A PLACE-BASED ASSESSMENT OF FOOD INSECURITY IN THE NORTH CENTRAL HEALTH DISTRICT OF IDAHO

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Abstract

The aim of this research is to understand the complexity of community food insecurity in a rural region of the United States. In this country food security is more about improper distribution than about scarcity. Quantifying why and where food distribution is not equitable or adequate depends on the context of place. Multiple indicators of food security specified in the literature were analyzed to create a food insecurity index. The index was compared to regional insight through the use of stakeholder surveys. We further analyzed the food insecurity index for spatial autocorrelation using Geographical Information Systems (GIS) technology to look for spatial patterns in the region of potential clustering or dispersal of the phenomena. Balancing top-down and bottom-up approaches, this project uses a mixed methods approach by testing the multidimensional indicators of food insecurity to uncover potential barriers that are affecting the most vulnerable areas within the region.

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Chapter 1: Literature Review

1.1 Introduction

Food is the basic building block for the sustenance of human life, yet over fourteen percent of the U.S. population was considered food insecure by the United States Department of Agriculture (USDA) in 2012 (Coleman-Jensen 2013). Food insecurity has implications on the local economy, the environment, public health, and the quality of our communities (Pothukuchi and Kaufman 1999). The first step towards the alleviation of the problem begins with documenting the spatial and temporal dimensions of food insecurity across the country (Bashir and Schilizzi 2013). One of the first attempts in the U.S. to spatially examine patterns of socioeconomic vulnerabilities was reported in the Hull House Maps and Papers published in 1895, which mapped nationality, wages, and employment history to assess the spatial variation of community sanitation needs in urban Chicago (Corburn 2009; Kruecheberg 1983). As the country's urban environment developed further, additional studies were conducted to assess standards for housing, transportation, and land-use planning. Although food is a vital component of the overall system of community health, it was not initially included in analyses (Pothukuchi and Kaufman 2000; Eckert and Shetty 2011). In 2007, the American Planning Association (APA) acknowledged the need for food to be added to its scope of practice with the development of a policy guide on community and regional food planning (Morgan 2009; American Planning Association 2007).

One of the most important outcomes of food security research is making sure that food resources are focused on the most vulnerable populations (Barrett 2010). The disparities between rural and urban environments are vast and often misunderstood, and hard to quantify (Headey and Ecker 2013; Garasky, Morton, Lois Wright, and Morton 2006). The 2011 Millennium Development Goals Report showed that although progress had been made, the majority of efforts had missed the most vulnerable and rural areas (Ecker, Olivier and Breisinger 2012). While there has been a continued focus on food access in urban areas (Curtis and Mcclellan 1995; Weinberg 2013; Kervenoael et al. 2004), rural food access issues are less understood and the reliance on urban food assessments as standardized

formats of analysis could overstate or understate the food environment in non-urban areas (Lois, Morton, and Blanchard 2007; Sharkey and Horel 2008).

The suburbanization of prime farmland, has had significant impacts on agriculture (Black et al. 1998). Food production and development have competed for the same landscapes; many of the same soils that are good for crops are also good for infrastructure (Imhoff, Lawerence, Stutzer, 1998). Before suburbanization, Johann Heinrich von Thünen, an economist of prominence in the 19th century, developed a theory of agricultural placement patterns based on transportation costs to the market and crop perishability (Peet 1969). Crop perishability manifested into a series of production rings which von Thünen referred to as agricultural zones. The more perishable the good, the closer to the market the good was produced. Movements within the von Thünen agricultural zones were determined by supply and demand (Peet 1969). As modern agriculture has expanded our urban centers, patterns of agriculture are more associated with urban development than with the perishability of the goods being produced (Sinclair 1967).

By 1992, 25% of prime farmland in the country had been absorbed by urban development leaving 185 of the 3000 counties in the country with no farm land at all (Maizel et al. 1998). Now much of the food that makes it to a grocery store shelf comes from just a few prominent agriculture zones that remain in the country, a pattern that renders counties with little to no farming activities reliant on national and international supplies (Imhoff et al. 1998). Who suffers the most in this scenario is the population that is not transit oriented and is forced to rely on resources available within their neighborhood food environment that may be limited in rural communities.

One of the economic forces driving the discrepancies between urban and rural places is Walter Christaller's Theory of Central Place (Wilson and Bennett 1987; Boventer 1969). Central Place Theory explains how and why markets position themselves geographically. The geographic range is defined as the maximum distance people are willing to travel to obtain a good or service and the demand threshold is defined as the minimum market demand a firm must acquire to be profitable selling that good or service (White 1977; Krugman 1993). As larger metropolises have developed throughout the country, economic activity has shifted away from rural local stores to market centers which offer a wider range of goods and services at lower prices (Morland et al. 2002). The theory is dynamic across

space and is determined by such forces as population density, type of agriculture produced, and governmental policy (Ullman 1941). While the theory focuses on the economic parameters of urban distribution, it ignores the geographical spatial structure of landscapes (Boventer 1969). Crop production will also align with the spatial structure of the landscape, including climatic and soil conditions (Polsky 2004).

This pattern of development has left many regions in the United States dependent on a food transportation system rather large in scale. In the 1920's, Walter Hedden first acknowledged this fact and introduced the concept of the foodshed with his book, *How Great Cities Are Fed*, to point out the dependency city centers had on a fully functioning distribution sector of the food system. A foodshed can be broadly defined as the geographic region a population relies on for the operation of the whole food system; from the production to the consumption of its food (Peters et al. 2008). While the flow of water through a watershed can be understood through the physical and ecological processes of elevation and climate, the barriers to the flow of food through the foodshed is a more complicated process (Hemenway 2006). With the suburbanization of prime farmland and all the efficiencies that conventional agriculture has brought, food typically travels between 1300 and 1500 miles before being consumed, making most foodsheds in the country quite large (Kloppenburg, Hendrickson, and Stevenson 1996; Govindasany et al. 2012). Estimates in the 1980's documented that as revolutionary as the U.S. food system was – being able to feed itself and 85% of the world even though only 3% (now 2%) of the US population were farmers – the average city had only a 2 or 3 day supply of food and even a slight disruption in the supply chain could be catastrophic (EPA 2013; The Cornucopia Project 1981). The efficiencies of conventional agriculture require huge inputs of fossil fuels for mechanical labor. That labor, combined with the distance food typically travels, has led to the current situation where twenty percent of the country's petroleum use goes into the production, processing and transportation of food; significantly adding to greenhouse gas carbon emissions (Chen 2012; Angelo 2010).

With these efficiencies of production, made possible through low energy costs despite them being nonrenewable; the inefficiencies of the food distribution system has not been a priority (Magdoff 2007). In the name of food security, the conventional agriculture has made many regions in the U.S. dependent on a complex transportation system for their basic food

needs (Kloppenburg, Hendrickson, and Stevenson 1996; Govindasany et al. 2012). These implications have caused people to question the sustainability of commercial agriculture (Farnsworth et al. 1996; Lobao and Meyer 2001).

1.2 Agriculture and Land Use

In the U.S., agriculture has under gone considerable changes since the early 20th century, first with the introduction of horse-powered agriculture in the beginning of the century, then with the advent of the Green Revolution and industrial agriculture after WWII. The primary goal of the Green Revolution was to find ways to feed the world's growing population through mass production and trade specialization (Black et al. 1998).

The underlying classical economic assumption promoting these changes was that, all other things being equal, land will be allocated to its highest and best use determined by the highest market price that can be obtained by the good being produced on the land (Polsky 2004). Like other markets, the success of the commercial agriculture system in this theory is being measured by scale and specialization (Warsh 2007). The Green Revolution embraced this theory of mass production and specialization, incorporating mechanical labor and huge inputs from fossil fuels to increase farm productivity (Angelo 2010). This new type of farming may have lowered labor costs, by replacing human labor with mechanical infrastructure, but this economic system of mass production and specialized markets has led to food insecurity throughout the globe and the deteriorating economic and social conditions in rural communities (Fazzino 2004; Angelo 2010; Padmavathy and Poyyamoli 2011).

1.3 Agriculture Policy & Food Assistance

U.S. legislation created the space for conventional agricultural practices to flourish and encouraged the over production of grain; having global repercussions on food security (Fazzino 2004; Angelo 2010; Burmeister 2008; Ecker, Olivier and Breisinger 2012; Pardue 2010; Magdoff 2007). The 1933 Agricultural Adjustment Act, what came to be known as the "Farm Bill", initially created subsidies for commodity crops with the intent to bring financial security to U.S. farmers (Burmeister 2008; Angelo 2010). Federal food assistance programs bought surplus goods from farmers and allocated them to people in need in a dual effort aimed at stimulating the economic viability of American farmers and helping those

struggling during the Great Depression (USDA, n.d.). Originally, assistance took the form of food handouts recouped from farmers' surplus crops. During WWII when it became harder to get surplus goods to people in need, the federal government started issuing cash reimbursements in lieu of the actual commodity goods (USDA, n.d.). These U.S. Department of Agriculture (USDA) Food and Nutrition Services (FNS) programs continue today and supplement the food resource needs of individuals that would be food-insecure without them (Finney Rutten et al. 2012). The FNS directs the programs and gives control to individual states for the administration of USDA food supplies and/or cash subsidies (USDA 2013a).

The Supplemental Nutrition Assistance Program (SNAP) (formally the Food Stamp Program) is the largest federal food security program and works with multiple state and community organizations to ensure that there are enough SNAP approved retail outlets available for all eligible recipients. Individual eligibility for SNAP benefits is determined by household income. Individuals whose income is below 130% of the poverty line receive cash credits in the form of Electronic Benefit Cards (EBT) that are distributed in a manner that allows food decisions to be made directly by the consumer (USDA 2012a).

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a federal FNS program with an objective of providing nutrition education, food, and a direct link to other health and social services to pregnant women, infants, and children up to the age of five that fall below 185% of the poverty line, but unlike SNAP, there are also medical or dietary risk requirements for eligibility. Food options vary depending on the eligible recipient's subgroup (e.g. "W" "I" or "C"). Cash vouchers are used in most states, but plans are underway to make the program operate like the EBT cards used by SNAP recipients (USDA 2012b).

While these programs help support many food insecure Americans, not all eligible participants take advantage of food assistance opportunities due to underfunding, the stigmas of needing assistance, and barriers to the application process (Forster 2002). These potential barriers are recognized by the FNS and the federal agency encourages states to set up SNAP Outreach Plans to alleviate some of these disconnects, providing monetary reimbursements of up to 50% of their administrative efforts (Donofrio et al. 2013). Despite

these avenues of outreach, the state of Idaho prohibits the Idaho Department of Health and Welfare from engaging in the implementation of such activities (Donofrio et al. 2013).

1.4 Agriculture Policy & Nutrition

A subsidiary of food security is nutrition security (Jaenicke and Virchow 2013; Ecker, Olivier and Breisinger 2012; Beuchelt and Badstue 2013). Nutrition was not a specific goal of traditional agriculture policies (Keding, Schneider, and Jordan 2013; Stuckler and Nestle 2012). Pardue (2010) eluded to the opposing forces of food security that we live with today: lack of food and obesity (Pardue 2010). The scientific debate continues in the literature as to whether we can blame obesity on the food environment (e.g. what stores are available), the built environment (e.g. access routes to available retail establishments), or socioeconomic characteristics (e.g. poverty and cultural perceptions) (Lopez and Hynes 2006; Sallis and Glanz 2006; Christakis and Fowler 2007; Mulvaney-Day and Womack 2009; Franzini et al. 2009; Gibson 2011), but the complexity of obesity and food security remain interrelated issues (Kaiser 2013).

Connecting food security to nutrition needs, The Nutrition Monitoring Advisory Council was established in 1992 by the National Nutrition and Relate Research Act of 1990 (Moshfegh 1994). A ten year comprehensive plan to monitor the dietary health and nutritional status of the U.S. population was the result of this public law and a jointly held responsibility by the USDA, the Center for Disease Control, and the National Center for Health Statistics (Carlson, Andrews, and Bickel 1999; Cohen 2002). And the 2004 Child Nutrition and Women, Infants, and Children Reauthorization Act requires all school districts to establish a wellness policy that lays out what goals they have for nutrition education and the meal plans that they will provide in their school cafeterias (Story, Nanney, and Schwartz 2009). Cementing that rationale even further, the Healthy Hunger Free Kids Act of 2010 made it mandatory that all school meals are updated to adhere to the Dietary Guidelines for Americans (USDA HHS 2013). The *Dietary Guidelines for Americans* is a collaboration between the USDA and the Department of Health and Human Services and every 5 years the scientific literature is reanalyzed for nutrition updates made by the health industry (USDA HHS 2010). Strategies recommended by the *Dietary Guidelines for Americans* include getting more dietary diverse nutrients into the lives of Americans and the development of

sustainable agriculture practices to enhance the availability of local food within the community (USDA HHS 2010).

Several FNS food assistance programs focus on school aged children and are starting to focus more heavily on nutrition. The National School Lunch Program (NSLP), established under the 1946 National School Lunch Act, distributes both cash reimbursements and USDA foods to schools to serve students lunch for free or at a reduced rate depending on whether their household income falls below 185% of the poverty line or 130%, respectively (USDA 2012c). At the time that NSLP was established, surplus distribution was still at the forefront of policy and the program did more to degrade health than to enhance it (Kaiser 2013). The School Breakfast Program, made permanent in 1975, extended breakfast services to the same groups for a free or reduced rate (USDA 2013b). And for schools not participating in any other programs, the Special Milk Program provides pasteurized fat-free or 1% fat milk to children at the same eligibility scale (USDA 2013c). The Summer Food Service Program, as it sounds, extends benefits to eligible children when school is not in session. The Child and Adult Care Food Program offers USDA foods or cash reimbursements to childcare or adult daycare facilities on an as needed basis (USDA 2013d). For all school programs, students that are not eligible can still purchase a meal or snack at a subsidized rate.

