers, herbicides, or insecticides are applied at an organic potato farm.

¹⁷ USDA, 2004

EMISSIONS FROM FARM FIELDS

The only direct greenhouse gas emission from farm fields modeled in this study is the emission of nitrous oxide from the application of nitrogen fertilizer. The conversion rate is taken from Brentrup, et al,¹⁸ who reviewed multiple studies of nitrous oxide emissions from nitrogen fertilizer application which can vary greatly depending on soil type, local climate, and fertilizer type. Brentrup et al came up with an emission factor of 0.0125, so that for every pound of nitrogen in the fertilizer applied, there will be 0.0125 pounds of nitrous oxide emitted. In the values for nitrogen fertilizer applied listed above, the values are given in terms of pounds of nitrogen, so this value can be directly converted to nitrous oxide emissions from the field.

¹⁸ Brentrup et al, 2000.

FARM FUEL USE

To determine the farm equipment used and the related fuel use by this equipment, various studies from Washington State University were used. These studies focused on the economic costs of starting up and maintaining apple, asparagus, and potato farms in Washington State, so the type of farm equipment needed and the fuel used was kept track of. The three types of fuel burned at the farms are: gasoline (pick-up trucks and all-terrain vehicles), diesel (tractors), and propane (wind machine).

The emissions from burning these fuels at the farm come from the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model,¹⁹ which has been modified by Joyce Cooper at the University of Washington,²⁰ and from the Environmental Protection Agency.²¹

Below are the emissions calculations for burning gasoline in a pick-up truck and ATV used in this study, and following that are the emissions for the three farms examined in this study. The final values for fuel use are given in British Thermal Units (BTU) per acre. A BTU is the unit of energy (similar to a calorie or a joule) that the GREET model uses to determine emissions.

One final assumption made throughout this study is that the fuel use at a farm in Washington is equivalent to the fuel used at a farm in New Zealand, Peru, and Idaho. In most cases this is a fair assumption because farming practices in all of these locales are modernized and will use similar equipment. However, there are differences in climate, soil type, and slight variations in the technology available that will always introduce error into this assumption.

The asparagus farm in Peru is the place where this assumption breaks down the most. In Ica, Peru, the climate is perfectly suited to growing asparagus year-round and the asparagus does not enter a dormant stage there²². This is significantly different from Washington State where there is only one main growing season for asparagus.

¹⁹ University of Chicago, 1999.

²⁰ University of Washington GREET 1.7 Data Extraction

²¹ EPA, 2005.

²² Nolte, 2006.

Emissions from burning gasoline in a pick-up truck and all-terrain vehicle

The emissions from burning gasoline at the farm (e.g. in a pick-up truck or in an ATV) was calculated on a per gallon basis following a worksheet from the EPA.²³ This worksheet follows the stoichiometry of carbon in a gallon of gasoline that gets converted to carbon dioxide and then determines an appropriate emission factor for methane and nitrous oxide. Chemically, there are 8788 grams of CO₂ emitted from burning a gallon of gasoline, assuming a 99% efficient burn. The total GWP of burning a gallon of gas includes a 5-6% input from methane and nitrous oxide, so the 8788 grams are multiplied by 100/95 to get the total GWP of 9250 grams of CO₂ equivalent.

To back-calculate the emission of methane and nitrous oxide necessary to increase the GWP from 8788 to 9251 grams of CO₂ equivalent, we assumed that the input from methane and nitrous oxide was equal, so they would each need to contribute a GWP of 231 grams of CO₂ equivalent. The amount of carbon dioxide, methane, and nitrous oxide emitted in grams to give a total GWP of 9250 grams of CO₂ equivalent is shown in Table 7.

Greenhouse Gas	Grams	g CO₂ eq
CO ₂	8788	8788
CH ₄	10.06	231
N ₂ O	0.7813	231
Total GWP		9250

Table 7. The calculated emissions of the three major greenhouse gases needed to contribute a total GWP of 9250 grams of CO₂ equivalent per gallon of gasoline burned.

Apples

The machine use and fuel use per machine for this study is characterized from a study of conventional, integrated, and organic apple farms.²⁴ In this six-year study, the four types of farm machinery that use fuel are a tractor, an all-terrain vehicle (ATV), a pick-up truck, and a wind machine. The activities carried out by these machines are shown in Table 8.