A program with integrated goals of increasing the amount of fresh fruits and vegetables served in school cafeterias, providing nutrition and agriculture education to students, and stimulating the local economy through the support of local and regional farmers is the Farm to School programs (FTS) which started in the 1990's (USDA 2013e; Joshi, Azuma, and Feenstra 2008a; Forster 2002; G. W. Feenstra 1997). With the support of the USDA Initiative for Future Agriculture and Food Systems, the National Farm to School Program was officially created in the year 2000, and it has been in use across the nation ever since (USDA 2009). The USDA Food and Nutrition Service has seven regional offices for the Farm to School Program and each year the department allocates $5 million to help states establish these nutritional, networking, and educational tools in their schools (USDA 2013e). To ensure success, the National Farm to School Network was initiated in 2007 and participation in FTS programs now extends to all 50 states with 2,571 individual farms taking part in the program (National Farm to School program 2013). In 2013 the Farm to

School (FTS) conducted its first census. Survey questionnaires were provided to school districts in all 50 states. The survey focused on examining local activities that the programs had stimulated and assessing the effects that programs had on educational enrichment (USDA 2013e). Not all schools participate in FTS programs despite all of their stated advantages. The main reasons for this lack of participation were logistics and pricing unpredictability (Vallianatos, Gottlieb, and Haase 2004; Joshi, Azuma, and Feenstra 2008). The convenience of the traditional, pre-prepared meal system that processed and commodity surplus meals offers is economical, requiring lower skilled kitchen staff and less prep and clean-up time (Joshi, Azuma, and Feenstra 2008). The logistics of ordering food also requires new systems of management, which makes some schools reluctant to stray from the norm (Joshi, Azuma, and Feenstra 2008).

Two additional FNS programs that focus on building up the local food market and incorporating more fresh foods into food assistance programs are the WIC Farmers Market Nutrition Program (FMNP) started in 1992 and the Farmers' Market Nutrition Program for Seniors (SFMNP) started in 2002 (USDA 2012d; Forster 2002; USDA 2013f). The programs aim to make more fresh and unprepared foods available to eligible recipients although the state of Idaho does not participate in these programs (USDA 2013g; USDA 2013f).

1.5 Defining Food Security

Defining what it means for a specific region to be food insecure is a prerequisite for identifying what actions can be taken to alleviate the problem (Raja and Yadav 2008). However, there is not a clear and universal definition of food insecurity, which makes it difficult to examine food insecurity in a standardized manner. Since the World Food Conference in 1974, there have been over 200 definitions of food security (Maxwell 1996). Definitions have varied on what contributing factors best explain food insecurity. This project used the definition provided at the 1996 World Food Summit that was reconfirmed at the 2002 and 2009 summits; that food security is achieved when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences to maintain an active and healthy lifestyle (Pinstrup-Andersen 2009; Barrett 2010; Maxwell 1996; Gregory, Ingram, and Brklacich 2005; Webb et al.

2006). At the 2009 food summit, the definition of food security was expanded by specifying the importance of securing individual dietary needs and food preferences, calling for more qualitative, place-based analyses (Pinstrup-Andersen 2009).

Prior research has used the 2009 Food Summit definition of food security with a central focus on household or individual food security (Coleman-jensen 2013; Webb et al. 2006; Radimer 2002; Carlson, Andrews, and Bickel 1999; Coleman-Jensen et al. 2012). More recently, Hamm (2003) emphasized collective security, termed, Community Food Security (CFS), as a situation in which all community residents obtain a safe, culturally acceptable, nutritionally adequate diet through an economical and environmentally sustainable food system that maximizes community self-reliance and social justice (Kaiser, 2013; Hamm, 2003). Community food security focuses on the broad goals of reducing poverty, protecting farmland, addressing the disintegration of rural communities and air and water pollution that is a product of the conventional agricultural system (Forster 2002). It aims to build up the community's food resources by focusing on community assets rather than only on deficiencies and looking at store locations, seasonal supplements like farmers markets and community gardens, and public transportation options (Forster 2002).

Above all else, food security is an interdisciplinary and systems-oriented process (Forster 2002). This attention on the collective, rather than the individual, illustrates the importance of the collaborative effort for sustaining adequate and accessible food sources in the present and future (Anderson and Cook 1999; Allen 1999).

1.6 Measuring Food Security

The spatial and temporal parameters to food security require assessments to adhere to the context of place. First world food insecurity cannot be assessed by the obvious signs of malnutrition just as understanding the phenomena in one third world country may not be the best template for examining it in another (Maxwell 1996; Carlson, Andrews, and Bickel 1999; Webb et al. 2006). Food insecurity in the U.S. is not necessarily about scarcity, but about distribution (G. Feenstra and Ohmart 2012; Sen 1981). The 1984 Report of the President's Task Force on Food Assistance addressed the discrepancies of malnourishment and food insecurity more typically experienced in the country as, not a sole product of

poverty but when individuals or households experience a lack of access to adequate foods temporally (Carlson, Andrews, and Bickel 1999).

Determining whether food distribution is equitable or adequate requires an assessment of multi-dimensional indicators. Assessments centered on food security have undergone three significant shifts since the World Food Conference in 1974 (Maxwell 1996). Analyses have shifted from being macro environment centric to focusing on the micro environment (Maxwell 1996; Koc and Dahlberg 1999; Webb et al. 2006). The conditions of the macro-environment determine the health of the larger scale population, while the conditions of the micro-environment determine the health of a particular community (Egger and Swinburn 1997). At the macro level, food policies, food taxes and prices, and consumer demand all affect a population's health. At the micro level, the neighborhood food environment, household income, and peer attitudes and family eating patterns are indicators of healthy communities (Egger and Swinburn 1997).

The second shift has moved away from a focus on the commodity of food and instead examines the socioeconomic characteristics that might contribute to access to that commodity (Maxwell 1996). In sum, food availability may be sufficient, but access to that food may not be accessible to all individuals at all times (Maxwell 1996; Sen 1981).

Legislation fueled by these parameters was the Community Food Security Empowerment Act of 1995, developed through a collaboration of anti-hunger and family farm advocates (Forster 2002). The act pushed for new legislation to address community access to fresh foods, the negative environmental effects of the current food system, diet-related diseases, and why the country was experiencing food insecurity in times of national economic growth (Forster 2002). Stemming from these concerns, the USDA's Community Food Security Initiative, created by the Secretary of Agriculture in 1999, was an inter-agency collaboration denoting community food security as an important goal and called for a comprehensive investigation into the components of a food secure community (Forster 2002; Cohen 2002).

The final shift has been from objective measures to subjective measures (Maxwell 1996; Webb et al. 2006). The Vivid Picture project was established in 2004 by the Roots for Change Council to identify indicators for a sustainable food system (G. Feenstra et al. 2005). Stakeholder input was determined as a critical factor that explains the overall list because all

of the other indicators would be useless without community buy-in and implementation (G. Feenstra et al. 2005).

1.7 Food Security Indicators

The World Food Summit identified three unified concepts in 1996 for analyzing food security: 1) food availability; 2) food access, including the subsidiaries of geographic access, economic access (price, transportation costs, and poverty), and informational access (educational, social, and cultural); and 3) utilization. Utilization is the quality and nutritional component of food security and aims to narrow the gap between availability and access through nutrition education and assistance programs (Agyeman & McEntee, 2009; Bashir & Schilizzi, 2013; Ecker, Olivier and Breisinger, 2012; Gregory et al., 2005; Jaenicke & Virchow, 2013; Maxwell & Unit, 1996; Padmavathy & Poyyamoli, 2011; Pinstrup-Andersen, 2009; Webb et al., 2006). The three concepts are hierarchical in nature, but not deterministic. Food availability is necessary, but not sufficient to maintain food access and food access is necessary, but not sufficient to maintain proper food resource utilization (Webb et al. 2006). These parameters were extended at the 2009 World Food Summit to add a fourth concept: the stability of the region or its ability to cope with alterations to the regional food system (Webb et al. 2006; Ecker, Olivier and Breisinger 2012; Padmavathy and Poyyamoli 2011). The stability of the food system takes steps to reduce the span of the whole food system and focus on what could be produced regionally to incorporate more sustainable solutions for the whole production, processing, distribution, and consumption sectors of the foodshed (Hemenway 2006; Kloppenburg, Hendrickson, and Stevenson 1996; Salkin and Lavine 2011).

Stability is a particularly important consideration with respect to increasing climate variability. In a Stanford symposium in 2011, climate scientologist David Lobell stated: “what we know well about climate change is that the earth is warming. This warming is more concentrated on land than at sea, and in the higher latitudes. We also know that rainfall is becoming heavier and that dry areas are becoming drier. What we do not know well is how to quantify local rainfall changes, the rate of warming, and year to year variability” (D. Lobell 2011). With climate abnormalities and other temporal changes, stability has become a more widely accepted unit of analysis (Webb et al. 2006; Morgan 2009). Feenstra (1997)

stated that residents could get more of their nutrients from local food sources if communities concentrated on seasonal availability (G. W. Feenstra 1997). Coping strategies will be key for food security in the future with climate change variability (D. B. Lobell et al. 2008).

Demographic indicators of food security are population, median age, racial makeup, citizenship, household structure, employment status, median income, and poverty status (Cohen 2002). While these indicators are important, research has expanded to show that food security is not only about poverty and socioeconomic status within a region (Cohen 2002).

Identifying a focus and evaluating indicators for community food security should be an interdisciplinary process and whole systems oriented (Forster 2002; G. Feenstra et al. 2005). The integration of this multi-dimensional complex set of potential indicators adopts sustainability's whole system approach to analysis. Munier (2005) said that "sustainability is not a goal, but a process" (Munier 2005). In assessing the health of any system, the analysis should follow sustainability's three-tiered metric of looking at the environmental, economic, and social health of what is being analyzed (LaGro 2001).

1.8 Thesis Outline

Chapter two introduces the reader to the North Central Health District of Idaho and the geographical, economic, and political landscape of the region. Chapter three discusses the methodology for this analysis and previous research methods used. The overall research questions and hypotheses are discussed here as well. Chapter four presents the results of this research and Chapter five discusses the results and how the data can be used regionally and what further research is suggested to take place. This chapter also discusses the limitations of this project and the potential limitations of research like it.

Chapter 2: Study Region

2.1 Regional Overview

Regional identity is more than just geographical boundaries, it also encompasses the political and cultural parameters of place (Morrissey 1997). To understand the sustainability of place, one must take an inventory of a region's natural (geographic environment), human (educational and economic environment), and cultural (social and political environment) capital (Munier 2005). This project assesses food security in a rural region in Idaho where several collaborative efforts on community food systems are already occurring. The Palouse-Clearwater Food Coalition is a grassroots organization engaged in projects to strengthen the regional food system through efforts aimed at bringing producers and consumers closer together. Another group, the Food System and Economic Development Initiative, which is sponsored by the University of Idaho's Department of Economic Development, aims to raise awareness campus-wide on food related research being conducted by University of Idaho faculty and students, and it encourages collaborative efforts by cultivating these connections (OED 2013). Both organizations were supported by an AmeriCorps position hosted by the Palouse Clearwater Environmental Institute in 2012 - 2014 focused on food systems enhancement and community involvement (PCEI).

2.2 Natural Capital

The state of Idaho was divided into seven health districts in 1970 to focus public health and welfare resources regionally and to extend resources to all rural areas of the state (IDHW 2013). The North Central Health District (district 2), the focus of this study, includes the five counties of Latah, Nez Perce, Lewis, Idaho, and Clearwater. The physical landscape of the region is quite variable. The five counties are situated between the Snake River to the west and the Bitterroot Mountains to the east. The individual counties have variable growing climates because they contain a variety of geographical features, including mountain ranges and river valleys (CEDA 2013a) and a wide elevation gradient that ranges from 700 to 8,500 feet with an average slope of 13% (O. R. Burt 1981; CEDA 2013a). These diverse landscapes alter the growing potential in the region (CEDA 2013a). The

hardiness zones in the region range from 4b, meaning low temperatures can be down to -25°F, for parts of Idaho County to 7b, meaning low temperatures can be down to 5°F for parts of Nez Perce County (USDA 2013h). Precipitation in the region ranges from 8 to 12 inches on the western edges and 60 to 80 inches on the eastern edges (IDWR 2013). Soils tend to be on the acidic side though many Idaho farms are using Global Positioning Systems (GPS) to map soil types and improve yields with as little fertilizer as possible (ISDA 2013; University of Idaho Extension 2013). The amount of land suitable for agriculture and zoned for this use varies in each county.

2.3 Human Capital

Idaho is primarily a rural state with, on average, 19 people per square mile compared to an average of 87 people per square mile nationally (US Census Bureau 2012). Persons per square mile in the North Central Health District range from 1.9 in Idaho County to 46.3 in Nez Perce County (US Census Bureau 2012). Figure 2.1 illustrates the distribution of population at the census track level to show the distribution across the region.

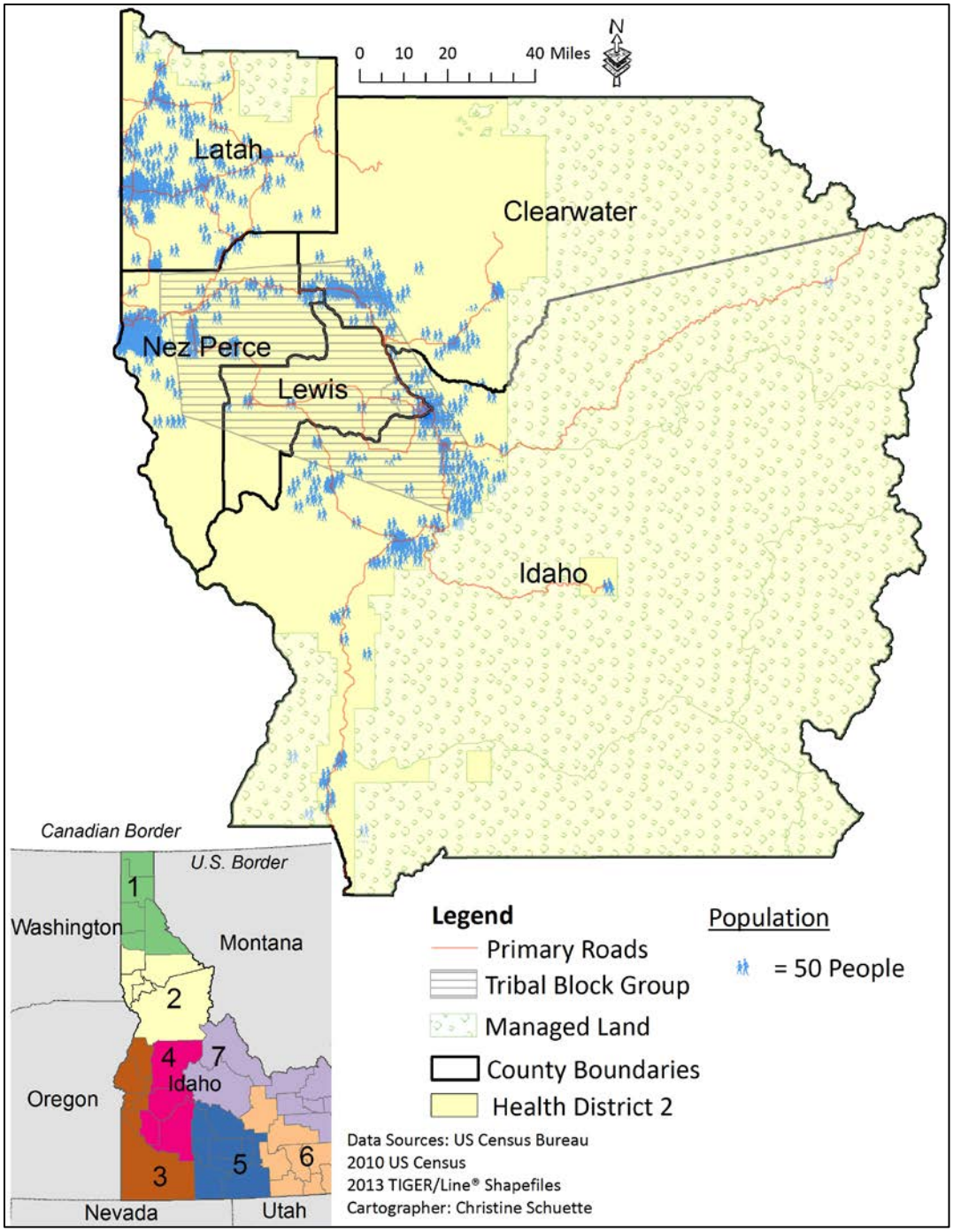

Figure 2.1: The Population Distribution in the Second Health District of Idaho

Idaho's economic wellbeing is linked to its natural capital and farming, ranching, and timber industries (Idaho Department of Agriculture and State 2013; CEDA 2013b). The state is also divided into economic development districts, and the same five countries in the North Central Health District make up the Clearwater Economic Development Association (CEDA). CEDA is not a government organization, but a not-for-profit 501c(4) established in 1968 to enhance economic stability through government and industry collaborations (CEDA 2013b). The economic base of the study region is in manufacturing and state and federal government employment, though agriculture also has a large economic presence (Office of Community Partnerships 2013). Household median income ranges from $35,551 in Clearwater County to $45,816 in Nez Perce County. The average poverty rate ranges from 12.7% in Nez Perce County and 21.0% in Idaho County (Office of Community Partnerships 2013).

Nez Perce County, home to Lewiston, the most populated community in the region, is located at the confluence of the Snake and Clearwater Rivers. The Port of Lewiston is the furthest inland seaport in the U.S. The port and the city's paper and saw mill make trade and manufacturing the base of Nez Perce's economy (CEDA 2013c), but agriculture, forestry, and livestock are also important economic activities for rural residents in the county. Forty eight percent of land in the county is used for agriculture (Nez Perce County Planning 1998; Clearwater County 2013). Eleven percent of county residents have not obtained a high-school degree and 21% have obtained a bachelor's degree or higher (OCP 2014).

Latah County has been reported to have some of the richest farm land in the United States, with 38% of the county's land devoted to agriculture (Clearwater County 2013). Latah County is home to the state's land grant college, the University of Idaho, in the city of Moscow, which is a dominating economic presence in the county (CEDA 2013d). Five percent of county residents have not obtained a high-school degree and 43% have obtained a bachelor's degree or higher (OCP 2014a).

Clearwater County has 53% federally managed forestlands. This and the topographic variation of the county, with the western river beds and the region's eastern mountainous areas, make the timber and service industries major economic players in the county. Productive agriculture can mostly be found in the south western side of the county; 2.4% of

land in the county is used for agriculture (Clearwater County 2013). Restrictions to expansion of croplands include soil limitations and the county's topography (Clearwater County Planning Department 2012). Fourteen percent of county residents have not obtained a high-school degree and 15% have obtained a bachelor's degree or higher (OCP 2014b).

Lewis County is the smallest county in the region and its economic portfolio consists of agriculture, forestry, manufacturing in wood products, and government employment. Fifty nine percent of Lewis County is used for agriculture (Clearwater County 2013). With agriculture playing such a valuable role in the county, sustaining fertile lands is of prime importance to the local government (Lewis County Planning Department and Lewis County 2009). Twelve percent of county residents have not obtained a high-school degree and 16% have obtained a bachelor's degree or higher (OCP 2014c).

Idaho County has 83% federally managed forestlands and its economic portfolio consists of agriculture, forestry, manufacturing in wood products, government employment, recreation, dry-land farming and commercial farming (CEDA 2013e). It also shares some of the limitations of Clearwater County with regards to agriculture production due to topography; only 4.3% of the land is used for agriculture (Clearwater County 2013). Twelve percent of county residents have not obtained a high-school degree and 15% have obtained a bachelor's degree or higher (OCP 2014).

Economic overlaps exist in the region with regards to agriculture and forestry production. Idaho and Clearwater counties, with a greater percentage of their county lands federally managed forestlands, rely heavily on the timber industry and government employment. The agriculture industry in each county's economic portfolio does not delineate between commercial contributions and those made to the local food market.

2.4 Cultural Capital

Regional policies and market conditions are limiting factors to food access in rural communities (Webb et al. 2006). Production and consumption patterns are shaped by federal and state policies as well as topographic conditions (Salkin and Lavine 2011). Due to rapid growth in the state in the 1970's, the Local Land Use and Planning Act was passed in 1975, encouraging all cities and counties to develop comprehensive plans for their community's visions for land management (Association of Idaho Cities). The Association of Idaho Cities

calls the comprehensive plan the “economic, environmental, and social blueprint for community characteristics” (Association of Idaho Cities).

The North Central Health District has several health and community sustainability programs focused on environmental and community health (IDHW 2013a). Targeting community health, the health district has started a three phased community garden program to promote and support sustainable agriculture in the region (IDHW 2013b). The program is in its infancy, but has outlined the procedures to follow for future projects. Under the umbrella of environmental health, the district works with the Department of Environmental Quality to regulate and test public water systems and provide information about safe water practices to private water systems due to the fact that private water is not regulated by the state of Idaho (IDHW 2013a).

Chapter 3: Methods

3.1 Introduction

The aim of this research is to understand the complexity of community food security in the North Central Health District of Idaho using both existing and primary data sources. It has been noted in the literature that planning and geography disciplines should incorporate both inductive and deductive approaches to research (Wilson and Bennett 1987). Balancing the top-down and bottom-up approaches, this project uses a mixed methods approach of concurrent triangulation to test the identified indicators from the literature in multiple ways. Mixed method approaches are becoming more of a recognized necessity to capture all of the variation in the particular phenomenon being studied (Creswell 2003). Concurrent triangulation is a research method selected to incorporate separate analyses to account for potential weaknesses in one method with the strengths in the other (Creswell 2003). Specifically, the methods used in the study are food security indexing, spatial analysis, and key informant surveys. Through a mixed methods approach, the quantitative findings from existing datasets are supplemented with place-based assessments from key informants in the region. The proposed approach counteracts potential problems with using a universal measure of food security, such as proximity to food retail store outlet, which makes it difficult to pinpoint the individual indicators that are most pertinent to individual communities (Borlaug 2009).

3.2 Past Studies

Many urban food security studies analyze food access by examining the road network, public transportation options, and using distance to food providers as the measure of food security (Morland et al. 2002; Sallis and Glanz 2006; Donkin et al. 2000; Pearce et al. 2007; Larsen and Gilliland 2008; Austin et al. 2005; Raja and Yadav 2008; Leete, Bania, and Sparks-Ibanga 2011; Hatfield 2005). While geographic access is a contributing indicator to whether a region is considered a food desert – living more than a mile from a grocery store for urban areas and more than 10 miles from a grocery store for rural areas – it is not the only contribution to food security (Padmavathy and Poyyamoli 2011; Raja and Yadav

2008). Garasky et al (2006) found that the rural food environment predicted food insecurity and that high prices and lack of store options were positively correlated to being food insecure. But Shaw (2006) found that proximity to grocery stores was not always perceived in the same way, and that healthy food purchases were not necessarily linked to economic viability as many people of means reported buying less healthy foods simply because they did not have time to prepare fresh foods. Moore et al. (2008) moved further beyond the assumption of supermarkets having a monopoly on neighborhood healthy foods and incorporated both GIS quantitative locational data and qualitative survey data to ground truth and gauge preference. Further emphasis on the importance of place is the 'Rural Families Speak' project, a longitudinal study of rural low-income families. The study found the importance of the social support system in tight rural communities in strengthening food security where SNAP and WIC could not do it alone (Garasky, Morton, Lois Wright, and Morton 2006). In order for people to make healthy choices about food, they must first have access to healthy food, be informed about those choices available to them, and have an environment enriched with a social acceptance for the choices that are accessible (USDA 2010).

3.3 Research Approach

This project examines community food security and the regional prevalence for self-resiliency. In this study, an extensive list of indicators, widely accepted in the literature as measures of food security, were assessed. Relying on nationally available data sets, this study quantifies the available food choices in the region and the accessibility of those food options. Extending beyond existing sourced indicators, a key informant survey instrument was used to collect primary data and gauge which social and cultural factors are contributing to the choices being made and any barriers that may exist to sustained food security in the region. Using Geographic Information System (GIS) technology, this study uses spatial analysis to test for spatial clustering in the food security indices, identifying areas within the region that are most vulnerable to food insecurity. By investigating the dynamics that shape food security indices, this study addresses a need identified in the literature for more place-based research to capture what may not be reflected in the formal methods of analysis.

3.4 Research Questions

Overall, this study aims to answer the following research questions and test their associated hypotheses:

Research Question 1: What is the state of community food security in the North Central Health District of Idaho?
Research Question 2: Which areas in the region are most food insecure?
Research Question 3: Is there a spatial pattern to the distribution of food insecurity across the region?

A general hypothesis associated with research question 3 examines the presence of clustering or dispersal in the data. The null hypothesis for this test is complete spatial randomness or no pattern.

Null Hypothesis: Complete Spatial Randomness (CSA)
Alternative Hypothesis 1: Spatial Clustering
Alternative Hypothesis 2: Spatial Dispersal

3.5 Data Sources

To compare the quantitative and qualitative datasets, zip code tabulation areas were used as the observational unit of analysis. Forty-two zip code observational units were identified in the region, but four were excluded due to more than fifty percent of their area occurring outside the study area. An additional zip code area was excluded due to the lack of any population reported in the American Community Survey 2012 data that was used. Figure 3.1 illustrates the study region, partitioned into zip code observational units and where the excluded zip codes occur.

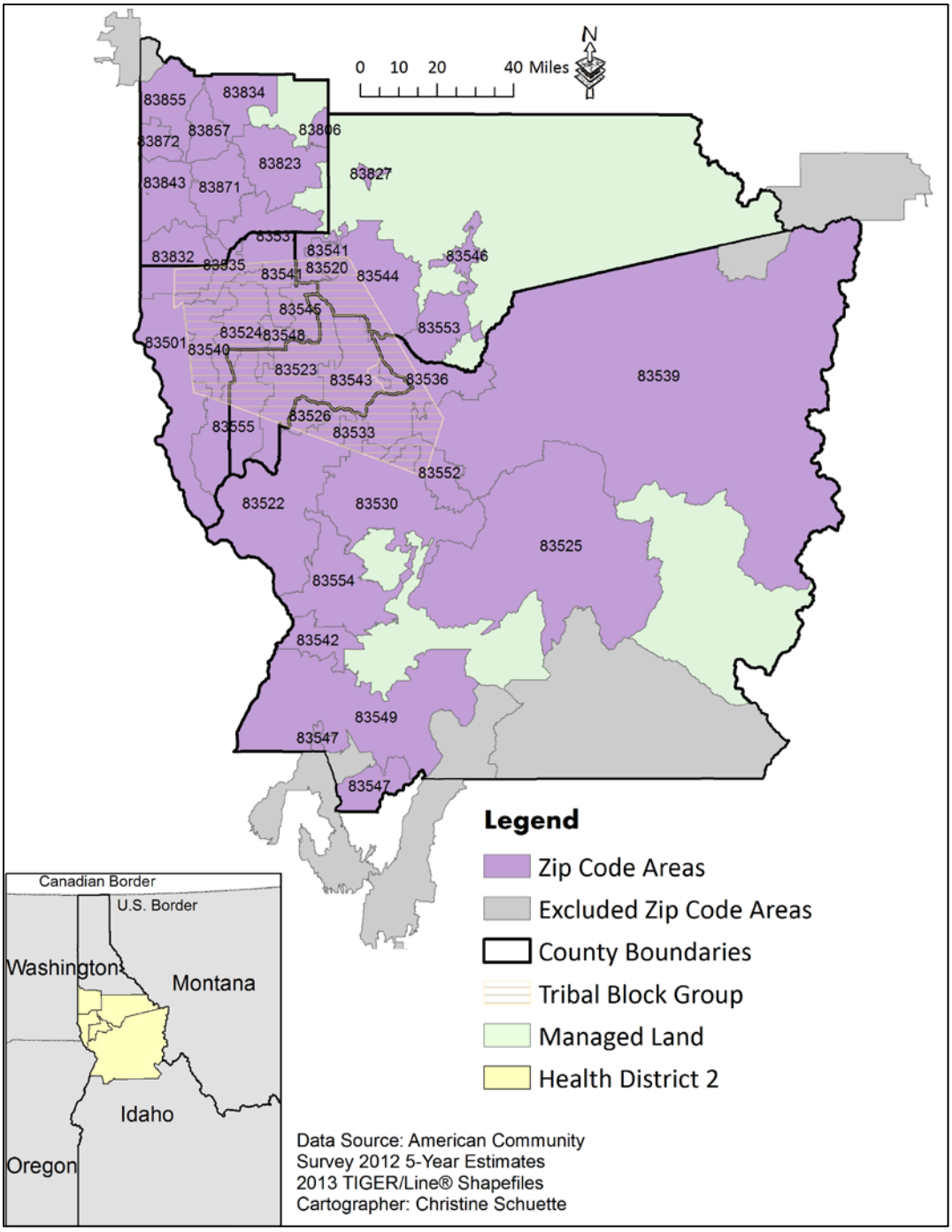

Figure 3.1: District 2 Zip Code Tabulation Areas

Data was collected from the Census Bureau for the American Community Survey 2012 5-Year Estimates. Collected variables for each tabulated zip code area included: population totals and racial distributions, age, household dynamics and income, poverty, unemployment, health insurance coverage, and food stamp participation (U.S. Census Bureau 2012).