²³ EPA, 2005.

²⁴ Glover et al, 2001.

Operation	Tooling
Fertilize	52HP-wt Tractor, Trailer w/ Hand Labor
Cover Crop Prep	52HP-wt Tractor, Rototiller
Seed Cover Crop	52HP-wt Tractor, Rented Seeder
Mildew Spray	52HP-wt Tractor, Blast Sprayer
Apply Mulch	52HP-wt Tractor, Trailer w/ Hand Labor
Irrigate	Solid Set Undertree Irr. System
Irrigate	4-Wheel ATV w/ Above Operation
Herbicide	52HP-wt Tractor, 100 gal. Sprayer
Mow Orchard	52HP-wt Tractor, 9' Rotary Mower
Cover Spray	52HP-wt Tractor, Blast Sprayer
Misc Use	1/2 Ton Pickup
Misc Use	4-Wheel All Terrain Vehicle
Frost Protection	Wind Machine

Table 8. Farm operations run by machine at an apple farm. This list includes all activities that might occur at a conventional and/or an organic apple farm.²⁵

The average hours of use per machine are shown in Table 9, and it was assumed that the average hours of use per machine was the same on the conventional farm as it was on the organic farm.²⁶ Since both the ATV and pick-up truck burn gasoline, it was assumed that they would have the same emissions and the fuel use for these two machines was combined in the LCA.

Tooling	Fuel Type	Machine Hours Per Acre	Gallons of Fuel Used per Hour	Gallons of Fuel Used per Acre	BTU/gallon	BTU/Acre
52 HP-Wheel Tractor	Diesel	34.1	1.5	51.2	139,000	7,110,000
4WD-ATV	Gasoline	15.7	0.5	7.85	124,000	973,000
Pickup	Gasoline	7.14	2	14.3	124,000	1,770,000
Wind Machine	Propane	4	13	52	91,000	4,730,000

Table 9. Fuel use at an apple farm used in this study.²⁷

²⁵ Glover et al, 2001

²⁶ David Granatstein, Washington State University, personal communication, 2/26/2007.

²⁷ Glover et al, 2001.

Asparagus

The machines used at an asparagus farm and the fuel use per machine for this study is characterized from a paper on establishing and running an asparagus farm in Washington.²⁸ We used only the equipment and fuel use data from the 6th year of production, which is when the asparagus farm was at full production. Table 10 shows the farm activities done by machine, and the machine used to perform them that are accounted for in this study.

Operation	Tooling
Beat Ferns	60 HP Tractor, Rotary Mower
Weed Control	60 HP Tractor, PTO Sprayer
Rotovate	60 HP Tractor, 6' Rotovator
Swamping	60 HP Tractor, PTO Sprayer
Spot Spray	60 HP Tractor, PTO Sprayer
Apply Herbicide	60 HP Tractor, PTO Sprayer
Labor Pickup	Miscellaneous Use
Pickup	Miscellaneous Use

Table 10. Farm operations run by machine at an asparagus farm. This list includes all activities that might occur at a conventional and/or an organic asparagus farm.²⁹

The average hours of use per machine are shown in Table 11, and it was assumed that the average hours of use per machine was the same on the conventional farm as it was on the organic farm.³⁰ Since both the labor pick-up and the pick-up truck burn gasoline, it was assumed that they would have the same emissions and the fuel use for these two machines was combined in the LCA.

Tooling	Fuel Type	Machine Hours Per Acre	Gallons of Fuel Used per Hour	Gallons of Fuel Used per Acre	BTU/gallon	BTU/Acre
60 HP Tractor	Diesel	1.85	2.88	5.328	139,000	741,000
Labor Pickup	Gasoline	1.8	2	3.6	124,000	446,000
Pickup	Gasoline	3	2	6	124,000	744,000

Table 11. Fuel use at an asparagus farm used in this study.³¹

²⁸ Ball et al, 2002.

²⁹ Ibid.

³⁰ David Granatstein, Washington State University, personal communication, 2/26/2007.

³¹ Ball et al, 2002.