Data for the availability of year round food resource retail outlets (labeled grocery stores) was obtained from InfoUSA Inc (InfoUSA 2012). Grocery stores are identified by North American Industry Classification System (NAICS) code 445110 (grocery stores in the study region were given the code 4451103). Grocery stores are differentiated from other store outlets as establishments selling a general line of foods both fresh and frozen (US Census Bureau 2014). Data for SNAP approved retail establishments was sourced through the USDA's Food SNAP Retailer Locator (USDA 2013i). SNAP approved retailer outlets extend beyond grocery store classifications. In the study region, businesses that were on the SNAP approved list included: grocery stores, service stations-gasoline & oil, convenience stores, one delicatessen and one grocery – wholesale (InfoUSA 2012).

Seasonal measures of stability were sourced online for farmers markets, community gardens, participation in the Farm-to-School program, and Community Supported Agriculture (CSA) (Eat Well Guide 2013; Ecovian 2013; Local Harvest 2013; Preferred 2012). CSA is a collaborative response to sustainability issues in local communities (Farnsworth et al. 1996). Like shareholders to the farm, CSA's operate in multiple ways with subscribers getting a share of the production each season, or in some instances, even helping with the harvesting themselves (Seastian 2013).

3.6 Food Security Index

Food security indices are not readily standardized in the literature. Prior research has focused on identifying household or individual food insecurity (Coleman-jensen 2013; Webb et al. 2006; Radimer 2002; Carlson, Andrews, and Bickel 1999; Coleman-Jensen et al. 2012). The USDA and the U.S. Census Bureau developed the Food Security Survey Module to measure national food insecurity at the household level (Kaiser 2013). This module represents a first attempt at defining a unified set of indicators to be used to measure food

access and accessibility (Cohen 2002). These surveys ask one household member questions about their ability to provide food for all household members adequately over the period of the previous year. Data from these studies is aggregated to the county level (USDA 2014). An index using existing data is the Food Environmental Atlas developed by the USDA's Economic Research Service, which also ranks counties across the country based on the multiple indicators of food security (USDA 2013j).

To capture more of the potential variation in the phenomena, this study created an index for food insecurity at the zip code tabulation area. Twenty-nine variables were initially collected. Variables were excluded from the index if they were unable to be ranked (e.g. nominal), exhibited too many missing values, or contained no variation within the values for the region. The remaining variables were checked for collinearity to eliminate redundancy. Variables quantifying year-round, seasonal, and assistance food retail establishments were determined to be key indicators to the study and were not part of the collinear pair plots. Correlation pair plots were used in R to check for collinearity within the existing data indicators (R Core Team 2013). All correlation coefficients of 0.7 or greater were considered correlated and a single variable was selected for the index (Zuur et al 2009). These tests were run to reduce the list of variables to a reasonable and meaningful number of indicator variables pertinent to the region. This strategy reduced the list of indicators from twenty-nine to sixteen variables, which were used to create the food insecurity index.

Values for each of the remaining variables were aggregated into six ranking classes (classes were ranked one to six, with six being the most food insecure). The total of six classes was determined using Sturges (1926) equation for optimal class size (J. E. Burt, Barber, and Rigby 2009). The equation used is provided below:

$$k = 1 + 3.3 \log_{10} n$$

where (k) is the optimal number of classes and (n) is the number of observations.

Data values were distributed within the six established classes using ArcGIS calculations based on the Jenks-Caspall algorithm. The Jenks classification method is used to achieve the least amount of variation between all values within each class (Slocum, Terry A. and McMaster, Robert B. and Kessler, Fritz C. and Howard 2009).

Each variable was individually assessed to determine whether a high or low score would be more advantageous to food security resulting in the determination of whether the highest or lowest cluster would be given a value of six (e.g. the high range of the poverty rate would be given a ranking of 6 and the low range of median household income would also be given a ranking of 6). Table 3.1 lists the sixteen variables included in the index and the range of values for each indicator within the region.

Scores for each ranked variable were summed and an overall food insecurity score was determined for each zip code area. Zip codes with the highest sum value after totaling ranking scores of all sixteen variables were determined the most food insecure.

Table 3.1: Indicators: Descriptive Statistics

INDICATOR	Range (Low)	Range (High)	Mean	Median	Standard Deviation
DEMOGRAPHIC					
Median Age	25.50	58.80	46.57	47.60	7.23
Labor force Participation	41.30	89.10	57.07	56.40	10.48
Unemployment Rate	0.00	21.90	9.23	8.60	6.30
Male householder, no wife present, family – With own children under 18 years	0.00	8.50	1.93	1.46	2.07
Female householder, no husband present, family – With own children under 18 years	0.00	18.69	3.71	2.94	4.22
Householder living alone – 65 years and over	0.00	25.00	10.78	9.20	5.71
Civilian population without health insurance	1.10	41.30	16.11	14.90	7.75
Civilian population under 18 years of age without health insurance	0.00	64.70	12.28	9.00	13.46
AVAILIBILITY, ACCESS, & UTILIZATION					
Year Round Food Resource Outlets (e.g. grocery stores)	0.00	7.00	0.86	0.00	1.62
SNAP Approved Retail Outlets	0.00	34.00	2.30	1.00	6.09
Food Banks and Food Pantries	0.00	12.00	1.14	0.00	2.50
Median Household Income	20,948	76,406	44,128	42,424	10,834
Poverty Rate	0.00	53.00	14.73	12.40	10.26
Poverty Rate Over 65 years of age	0.00	57.10	8.72	6.80	12.35
Households receiving SNAP benefits	0.00	32.38	9.06	6.74	6.91
STABILITY					
Aggregated Seasonal Food Resource Outlets (e.g. CSA's, farmer's markets, community gardens, participation in Farm-to-School)	0.00	15.00	0.97	0.00	2.52

3.7 Global and Local Moran's I Statistics for Spatial Autocorrelation

Tobler's first law of geography tells us that everything is related to everything else, but near things are more related than distant things (Cliff, A D & Ord 1981). Spatial analysis is the assessment of this law and the relationships and interactions of variables in a dataset that may be contributing to the overall variation across space (Haining 2003). Specific to the nature of this study, Hyman (2005) reported that the introduction of space into analyses can enhance the empirical understanding of both global and local spatial effects on poverty and food security outcomes. It was noted in the paper that we could expect the varying population densities and zip code land masses across our study region to have an impact on the distribution of food security (Palmer, Bailey, and Gatrell 1996).

The established food security index is used to explore the spatial relationship and significance of the pattern of food security in the study region. Data was examined for spatial autocorrelation using the Spatial Autocorrelation (Global Moran's I) tool test statistic in ArcGIS (ESRI (Environmental Systems Resource Institute) 2014). The Moran coefficient is a spatial statistic that extends from time series analyses, the first statistical tests to deviate from the assumptions in classical statistics of independently and identically distributed data (Chun, Yongwan & Griffith 2013). The Moran's I test in not based on a linear structural relationship, but on a spatial or general topologically-based relationship (Chun, Yongwan & Griffith 2013). Using the Moran's I equation for regional data is best for ranks, ratio, or interval data (Ebdon 1985). The specific equation used by ArcGIS is below:

$$\mathrm{I}= \frac{n}{S_0}\frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{i,j}\,(x_i-\bar{x})\left(x_j-\bar{x}\right)}{\sum_{i=0}^{n}(x_i-\bar{x})^2}$$

where (I) is the spatial autocorrelation coefficient of the Moran's I statistic, (n) is the number of zip code tabulation areas within the region, (x) is the value of the food insecurity index of zip codes (i) and (j), ($\bar{x}$) is the mean of all of the (x) food insecurity indices, ($w_{i,j}$) is the spatial weight between zip codes (i) and (j) where ($w_{i,j}$) = 1 if region (i) is one of the (q) nearest neighbors of (j) within the specified distance threshold and ($w_{i,j}$) = 0 otherwise. (S_0) is the combination of all spatial weights.

The first step in spatial analysis is to test the null hypothesis of spatial randomness against the alternative of spatial autocorrelation (Baller et al. 2001). Spatial autocorrelation tests whether the degree to which food security is indexed in our region is correlated in space (Chou 2010).

$H_0 = 0$ Complete spatial randomness between food security indices

$0 < H_a \leq 1$ Food security indices are positively spatially autocorrelated – areas that are more food insecure will be clustered together

$0 < H_a \leq -1$ Food security indices are negatively spatially autocorrelated – areas that are more food insecure are uniformly distributed across the region

An underlying assumption of the global Moran's I statistic is that the data is stationary, meaning that the distribution of the process being studied is independent of location and can be interpreted in the same way across the study region (e.g. if the global Moran's I statistic returns a autocorrelation value of 1 then it can be assumed that that value of 1 explains the spatial variation of the whole study region) (Fotheringham and Brunsdon 1999). If the global I statistic is significant for spatial clustering a local Moran's I statistic should be used to pinpoint specific clustering of positive and negative autocorrelation (J. E. Burt, Barber, and Rigby 2009).

The *'Cluster and Outlier Analysis (Anselin Local Moran's I)'* tool in ArcGIS, a local test for spatial clustering of high and low values and spatial outliers was used to further analyze the data (ESRI 2014). A fixed distance band was selected as the basis of the spatial weighting matrix because edge based contiguity neighbors were not appropriate due to one of the tabulation zip codes being completely disconnected from the rest. Fixed distance bands are also a good method of conceptualizing spatial relationships when there is a lot of variation in size of your observational units (ESRI 2014). Neighborhood ranges were determined by a distance threshold of 81,568 meters, which ensured that each zip code tabulation area would have at least four neighbors. A contiguity matrix was used to calculate the average connections between all observational units. This average of four neighbors, along with the *'Calculating Distance Band from Neighbor Count'* tool in ArcGIS was used

to determine the appropriate 81,568 meter threshold to capture any potential non-stationarity in the data (ESRI (Environmental Systems Resource Institute) 2014). The specific equation used by ArcGIS for the local I statistic is below:

$$I_i = \frac{x_i - \bar{X}}{S_i^2} \sum_{j=1, j \neq i}^{n} w_{i,j}\left(x_j - \bar{X}\right)$$

where (x) is the value of the food insecurity index of zip codes (i) and (j), $(\bar{x})$ is the mean of all of the (x) food insecurity indices, $(w_{i,j})$ is the spatial weight between zip codes (i) and (j) where $(w_{i,j})$ = 1 if zip code (i) is one of the (4) four neighbors of (j) and $(w_{i,j})$ = 0 otherwise and:

$$S_i^2 = \frac{\sum_{j=1, j \neq i}^{n} (x_i - \bar{x})^2}{n - 1} - \bar{X}^2$$

where (n) is the number of zip code tabulation areas within the region.

A test for the significance of the Moran's I statistic is also calculated in Arc GIS by comparing the values of observations against the expected values.

3.8 Key Informant Survey Instrument

Key informants are community representatives that can provide a place-based understanding of community food security could include any number of community members (Pothukuchi et al. 2002; Cohen 2002). National food-intake surveys such as the Nationwide Food Consumption Survey (NFCS) and the National Health and Nutrition Examination Survey (NHANES) have focused on household food security levels, but have not addressed the collective, community level concepts of the availability and accessibility of food resources (Anderson and Cook 1999).

For this research, sample selection was based on an attempt to survey as many key informants related to food security in the region as possible. Key informants for this study were modeled off of the literature to include community members in the various fields of health care, education, faith-based and community-based organizations, and local government, as well as farmers, food processors and manufacturers, and food assistance

providers (Cohen 2002; Pothukuchi et al. 2002). A list of potential respondents was obtained through InfoUSA Inc. data (InfoUSA 2012), the researcher's own search, and suggested contacts from collaborators. InfoUSA data was filtered by primary business category due to inconsistencies found in the NAICS codes reported for each business. Groupings of key informant businesses were defined by businesses related to city and county government, farms, churches, social services, health services, non-profits, and schools. Seven hundred and fifty potential key informants were identified and this list was further condensed by the availability of contact information (email addresses) for each business.

Three hundred and ninety two surveys were administered online, with the exception of three surveys sent out by mail upon request. Due to key informant self-identification of belonging to multiple key informant groups, the ten original categories of key informants were condensed into the following five categories: community-based organizations, faith community, food supply (e.g. farmers, processors and distributors), government, and health care and education. Table 3.2 illustrates the distribution of surveys sent by group and by county.

Table 3.2: Survey Distribution

Key Informant Groups	Clearwater	Idaho	Latah	Lewis	Nez Perce	Totals: Category	Percent By Category
Community Based Organization	4	5	19	1	15	44	11.22%
Faith Community	3	6	19	3	13	44	11.22%
Food Supply	4	11	62	5	20	102	26.02%
Government	12	8	20	4	14	58	14.80%
Health Care and Education	10	17	74	8	35	144	36.73%
Totals: County	33	47	194	21	97	**392**	
Percent By County	8.42%	11.99%	49.49%	5.36%	24.74%		

The survey was designed to assess the perception of food security from key informants in the region. The survey consists of thirty-two closed and open-ended question. Fourteen closed-ended questions (e.g. Yes, No, Not Sure) were designed around the four parameters of food security outlined in the World Food Summit; availability, access, utilization, and

stability (Webb et al. 2006; Ecker, Olivier and Breisinger 2012; Padmavathy and Poyyamoli 2011). Using Excel Pivot Tables, comparisons were made of answers for all closed-ended questions and displayed with plus or minus one standard error (Microsoft Corporation 2010). Twelve open-ended questions were designed to gather further information and identify potential barriers to food security not specified to the region. The use of supplemental open-ended questions allow respondents to answer freely in their own words about the subject matter (Jackson and Trochim 2002; Mossholder et al. 1995). One of these open-ended questions asked about preference and shopping patterns in the community. Answers to this question were analyzed with Wordle's to show the strength of each food retail establishment mentioned (Feinberg 2013). Additional questions were designed to gather demographic data about the respondents. A copy of the complete survey can be found in Appendix B.

3.9 Policy Review

To enrich the place-based assessment of the analysis, the comprehensive plans of Clearwater, Latah, Lewis and Nez Perce County were analyzed using text analysis for policies identified in the literature to promote local food security (Forster 2002). Policies and mentions of the following were identified: food stamp outreach, famers' markets, community gardens, community supported agriculture, and farm-to-school programs. Idaho County does not have a comprehensive plan so the City of Grangeville's Planning & Commission Department's website was assessed for these same programs and policies. This data is aggregated at a lower resolution than our zip code analyses and serves as a qualitative supplement to our study. Data analysis from the key informant surveys is also cross checked for these policy identifications.

Chapter 4: Results

4.1 Spatial Analysis

Figure 4.1 illustrates the distribution of the food insecurity index across the study area. The index describes the distribution of food insecurity across the study region based on our aggregated data variables. The lowest ranked zip code areas: 83843 and 83871 in Latah County and 83501 in Nez Perce County are determined to be the most food secure according to the index. Initial observation concludes that there appears to be a clustering of areas classified as most to moderately food secure (index score 1-3) in the northwest of the region, and a clustering of areas classified as most to moderately food insecure (index score 4-6), with the highest food insecurity rankings, in the eastern side of the region. To test the relationship predicted in the literature between food insecurity and population density, a simple linear regression model was conducted on the logged population density against the index. A correlation value of -0.45 suggests a negative linear relationship. The F test for significance on the linear regression model was insignificant with a $F_{1,36} = 9.09$, $P = 0.004$, indicating that population density had a significant negative linear relationship with the food insecurity index.

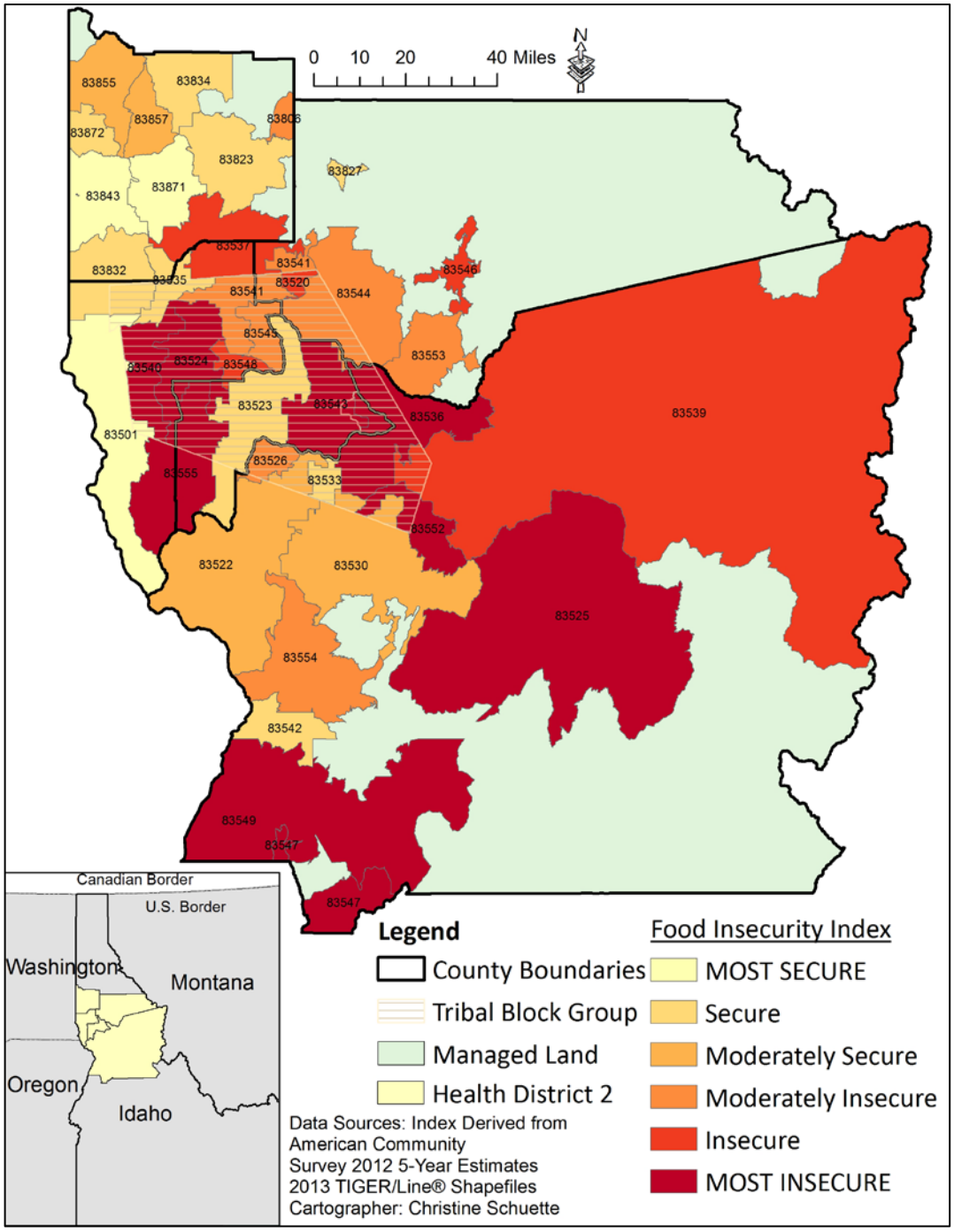

Figure 4.1: Food Insecurity Index

To test for significance in any clustering or dispersal amongst the food insecurity rankings, a global Moran's I test for spatial autocorrelation was conducted on the aggregated index score for each zip code area. A test for the significance of the Moran's I statistic is calculated by comparing the values of observations against the expected values. Table 4.1 lists the global Moran's I results for spatial autocorrelation including values for the I statistic and for the significance test.

The results suggest that there is clustering within the food insecurity indices. The test for signification suggests that there is a less than 5% chance that the pattern could be explained by complete spatial randomness therefore the null hypothesis is rejected.

Table 4.1: Global Moran's I Test Statistic

Moran's Index:	0.048447
Expected Index:	-0.02778
Variance:	0.001144
z-score:	2.253811
p-value:	0.024208

To illustrate where this spatial clustering occurs within the study region and the difference between clusters of high food insecurity and clusters of low food insecurity a local Moran's I statistic was calculates and is illustrated in Figure 4.2.

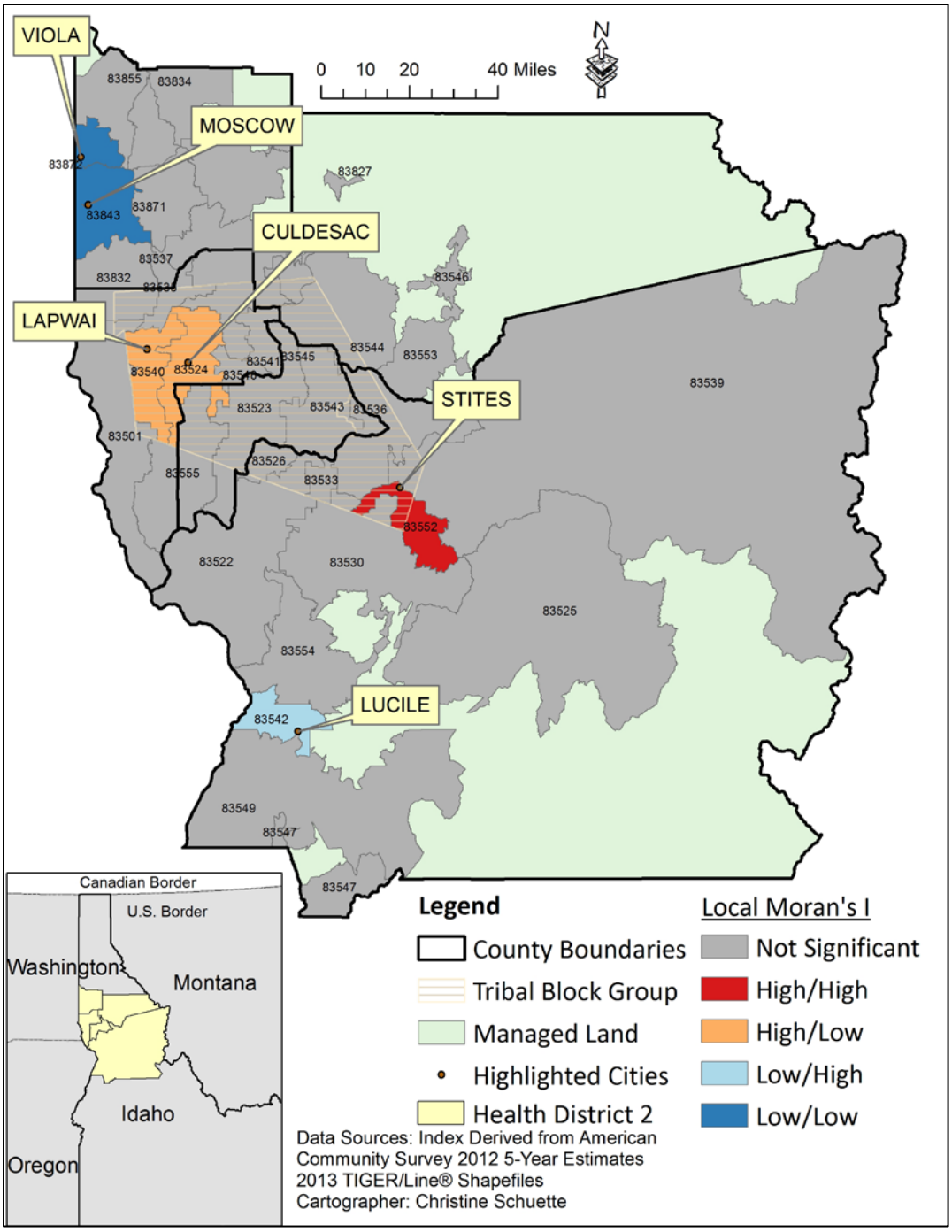

Figure 4.2: Local Moran's I Statistic: Spatial Autocorrelation of High and Low

Figure 4.2 shows clusters of high food insecurity at the 0.05 significance level (HH) centered on zip code 83552 (Idaho County) and the city of Stites. Clusters of low food insecurity at the 0.05 significance level (LL) are centered on zip code areas 83872 and 83843 (Latah County) and the cities of Viola and Moscow. The (HL) and (LH) identified areas of the map illustrate spatial outliers in the region where zip code area 83542 (Idaho County) and the city of Lucile was in the "Secure" group of the food insecurity index, but is surrounded by areas of higher food insecurity. Zip code areas 83540 and 83524 (Nez Perce County) and the cities of Lapwai and Culdesac received a higher score of food insecurity, but are surrounded by areas of lower insecurity. These areas in the region could be further explored to understand the spatial processes that might be leading to the variation displayed.

4.2 Key Informant Comparison

One hundred and eighty two responses were received from the online survey out of the sample of three hundred and nighty two potential respondents; for an overall response rate of 46.43%. Table 4.2 shows the response rate by each category and by each county.

Table 4.2: Survey Response Rate

Key Informant Groups	Clearwater	Idaho	Latah	Lewis	Nez Perce	Totals: Category	Percent By Category
Community Based Organization	3	2	8	0	8	21	11.54%
Faith Community	2	2	7	0	6	17	9.34%
Food Supply	2	1	33	0	7	43	23.63%
Government	4	7	8	4	11	34	18.68%
Health Care and Education	1	7	35	5	16	64	35.16%
Unknown	1	1	1			3	
Totals By County	13	20	92	9	48	**182**	
Response Rate By County	39.39%	42.55%	47.42%	42.86%	49.48%		
Total Response Rate	46.43%						

To compare directly to the food insecurity index, the survey responses were partitioned into zip code areas. Zip code areas with less than ten surveys were not analyzed, which reduced the sample size to 140 (77% of the original sample). The 140 respondents were distributed over 5 zip code areas; 83501 in Nez Perce County, 83530 in Idaho County, 83544 in Clearwater County, and both 83843 and 83871 in Latah County. Demographic characteristics of the respondents are summarized in Figure 4.3 and Table 4.3. Figure 4.3 illustrates the distribution by gender of survey respondents and Table 4.3 lists respondent distribution by age group.

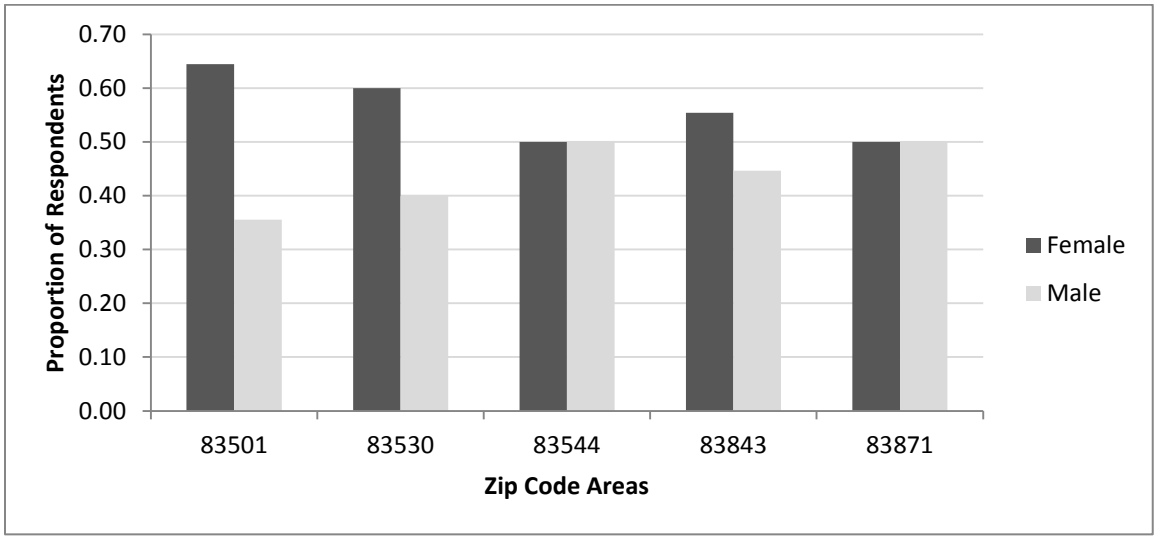

Figure 4.3: Survey Respondent Distribution by Gender

Table 4.3 Survey Respondent Distribution by Age in each Zip Code

Zip Code Areas	18 - 24 years old	25 - 34 years old	35 - 44 years old	45 - 54 years old	55 - 64 years old	55-64 years old	65 - 74 years old	75 years or older
83501	2.22%	4.44%	17.78%	35.56%	37.78%	0.00%	2.22%	0.00%
83530	0.00%	10.00%	30.00%	40.00%	0.00%	10.00%	10.00%	0.00%
83544	0.00%	0.00%	40.00%	10.00%	40.00%	0.00%	10.00%	0.00%
83843	3.08%	23.08%	7.69%	18.46%	40.00%	0.00%	4.62%	3.08%
83871	0.00%	10.00%	30.00%	20.00%	40.00%	0.00%	0.00%	0.00%

Both closed-ended and open-ended survey questions were designed to gather insight about perceptions of food insecurity in the region. Table 4.4 lists the fourteen closed-ended questions asked of survey respondents that were used as a direct comparison to the food insecurity index created by the existing data variables. The questions are partitioned into the four parameter categories discussed in the literature, availability and access, utilization, and stability. Figure 4.4 illustrates the comparison for answers given to Question 1: *Is community food security a problem in your community?* Looking at Figure 4.4, we cannot conclude a majority perception of community food security in any of the five zip code areas.