Potatoes

The machines used at a potato farm and the fuel use per machine for this study is characterized from a paper on running a potato farm in the Columbia Basin, Washington, under center-pivot irrigation.³² Table 12 shows the farm activities done by machine, and the machine used to perform them that are accounted for in this study.

Operation	Tooling
Rip Field	300 HP-wt, 8 Shank Ripper
Till Field	300 HP-wt, 17' Chisel/18' Packer
Mark Out Field	150 HP-wt, 6-row Marker Bar
Load Seed	Seed Loader
Plant	200 HP-wt, 6R-Potato Planter
Insecticide	200 HP-wt, Insecticide Applicator
Fungicide	200 HP-wt, Fert/Fung Applicator
Drag Off	150 HP-wt, 24' Harrow
Reservoir Till	200 HP-wt, 6R-Dammer/Diker
Border Maintenance	150 HP-wt, 13' Tandem Disk
Pull/Pack	300 HP-wt
Dig Potatoes	200 HP-wt, 3R-Potato Harvester
Pickup, Management	3/4 Ton Pickup Truck
Pickup, Irrigation	3/4 Ton Pickup Truck

Table 12. Farm operations run by machine at a potato farm. This list includes all activities that might occur at a conventional and/or an organic potato farm.³³

The average hours of use per machine are shown in Table 13, and it was assumed that the average hours of use per machine was the same on the conventional farm as it was on the organic farm.³⁴ In the LCA, all of the diesel fuel that the tractors burn is summed into one total and burned together since it is assumed that all tractors will have the same emissions to burn the same BTU or diesel fuel. The same assumption is made for all of the motors that burn gasoline.

³² Hinman et al, 2006.

³³ Ibid.

³⁴ David Granatstein, Washington State University, personal communication, 2/26/2007.

Tooling	Fuel Type	Machine Hours Per Acre	Gallons of Fuel Used per Hour	Gallons of Fuel Used per Acre	BTU/gallon	BTU/Acre
300 HP -wt	Diesel	0.77	12	9.24	139,000	1,280,000
200 HP-wt	Diesel	1.35	9	12.15	139,000	1,690,000
150 HP-wt	Diesel	0.23	8	1.84	139,000	256,000
Seed Loader	Gasoline	0.23	0.3	0.069	124,000	8,560
Pickup	Gasoline	1.2	3	3.6	124,000	446,000

Table 13. Fuel use at a potato farm used in this study.³⁵

³⁵ Hinman et al, 2006.

SALMON FUEL USE

Wild-caught Salmon

There are many types of fishing boats used to catch salmon in Alaska, including purse-seiners, trollers, and gillnetters.³⁶ In this study, the fuel used to catch salmon is based on a study of Canadian salmon fisheries that examined multiple types of salmon fishing boats and came up with an industry average fuel use of 0.13 gallons of diesel fuel burned per pound of salmon caught.³⁷ Thus, the only steps required to catch and deliver a Copper River salmon to Seattle are to burn the fuel in the fishing boat to catch the fish and keep it on ice once it is caught, and then to deliver the salmon to Seattle. In this study the salmon is shipped from Anchorage, AK to Seattle on a refrigerated container ship.

To make a fillet of fish you need to catch a larger piece of fish that can be cut down into a fillet. The ratio of the weight of fish caught to weight of a fillet is called the fillet factor and we used a fillet factor of 2.3.³⁸ Thus, in order to produce a 0.5 pound fillet, 1.2 pounds of wild salmon needs to be caught. So the total fuel burned to catch the fish and ship it is the amount needed to catch and ship 1.2 pounds of salmon. It is assumed that the salmon is filleted in Seattle by the retailer.

Norwegian Farmed Salmon

The salmon in this study are fed a mixture of the four most common fish feeds available in France. The fish feed is a mixture of fish meal, wheat, corn various vegetable oils, and other supplements. A recent study assessing the environmental impacts of making fish feed³⁹ was used to assess the greenhouse gas emissions from producing, delivering, and administering the feed to the salmon at the farm.

The emissions from producing, delivery, and applying the fish feed are 611 grams of CO₂ equivalent for one pound of fish feed.⁴⁰ A feed factor of four was used in this study. Thus, a farmed salmon needs to eat four pounds of feed to put on one pound of weight. In researching

³⁶ Alaska Department of Fish and Game, 2005

³⁷ Henderson & Healey, 1993.