Table 4.4: Key Informant Closed-ended Questions

Access & Availability	
Q1	Is community food insecurity a problem in your community?
Q2	Can residents in your community do their food shopping within a 10 mile radius of their home?
Q3	Does the food retail provider nearest to your community offer a wide variety of food options?
Q4	Does the food retail provider nearest to your community offer the foods that residents in your community prefer to purchase at a price that most people can afford?
Q6	Do residents in your community experience a seasonal change to their food security?
Q8	Are there any public transportation options available in your community that connect to places to obtain food?
Q9	Are there any “para-transportation” options in your community?
Utilization	
Q11	Are there any barriers to participation in the Supplemental Nutrition Assistance Program (SNAP) formally called Food Stamps in your community?
Q13	Are there any barriers to participation in the Women, Infants, and Children Program (WIC) in your community?
Q15	Are there other food assistance options in your community?
Stability	
Q18	Does your community have Community Supported Agriculture (CSA’s)?
Q20	Are there any community gardens in your community?
Q23	Are there local policies that affect the availability of local foods in your community?
Q25	Does your school district participate in the Farm-to-School program?

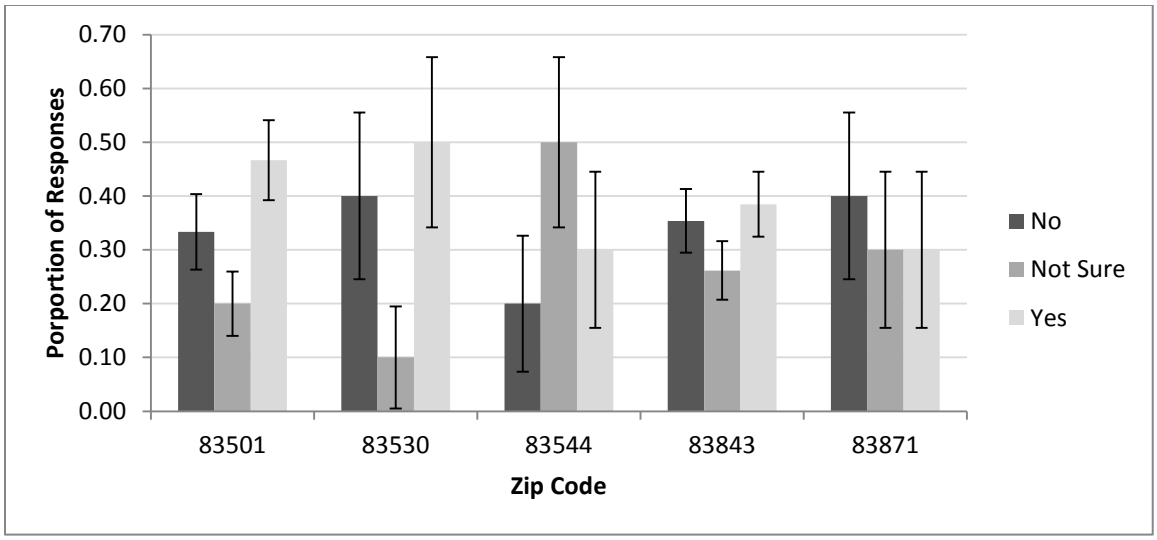

Figure 4.4: Response Distribution to Question 1

Bar graphs with plus or minus one standard error, like above, were created for each of the fourteen closed-ended survey questions. These perceptions of food insecurity by key informants were compared to the food insecurity index created by the existing variables. Table 4.5 illustrates the comparisons between the survey respondents and the food insecurity index. The Index Row displays the classification for each zip code based on the determination of the food insecurity index. Each survey question received a “Secure” or “Insecure” ranking based on the nature of the question (e.g. whether a majority answer of Yes would be more or less advantageous to food security), and a “No Consensus” (-) if given an overlap in standard error bars a suggested distinction Secure” and “Insecure” could not be made. The remaining rows in the table list the proportions of “Secure” and “Insecure” answers given to all fourteen closed-ended questions.

Table 4.5: Key Informant Perception Comparison to Food Insecurity Index

	83843 (Latah)	83501 (Nez Perce)	83871 (Latah)	83530 (Idaho)	83544 (Clearwater)
INDEX GROUP	Most Secure	Most Secure	Most Secure	Moderately Secure	Moderately Insecure
SURVEY					
Q1	-	-	-	-	-
Q2	Secure	Secure	-	Secure	Secure
Q3	Secure	Secure	-	Secure	Secure
Q4	Secure	Secure	-	-	Secure
Q5	-	Secure	Insecure	-	-
Q6	Secure	Secure	Insecure	-	-
Q7	Secure	Secure	-	Secure	-
Q8	-	-	-	-	-
Q9	-	Secure	-	Secure	-
Q10	Secure	Secure	Secure	Secure	Secure
Q11	Secure	-	-	Insecure	Insecure
Q12	Secure	Secure	Secure	Secure	Insecure
Q13	Secure	Secure	Secure	Secure	Secure
Q14	Insecure	Insecure	Insecure	Insecure	Insecure
Secure	64%	71%	21%	50%	36%
Insecure	7%	7%	21%	14%	21%
No Consensus	29%	21%	57%	36%	43%

When asked about proximity to grocery stores, key informants in all but one zip code area, 83871 (Latah County), felt that community members could do their shopping within a 10 mile radius and that a variety of food options were provided at those retail food outlets. A further open-ended question about shopping patterns revealed that many key informants from the 83871 zip code area, who reported that community members could not do most of their shopping within a 10 mile radius, felt that people traveled to 83843 (Latah County), more than 10 miles away, to shop at Winco for their food needs. In fact, the top five options mentioned in 83871 (Latah County) were located in 83843 (Latah County). Figures 4.6 (a-e) illustrate the prevalence of each food retail establishment in each of the five zip code areas.

Figure 4.6: Shopping patterns in a) 83501 (Nez Perce County), b) 83871 (Latah County), c) 83843 (Latah County), d) 83530 (Idaho County), and e) 83544 (Clearwater County)

a)

b)

c)

d)

e)

When asked about the affordability of those choices, in the closed-ended question, the majority of key informants in three out of the five zip code areas felt that choices were affordable. However economic access was mentioned numerous times in the open-ended questions about the barriers to nutritious food in the region. Using a reductionist approach, the researcher categorized open-ended responses to questions regarding access to nutritious foods into the four parameters of food security. Table 4.6 lists the reasons given. Specific barriers mentioned pertaining to economic access were food costs and income levels and/or the lack of jobs in the area. Specific barriers mentioned pertaining to informational access were education and cooking skills needed to prepare and preserve fresh foods and communication between producers and consumers. Specific barriers mentioned pertaining to utilization were limited hours of operation for local food markets and the limited ability to process SNAP and WIC benefits at local food markets. Several respondents gave multiple reasons and the proportions of answers were determined on the total number of separate answers given.

Table 4.6: Barriers to Access to Nutritious Food

ZIP CODE AREAS	**83843 (Latah)**	**83501 (Nez Perce)**	**83871 (Latah)**	**83530 (Idaho)**	**83544 (Clearwater)**
INDEX GROUP	Most Secure	Most Secure	Most Secure	Moderately Secure	Moderately Insecure
PERCEIVED BARRIERS					
Availability of Nutritious Foods	10	5	5	7	1
Geographical Access (Transportation)	15	8	1	3	2
Economic Access	26	19	2	4	3
Informational Access	20	9	3	4	1
Utilization (Systematic Access)	11	3	1	0	1
None	5	3	0	4	1
Not Sure	5	3	0	0	1

There was less consensuses on whether the region experienced a seasonal change to food security with the exception of the majority of respondents in 83871 (Latah County) that said that there was. Figure 4.5 shows the distribution of answers given to this close-ended question.

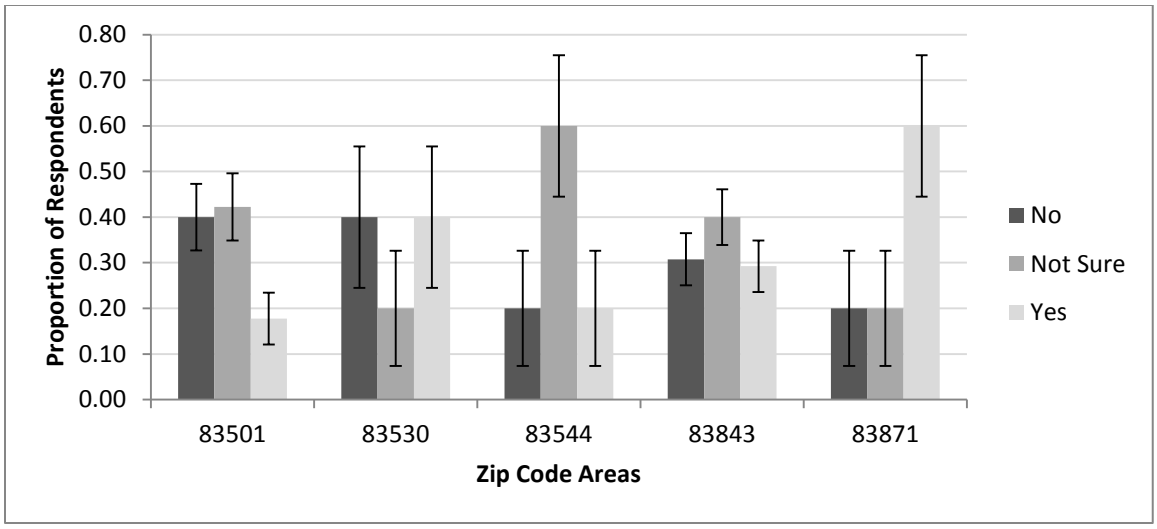

Figure 4.5: Seasonal Food Security

A follow-up open-ended question revealed more of a consensus that any change in seasonal food security would be more severe in the winter months, although some additional considerations were mentioned. Table 4.7 lists the reasons suggested for seasonal food security in the region.

Table 4.7: Perceptions of Seasonal Food Insecurity

ZIP CODE AREA	83843 (Latah)	83501 (Nez Perce)	83871 (Latah)	83530 (Idaho)	83544 (Clearwater)
INDEX GROUP	Most Secure	Most Secure	Most Secure	Moderately Secure	Moderately Insecure
PERCEIVED SEASONAL FOOD SECURITY					
Availability of resources is Diminished in the Winter	56%	67%	100%	75%	50%
Geographical Access is Inhibited by Weather in the Winter	0%	17%	0%	0%	0%
Economical Access is Diminished in the Winter	15%	8%	0%	25%	0%
Economical Access is Contingent on the Timing of College Student Loan Imbursements	4%	8%	0%	0%	0%
Seasonal Unemployment	15%	0%	0%	0%	50%
Access to Supplemental Food Resources is Restricted in the Summer	11%	0%	0%	0%	0%

Whether there were barriers to participation in SNAP and WIC programs on a whole were less agreed upon in all five zip code areas. A follow up open-ended question asking about specific barriers to each program revealed that there was also little consensus on what the most influential barriers might be. Tables 4.8 and 4.9 summarize the answers provided for potential barriers to both SNAP and WIC programs.

Table 4.8: Perceived Barriers to SNAP

ZIP CODE AREA	83843 (Latah)	83501 (Nez Perce)	83871 (Latah)	83530 (Idaho)	83544 (Clearwater)
INDEX GROUP	Most Secure	Most Secure	Most Secure	Moderately Secure	Moderately Insecure
PERCEIVED BARRIERS					
Distance Between Households and Attaining Benefits	8%	11%	40%	17%	20%
Inconvenient Hours	6%	2%	0%	17%	0%
Lack of Local Resources to facilitate the program Benefits	4%	7%	0%	0%	40%
Lack of Support of Government Programs	17%	15%	20%	0%	0%
Poor Customer Service	2%	7%	0%	0%	0%
Program Enrollment Limitations	19%	17%	20%	17%	0%
Restricted Qualifications Due to Asset Tests or Work Requirements	19%	13%	0%	17%	0%
Social Stigma	23%	24%	0%	17%	0%
Other	2%	4%	20%	17%	40%

Table 4.9: Perceived Barriers to WIC

ZIP CODE AREA	83843 (Latah)	83501 (Nez Perce)	83871 (Latah)	83530 (Idaho)	83544 (Clearwater)
INDEX GROUP	Most Secure	Most Secure	Most Secure	Moderately Secure	Moderately Insecure
PERCEIVED BARRIERS					
Distance Between Households and Attaining Benefits	10%	0%	67%	0%	18%
Inconvenient Hours	13%	0%	0%	25%	18%
Lack of Local Resources to facilitate the program Benefits	10%	10%	0%	0%	27%
Lack of Support of Government Programs	10%	10%	0%	0%	9%
Poor Customer Service	3%	10%	0%	0%	9%
Program Enrollment Limitations	13%	30%	0%	0%	9%
Restricted Qualifications Due to Asset Tests or Work Requirements	7%	10%	0%	0%	0%
Social Stigma	13%	20%	0%	25%	0%
Other	20%	10%	33%	50%	9%

Responses to the “Other” option for both programs included: cuts to federal funding and knowledge of the programs.

Figure 4.6 illustrates that, despite the uncertainty about SNAP and WIC programs, key informants agreed unanimously that there were food assistance options available in their communities.

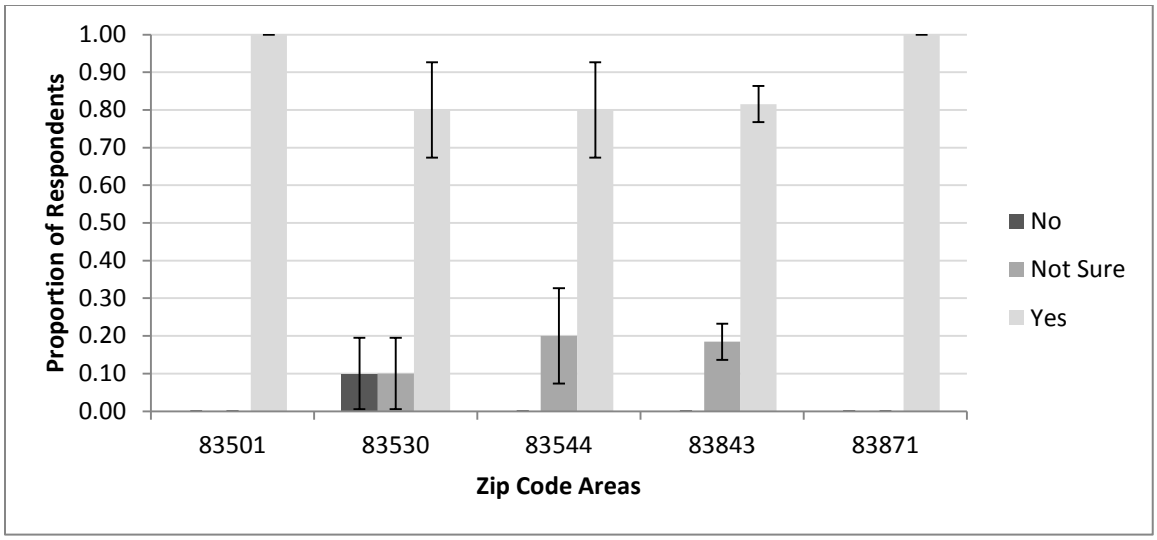

Figure 4.6: Presence of Food Assistance Options

An open-ended question asking respondents for the sources of those options suggested that the majority of perceived sources came from charity organizations and food banks. Table 4.10 summarizes the sources of food assistance stated by survey respondents.