³⁸ Ellingsen & Aanondsend, 2006.

³⁹ Papatryphon et al, 2004.

⁴⁰ Ibid.

the appropriate value for the feed factor, values varying from 1 to 10 were observed. A feed factor of four was selected as it seemed to be a median choice. The value of the feed factor can significantly affect the results of the farmed salmon LCA.

The fillet factor of 2.3 also applies to farmed salmon. So, to obtain a 0.5 pound fillet of salmon, we need 1.2 pounds of salmon which requires 4.8 pounds of fish feed. Unlike the wild salmon, it is assumed that the farmed salmon is filleted on site at the farm, so only 0.5 pounds are shipped to Seattle.

TRANSPORTATION

There are three modes of transport used to deliver food to Seattle used in this study. They are: road transport by semi-truck or light-truck, rail transport by train, and container transport by ship. Below are the distances traveled used in this study.

To calculate the road distances traveled by the food, we used the website for Google Maps.⁴¹ At this website, the city name for the point of origin was entered and the city name for the destination was entered. The website determines a driving distance along major routes from city center to city center. The distance is given in miles and is converted to kilometers for this study (1 mile = 1.609 kilometers).

From - To	Miles	Kilometers
Yakima, WA to Seattle	143	230
Yakima, WA to Wenatchee	106	171
Wenatchee, WA to Seattle	148	238
Prosser, WA to Seattle	191	320
Blackfoot, ID to Seattle	756	1,216

Table B5. Highway distances between city centers used in this study.

To calculate the distances between ports to ship food from overseas, we used a *World Ports Distances Calculator* available online.⁴² The port-to-port distances are given in nautical miles and are converted to kilometers for this study (1 nautical mile = 1.852 kilometers)

From - To	Nautical Miles	Kilometers
Auckland, New Zealand to Seattle	6,183	11,451
Callao (Lima), Peru to Seattle	4,479	8,795
Anchorage, AK to Seattle	1,427	2,643
Bergen, Norway to New York City	3,365	6,232

Table 4. Port-to-port distances used in this study.

⁴¹ <http://maps.google.com>

⁴² <http://www.distances.com>

To deliver the Norwegian farmed salmon to Seattle, it was initially shipped from Bergen to New York city, and from New York City it traveled by train to get to Seattle. These distances come from the rail distances that Amtrak travels between cities.⁴³

From - To	Miles	Kilometers
New York City to Chicago	1,147	1,844
Chicago to Seattle	2,206	3,550
New York to Seattle Total	3,353	5,394

Table 5. Rail distances between cities used to transport salmon in this study.

⁴³ <http://www.amtrak.com/>

LCA CALCULATION PROCEDURE

This section lays out the method used to calculate the greenhouse gas emissions using the Life Cycle Assessment framework. This will work through the example for calculating the emissions for a 0.5 pound potato.

Following the method laid out by Heijungs and Suh,⁴⁴ the inventory data have been separated into a technology matrix (A) and an intervention matrix (B). These matrices consist of process vectors (P_i) that are partitioned into economic flows and environmental flows. The technology matrix is made up by the economic flows and is a square matrix with the 12 included processes that are based on the system boundaries and the cut-off criteria. The intervention matrix is made up of the environmental flows and consists of the three major greenhouse gases: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) that are produced by each of the unit processes. An example of these matrices is shown in Figure 1. The Microsoft Excel program was used for the calculations in this LCA.

The technology matrix consists of all of the unit processes required to cultivate and transport potatoes to Seattle, and the intervention matrix consists of the greenhouse gases we are tracking in this study. The data presented in the technology and intervention matrices are not scaled to produce one 0.5 pound potato; it is scaled for various degrees of performance. To solve the inventory problem, we follow the basic method described by Heijungs and Suh (2002), which is briefly described below.

To scale the technology and intervention matrices to the desired level, we create a *demand vector* (f) which we can use to demand the desired quantity of each of the economic flows. In Appendix A you will see that the demand vector is set up to demand a weight of potatoes (lbs) to be delivered a certain amount of distance (kg-km) so that we can study different delivery options for the apples. The units of kg-km used in the distance calculation are convenient when we want to move a certain weight a certain distance.

⁴⁴ Heijungs & Suh, 2002.

The demand vector represents the economic flows, which correspond to the reference flows. The demand vector “demands” the product, functional unit, of the system, in this case a 0.5 pound potato. In order for the system to create the desired demand, we have to solve for the correct *scaling vector* (s). The scaling vector is the unknown vector that can be multiplied by the intervention matrix to give the desired demand and solved for as shown below:

$$A * s = f$$
$$s = A^{-1} * f$$

So, we solve for the scaling vector by inverting the technology matrix and multiplying it by the demand vector. The result is that the scaling vector tells us exactly how much of each economic flow (e.g. fertilizers, herbicides, insecticides, diesel fuel, etc.) it will take to create the 0.5 potato that we have demanded (as well as the fuel requirements for how far we demanded it be shipped).

The next step for solving the inventory problem is to determine the system-wide environmental flows from the intervention matrix, which are then used for impact assessment. This solution is called the *inventory vector* (g), which is determined by solving the equation:

$$g = B * s ,$$

where B is the intervention matrix. The concept here is that once we have the scaling vector that tells us how much of each economic flow we need to make a 0.5 pound potato, we multiply it by the emissions in the intervention matrix (the greenhouse gas emissions for each process) and we get the emissions created for making the 0.5 pound potato.

To calculate the total Global Warming Potential of the 0.5 pound potato, we multiply each greenhouse gas by its appropriate scaling factor as outlined in the Methods section and add up the total emissions.

Technology Matrix (<i>A</i>)		Demand Vector (<i>f</i>)										Scaling Vector (<i>s</i>)			
Economic Flow	Units	Cultivate potato per acre	Herbicide production	Insecticide production	Nitrogen fertilizer production	Phosphate fertilizer production	Potash fertilizer production	Well-to-Pump gasoline production	Gasoline burned in pickup truck	Well-to-POU diesel production	Diesel fuel burned in farming tractor	Well-to-Pump diesel production	Diesel fuel burned by semi-truck	Demand Vector	Scaling Vector
Potatoes	lbs	62,000	0	0	0	0	0	0	0	0	0	0	0	0.5	0.000008
Herbicides	lbs	-2.2	0.0022	0	0	0	0	0	0	0	0	0	0	0	0.01
Insecticides	lbs	-3.5	0	0.0022	0	0	0	0	0	0	0	0	0	0	0.01
Nitrogen fertilizer	lbs	-245	0	0	0.0022	0	0	0	0	0	0	0	0	0	0.90
Phosphate fertilizer	lbs	-201	0	0	0	0.0022	0	0	0	0	0	0	0	0	0.74
potash fertilizer	lbs	-269	0	0	0	0	0.0022	0	0	0	0	0	0	0	0.98
Gasoline to pump	Btu	0	0	0	0	0	0	1000000	-124,000	0	0	0	0	0	0.000004
Gasoline at POU	Btu	-454,956	0	0	0	0	0	0	124,000	0	0	0	0	0	0.000003
Diesel to POU	Btu	0	0	0	0	0	0	0	0	1,000,000	-1,000,000	0	0	0	0.000003
Diesel at POU	Btu	-3,228,970	0	0	0	0	0	0	0	0	1,000,000	0	0	0	0.000003
Diesel to pump	Btu	0	0	0	0	0	0	0	0	0	0	1,000,000	-0.8841	0	0.000006
Diesel used by truck	kg-km	0	0	0	0	0	0	0	0	0	0	0	0	1	73
Intervention Matrix (<i>B</i>)															
Environmental Flow															
CO2	grams	0	16.11	18.54	2.205	0.7542	0.4131	15917	8788	12954	77265	13845	0.0688		
CH4	grams	0	0.0002	0.0002	0.0026	0.0015	0.0007	107.2	10.06	101.7	0.6500	102.7	0.000001		
N2O	grams	1389	0.0003	0.0003	0.0016	0.00002	0.00001	1.140	0.7813	0.2205	0.9200	0.2347	0.000002		
Inventory Vector (<i>g</i>)															
Global Warming Potential															
Impact	Grams	11,857													
CO2	CO2 eq (g)	11.9													
CH4		0.3													
N2O		3.8													
Total		16.0													

Figure 1. The matrix format for the LCA analysis.

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