Table 4.10: Food Assistance Sources by Zip Code

ZIP CODE AREA	83843 (Latah)	83501 (Nez Perce)	83871 (Latah)	83530 (Idaho)	83544 (Clearwater)
INDEX GROUP	Most Secure	Most Secure	Most Secure	Moderately Secure	Moderately Insecure
PERCEIVED FOOD ASSISTANCE SOURCES					
Charity Organization or Church Group	27%	28%	35%	22%	32%
Family and Friends	16%	13%	8%	11%	11%
Local Food Bank	27%	31%	35%	30%	37%
Local Food Pantry	12%	15%	12%	7%	21%
Local Farmers or Community Members	13%	8%	8%	4%	0%
Others	4%	5%	4%	26%	0%

Responses to the "Other" option included: Backpack for Kids, hunting and fishing, the school district meal program, and the State Food Bank.

Considering stability indicators centered on local food potential, there was little perceived presence of CSA's, but almost universal acknowledgment of community gardens within the region with the exception of 83544 (Idaho County). Figure 4.7 illustrates the distribution of answers to the closed-ended question about community gardens.

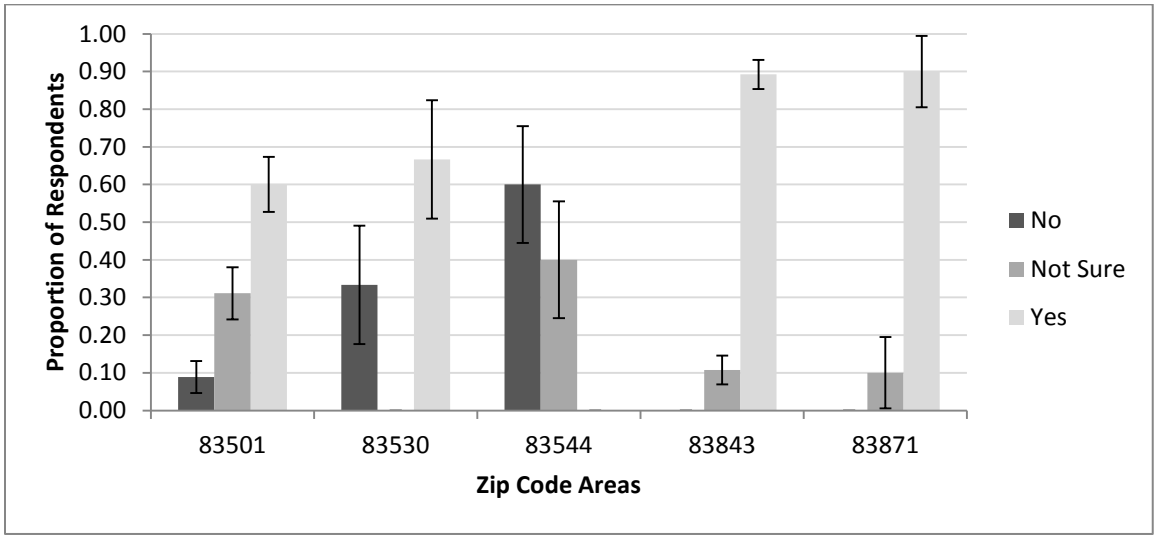

Figure 4.7: Perceived Presence of Community Gardens

Key informants were asked about potential barriers to another direct-to-consumer market, Farmer's Markets. Table 4.11 lists the answers given to this question.

Table 4.11: Potential Barriers to the Local Farmer's Market by Zip Code

ZIP CODE AREA	83843 (Latah)	83501 (Nez Perce)	83871 (Latah)	83530 (Idaho)	83544 (Clearwater)
INDEX GROUP	Most Secure	Most Secure	Most Secure	Moderately Secure	Moderately Insecure
PERCEIVED BARRIERS					
Too Far Away	5%	8%	38%	9%	0%
Too Expensive	29%	17%	19%	18%	8%
Do Not Feel Comfortable There	10%	6%	13%	0%	8%
There Are No Barriers to Shopping at the Farmer's Market	25%	17%	19%	27%	25%
Not Sure	16%	17%	6%	18%	33%
Other	15%	36%	6%	27%	25%

Responses to the "Other" option included: parking availability, mobility and transportation issues, limited accessibility of SNAP benefits, too few vendors and not a lot of variety.

4.3 Policy Review Results

The Clearwater, Latah, Lewis and Nez Perce comprehensive plans were analyzed to see what emphasis was given, if any, to local food production. Idaho County was not included because they have not written a comprehensive plan for their county. Language found in all comprehensive plans was focused primarily on the historic representation of the region as a prime agricultural producer and in emphasizing the need to protect the region's natural capital. The two largest cities within the region, Lewiston in Nez Perce County and Moscow in Latah County, have their own comprehensive plans and an additional text analysis was done on their plans.

Nez Perce County projects growth for the food processing sector and advocates for maintaining lands suitable for the production of food, fiber, timber, or minerals, but makes no mention specifically to local foods. The plan does define soils as the most important natural resource in the county in need of protection (Nez Perce County and Nezperce County 1998). The City of Lewiston's Comprehensive Plan, while not singling out local food production, acknowledges commercial agriculture as a prime source of water pollution.

The plan also discusses the need for agricultural land to be protected from future residential development (Lewiston City Planning).

Latah County was the only county to mention in its plan the need for the self-sufficiency of the regional food system (Latah County Planning and Latah County 2010). The Moscow City Comprehensive Plan reports an increase in farms in the county between 1997 and 2002, which is an anomaly to the national trend. In 2002, fifty four farms were reported to sell products, through all market options, directly to consumers (Moscow City Planning 2007).

Clearwater County, due to topographic restrictions, has a smaller agricultural industry than most of the counties. The plan uses standard legal language to suggest the protection of prime agricultural lands suitable for the production of food, fiber, and minerals. The county also strives to improve the livelihood of its citizens through outdoor recreation and the harvesting of supplemental food stocks (Clearwater County 2013).

Lewis County encourages the promotion of local resources and agricultural alternatives though none were specifically identified. The plan also reported that citizens feel strongly about preserving land for the production of food, fiber, and materials (Lewis County Planning Department and Lewis County 2009).

Participation in the farm-to-school program is supported in all counties but Clearwater County. Both Moscow S.D. #281 and Lewiston S.D. #340 report annual food budgets of 5% spent on local food (USDA 2013k). The Palouse Prairie School in Moscow reports annual food budgets of 1% spent on local food although they were not listed in the Idaho Preferred listing of schools participating in Farm-to-School (USDA 2013k; ISDA 2014) . Schools participating in farm-to-school listed serving local fruits and vegetables, particularly apples, potatoes, watermelons, pears, pluots, cherry tomatoes and grapes (ISDA 2014).

Chapter 5: Discussion

5.1 State of Regional Food Insecurity

This study revealed that the mixed method approach consisting of the descriptive food insecurity index, spatial analyses, and surveys of key informants provided complementary information to each individual method of analysis. Hyman (2005) reported that the introduction of space into analyses can enhance the empirical understanding of both global and local spatial effects on poverty and food security outcomes. Because of this and the spatial parameters of food insecurity and the discrepancies between urban and rural environments; the use of spatial analysis enriched the exploration of spatial relationships in the region and identified areas for further research to get closer to the understanding the spatial process of the phenomena. Results from this study described the variability in food insecurity at the zip code level, which is a finer-scaled approach than the county level, and a useful scale for community assessment and planning to target the most vulnerable populations (Cohen 2002; Barrett 2010). Analyzing food security is in line with the American Planning Association's more recent acknowledgment that food systems research adds an important contribution to the assessment of community health (Morgan 2009; American Planning Association 2007).

To answer research question 1 about the state of community food security in the North Central Health District of Idaho, the use of mixed methods and specifically the use of stakeholder surveys is in line with literature claims that assessments of food security should be context specific (Eric Holt Gimenez 2008). Research is appropriately moving towards capturing qualitative, local perceptions to improve the identification of food-insecure subpopulations (Barrett 2010; Franzini et al. 2009; Gibson 2011; Ecker, Olivier and Breisinger 2012; Pinstrup-Andersen 2009). Stakeholder input was also determined by Feenstra (2005) as one of the key indicators of the sustainable food system (G. Feenstra et al. 2005). This research found that the uncertainty of specific barriers to food assistance in the region reported by key informants is grounds for conducting future focus group sessions with the recipients and eligible participants of these programs.

Many urban food security studies focus on proximity to food retail establishments. The USDA classifies areas of the country as food insecure in rural environments that are more than 10 miles away from the nearest grocery store. Key informant respondents from four out of five of the analyzed zip code areas almost unanimously reported that residents in their communities could shop within 10 miles of their home. Thus, a study solely based on proximity might underestimate the presence of food insecurity in the region. Even in 83871 (Latah County), where key informants reported that most of their food needs could not be met within a 10 mile radius, past research has shown that proximity alone will not determine whether people perceive themselves to be food insecure and will not dictate the choices that communities make about their food purchases (Shaw 2006; Padmavathy and Poyyamoli 2011; Raja and Yadav 2008).

The findings of this study support the multidimensionality of food security research and the call for more collaborative efforts in analysis. To answer research question 2, a food insecurity index was created to identify areas within the region that were more food insecure. Because the literature suggests that the dimensionality of vulnerabilities vary across landscapes (Bashir and Schilizzi 2013), a global Moran's I spatial autocorrelation was used on rankings of the food insecurity index to answer research questions 3 concerning potential spatial patterns to food insecurity within the region and its hypothesis for complete spatial randomness. To identify which areas were most vulnerable we conducted a second Local Moran's I. A linear regression between the food insecurity index and population density was conducted to test the claim that food insecurity was correlated with population density (Palmer, Bailey, and Gatrell 1996). There was a significant negative linear relationship between density and index. Population density explained 21% of the variation of the phenomena in the region.

Food security in the North Central Health District of Idaho exhibits some spatial clustering. These relationships should be explored further to understand this observed pattern. The Local Moran's I test agrees with the initial descriptive map in Figure 4.1, which suggested clustering of low food insecurity values in the northwestern part of the region and higher food insecurity values in the middle and eastern part of the region. The local spatial autocorrelation analysis can be used to help develop further hypotheses about the nature of the spatial process dictating those relationships, such as diffusion (the spread of the attribute

through a fixed density), exchange and transfer (how local economies are affected by regional ones), interaction (dependent relationships or externalities), or dispersal (the dynamic movements of a population) (Haining 2003).

Community food security assessments should focus on the collective process instead of individual needs (Anderson and Cook 1999). Understanding what specific food choices exist within a region, how accessible those choices are and how they are perceived could guide local government agencies in their effort to increase food security in the future. Key informants were asked about policies that affected the local food market in their communities. Poultry zoning laws were listed as concerns in both 83501 (Nez Perce), and 83843 (Latah County). Respondents from 83843 also mentioned a policy that strengthens the local food market, a recently adopted Urban Agriculture ordinance that allows for community and market gardens in the City of Moscow. No policies affecting the local food market were listed in the remaining three zip code areas analyzed.

In the key informant surveys, availability and economic access were the two most commonly stated barriers to obtaining nutritious foods. And while some regional participation in the Farm to School program is reported on the Idaho Preferred data and county comprehensive plans, key informants in all five zip code areas did not think that the schools in their communities participated in the program (Preferred 2012).

5.2 Expected Outcomes & Further Research

Outcomes of this research should target vulnerable areas of the region for collaborative programs and further analysis. Flexibility, adaptability, diversification, and resilience are key words to the community food security assessment and the identification and weighting of indicators can only truly be decided by the food insecure themselves (Maxwell 1996). Focus groups in areas with the highest food insecurity could further supplement the findings with valuable insight from these populations.

The methodology used in this study is also anticipated to be used as a template for the other six health districts of Idaho. To verify the explanatory power of each of the sixteen variables and potentially reduce the number to those explaining the most variation of the phenomena in the region, an additional research component to be explored is Generalized Least Squares regression models (GLS). As opposed to ordinary linear regression, GLS

relaxes the assumption of traditional Ordinary Least Squares which allows for autocorrelation in the dataset for a cross section of time (Term and Burke 2010).

5.3 Limitations

Our study had several limitations. Primarily, nutrition and quality were not quantitatively assessed in this research. With additional funding we could have conducted Food Costs and Nutrition Environment Assessments (NEM) of stores in the region. The researchers also found it difficult to quantify the quality of food choices available at all food retail outlets. It is also difficult to tabulate all of the community gardens, house gardens, and the number of farmers that let people grow foods on their unused lands which limits the researcher's' ability to understand all of the alternative forms of food access being utilized. The survey data cannot be used to generalize to the population because it was not collected with a stratified-random sampling design. Instead, this study relied on respondents whose contacts were readily available and who were familiar with web-based surveys. In analyzing the key informant surveys, only 5 out of the 37 zip code areas had a large enough sample size to add to our analysis. Further research should also target the areas under surveyed to supplement the data.

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Appendix A

Letter of Approval from the Institutional Review Board at the University of Idaho

University of Idaho

November 19, 2013

Office of Research Assurances
Institutional Review Board
875 Perimeter Drive, MS 3010
Moscow ID 83844-3010

Phone: 208-885-6162
Fax: 208-885-5752
irb@uidaho.edu

To: Tamara Laninga
Cc: Christine Schuette

From: Traci Craig, PhD
Chair, University of Idaho Institutional Review Board
University Research Office
Moscow, ID 83844-3010

Title: 'The Prevalence of Food Insecurity and the Geographical Disparities Affecting Food Security Metrics in the North Central Health District of Idaho'

Project: 13-272

Approved: 11/16/13
Expires: 11/15/14

On behalf of the Institutional Review Board at the University of Idaho, I am pleased to inform you that the protocol for the above-named research project is approved as offering no significant risk to human subjects.

This approval is valid for one year from the date of this memo. Should there be significant changes in the protocol for this project, it will be necessary for you to resubmit the protocol for review by the Committee.

Traci Craig

Traci Craig

Appendix B

Food Insecurity Survey Instrument

In answering these questions, think about Food Security as a state when all people, at all times have the geographical, economical, and informational access to an adequate supply of safe and nutritious food that also satisfies their food preferences. *Your community is defined in this study by your zip code.*

Access & Availability

1. Is community food insecurity a problem in your community?
   - Yes
   - No
   - Not Sure

2. Can residents in your community do their food shopping within a 10 mile radius of their home?
   - Yes
   - No
   - Not Sure

3. Does the food retail provider nearest to your community offer a wide variety of food options?
   - Yes
   - No
   - Not Sure

4. Does the food retail provider nearest to your community offer the foods that residents in your community prefer to purchase at a price that most people can afford?
   - Yes
   - No
   - Not Sure

5. Where do residents in your community do most of their households' food shopping?

- Store A (will fill in with place-based retail establishments)
- Store B
- Store C
- Other, please list_____
- Not Sure

6. Do residents in your community experience a seasonal change to their food security?
   - Yes
   - No
   - Not Sure

7. If so, please describe the seasonal change to food security experienced in your community? **(open ended question)**

8. Are there any public transportation options available in your community that connect to places to obtain food?
   - Yes
   - No
   - Not Sure

9. Are there any “para-transportation” options in your community? (private door-to-door services, supermarket vans, elderly assistance, not taxis)
   - Yes
   - No
   - Not Sure

10. What other barriers exist regarding access and availability to adequate and nutritious food in your community? **(open ended question)**

Utilization

11. Are there any barriers to participation in the Supplemental Nutrition Assistance Program (SNAP) formally called Food Stamps in your community?
    - ☐ Yes
    - ☐ No
    - ☐ Not Sure

12. If so, what are the barriers to participation in SNAP? **(Check all that apply)**
    - ☐ Lack of local resources to facilitate the program benefits
    - ☐ Distance between households and attaining benefits
    - ☐ Program enrollment limitations
    - ☐ Inconvenient hours
    - ☐ Poor customer service
    - ☐ Social stigma of participating
    - ☐ Lack of support of government programs
    - ☐ Restricted qualification due to asset tests or work requirements
    - ☐ Other, please list _____

13. Are there any barriers to participation in the Women, Infants, and Children Program (WIC) in your community?
    - ☐ Yes
    - ☐ No
    - ☐ Not Sure

14. If so, what are the barriers to participation in WIC? **(Check all that apply)**
    - ☐ Lack of local resources to facilitate the program benefits
    - ☐ Distance between households and attaining benefits
    - ☐ Program enrollment limitations
    - ☐ Inconvenient hours
    - ☐ Poor customer service

- Social stigma of participating
- Lack of support of government programs
- Restricted qualification due to asset tests or work requirements
- Other, please list _____

15. Are there other food assistance options in your community?
    - Yes
    - No
    - Not Sure

16. If so, what are the other food assistance options present in your community? **(Check all that apply)**
    - Charity organization or church group
    - Family and friends
    - Local food bank
    - Local food pantry
    - Local farmers or community members
    - Other, please list _____

17. What other barriers exist regarding the utilization of adequate and nutritious food resources in your community? (open ended question)

Stability

18. Does your community have Community Supported Agriculture (CSA's)? *(CSA's are direct-to-consumer markets where consumers purchase a share of the crops produced each season)*
    - Yes
    - No
    - Not Sure

19. If so, please list the Community Supported Agriculture (CSA's) in your community? **(open ended question)**

20. Are there any community gardens in your community?
    - Yes
    - No
    - Not Sure

21. If so, please list the community gardens in your community and who operates them *(e.g., city/county government, religious organization, food bank, etc)*? **(open ended question)**

22. What, if any, are the barriers to residents shopping at your community's farmer's market? **(Check all that apply)**
    - Too far away
    - Perceived to be too expensive
    - Do not feel comfortable there
    - Not Sure
    - There are not barriers to shopping at the farmer's market
    - Other, please list_____

23. Are there local policies that affect the availability of local foods in your community? *(e.g. zoning ordinances that restrict the installation of community gardens)*
    - Yes
    - No
    - Not Sure

24. If yes, please list policies or ordinances that affect the availability of local foods in your community. **(open ended question)**

25. Does your school district participate in the Farm to School program?
    - Yes
    - No
    - Not Sure

26. What other barriers exist regarding adequate and nutritious food resource stability in your county? **(open-ended question)**

Socioeconomic

27. What key informant group does the industry that you represent or formerly represented fall into?
    - Farmer / Producer
    - Health Care
    - Food Assistance
    - Food Retailer
    - Food Processor
    - Food Distributor
    - Community-Based Organization
    - Faith Community
    - Government
    - Economic Development
    - Waste / Disposal
    - Other, please list_____

28. What is your age group?
    - 18 – 24 years old
    - 25-34 years old
    - 35-44 years old
    - 45-54 years old
    - 55-64 years old

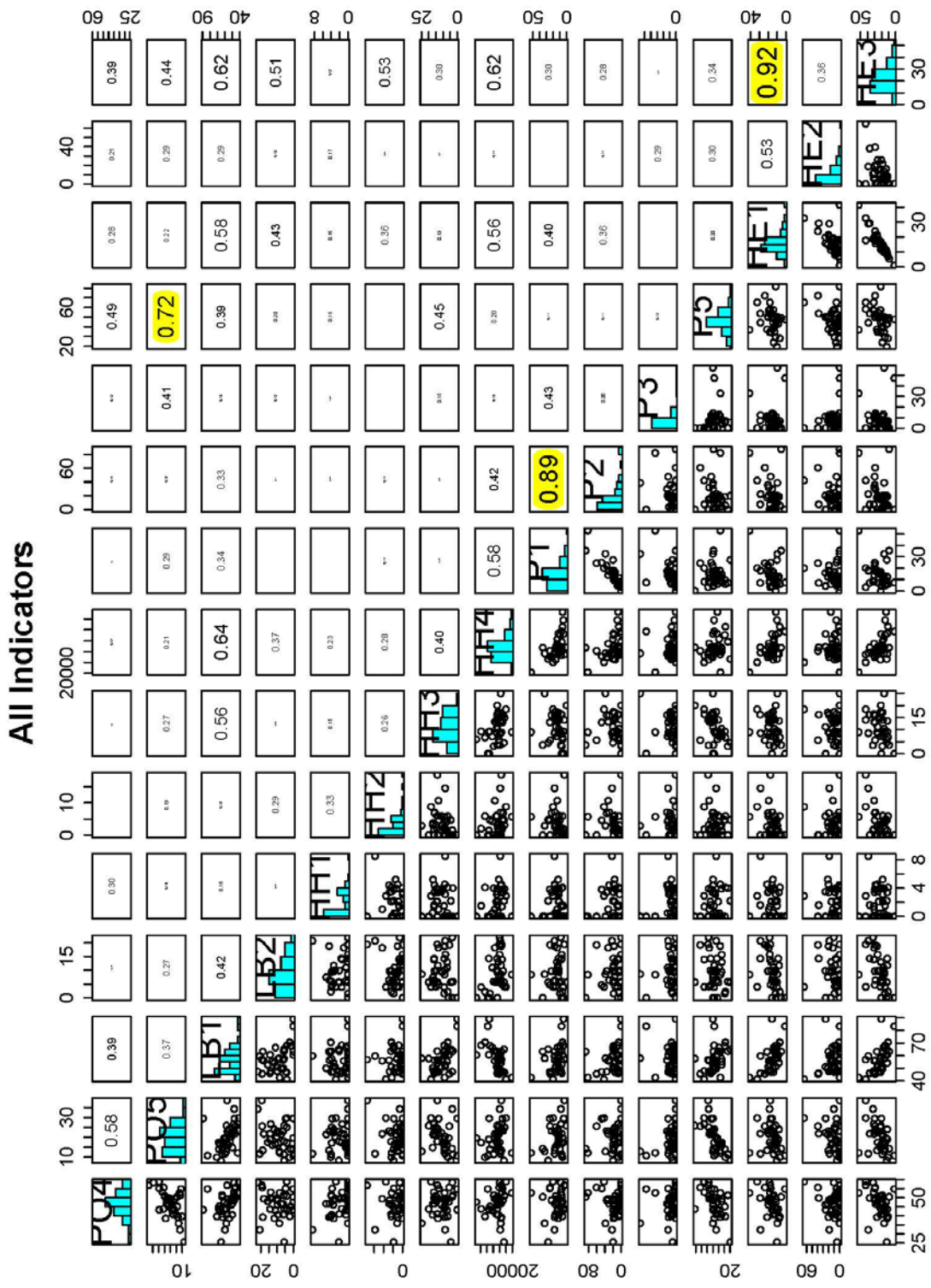
- 65-74 years old
- 75 years or older

29. What is your gender?
    - Male
    - Female

30. What is your zip code?
    - Please list_____

Appendix C

Correlation Pair Plots for All Indexing Indicators


All Indicators

Appendix D

Raw Data for Index

Zip Code	Median Age	Laborforce Participation	Unemployment Rate	Male, no Spouse w/ Children	Female, no Spouse w/ Children	65 and older Living Alone	Median Household Income	Poverty Rate	Poverty Rate 65 and Older	Households Receiving	Households w/o Health Insurance	Under 18 - w/o Health Insurance	Seasonal Food Retail Establishments	Grocery Store Retail Outlets	SNAP Retail Store Outlets	Food Pantires & Banks
83501	40.9	63.5	5.7	2.1	6.0	14.0	45354	11.1	8	10.0	12.5	6.3	5	7	34	8
83520	56.8	56.9	19.4	0.0	18.7	14.0	37375	3.3	0	10.3	17.7	0	0	0	0	0
83522	40.5	50	6.2	0.5	3.2	17.3	42424	16.9	8.2	3.4	14.7	9.5	0	2	2	0
83523	45.1	67.8	1.6	0.0	4.7	9.2	55156	9.7	5.6	5.0	11.9	9.6	0	1	1	1
83524	46.1	51.1	9.8	3.5	5.9	11.1	44375	15.9	11.2	9.7	19.9	25.8	0	0	1	0
83525	52.6	42.6	8.4	0.0	5.7	8.9	20948	53	32.9	5.7	41.3	0	1	0	2	0
83526	38.5	54.2	11.7	3.4	0.0	13.6	37917	12.4	0	0.0	7.9	8.5	0	0	0	0
83530	46.6	56.4	6.4	4.4	7.1	16.0	38151	17.5	14	14.2	15.6	0.7	3	2	5	6
83533	54.7	83.2	0	0.0	0.0	0.0	58438	7.4	47.4	0.0	1.1	0	0	0	0	0
83535	43.6	60.7	14.3	0.0	1.4	9.1	56750	12	5.4	6.3	8.8	7.1	1	1	1	0
83536	48.6	47.3	9.7	3.4	6.8	16.0	34653	22.2	8.8	13.5	20.4	19.5	2	0	1	2
83537	49.3	55.9	18.2	1.0	10.7	13.2	47500	13.8	4	5.6	19.5	12.2	0	1	1	3
83539	50.9	46.7	4.1	3.9	3.1	14.9	32548	16.1	6.8	5.0	14.3	9	1	0	2	0
83540	32.2	59.7	20.7	8.5	14.5	8.5	39013	17.9	12.4	19.9	28.8	18.8	1	1	1	1
83541	49.5	51.3	10.1	3.1	0.0	8.5	44457	11.4	10.9	3.3	11.5	2.1	0	0	0	0
83542	43.3	89.1	0	0.0	0.0	0.0	56250	4.3	0	12.0	15.8	25.6	0	0	1	0
83543	46.6	50	7.5	5.2	3.7	17.0	41250	12.4	7.1	8.5	14.9	21.5	0	0	1	0
83544	49.2	47.7	9.9	2.1	2.1	14.4	42631	11.6	7.6	6.7	16.4	14.9	2	4	5	0
83545	49.3	55.3	13	0.0	1.3	7.1	42159	14.4	4.6	5.3	16.8	15.7	0	0	0	0
83546	49.8	46.1	14.3	1.6	0.0	16.2	43819	7.1	7.1	6.7	29.1	38.1	0	1	1	0
83547	55.6	45.6	19.2	0.0	0.0	5.6	40625	24.4	0	14.1	23.9	39.5	0	0	0	0
83548	35.8	57.9	8.6	0.0	2.9	25.0	38333	32.5	57.1	8.8	9.8	0	0	0	0	0
83549	58.8	41.3	4	2.9	8.8	18.4	30139	20.1	0	13.6	32.6	64.7	1	0	3	0
83552	39.2	63.1	18.8	4.5	2.6	8.8	37298	17.7	11.4	6.4	21.4	20.3	0	1	1	0
83553	53	47.8	13.9	1.4	1.8	16.4	36442	8.1	0.7	7.1	18.2	5.9	0	1	1	1
83554	58.3	47.3	21.9	0.0	1.5	3.5	39844	8.4	0	10.0	18.6	10.6	0	0	0	0
83555	55	47.1	4.7	3.8	4.6	13.0	35625	24.9	12.2	5.5	17.4	5.6	0	0	1	2
83806	48	52.9	15.7	0.0	0.0	8.3	40139	7.3	7.9	31.0	18.3	0	1	0	0	0
83823	43	66.4	11	0.5	4.3	7.1	51518	13.4	13	10.8	14	14	2	2	1	2
83827	50.4	63.2	0	0.0	0.0	3.6	43571	35.4	0	12.5	5.5	0	0	0	0	1
83832	39.6	70.6	2.2	4.1	5.9	6.7	62829	6	6.8	5.8	7	1.3	2	0	0	1
83834	43.7	57.7	5.7	0.0	0.0	20.0	43884	0	0	32.4	11.6	0	0	0	0	0
83843	25.5	65.1	5.7	2.2	4.7	4.5	33189	27.2	5.3	10.1	10.2	4.9	18	6	17	12
83855	40.5	57.6	9.4	3.9	3.0	10.3	43750	11.5	4.1	4.7	13	13.7	2	1	1	1
83857	51.3	63.6	5.9	4.0	0.0	3.1	49148	7.1	0	3.6	14	6.7	0	0	0	0
83871	43.8	68.2	3.9	1.5	2.0	9.2	68816	4.8	2.1	5.4	10.1	6.2	1	1	1	1
83872	47.6	60.6	0	0.0	0.0	6.0	76406	5.9	0	2.3	11.4	16.2	0	0	0	0