

Logistics Cities
Poverty, Immigration and Employment in Seattle's Southern Suburbs

Phillip A. Neel

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Luke R. Bergmann

William B. Beyers

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Phillip A. Neel

University of Washington

Abstract

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Phillip A. Neel

Chair of the Supervisory Committee:

Professor Luke Bergmann

Department of Geography

Despite its reputation as a "post-industrial" metropolis, parts of Seattle have either become or remained devoted to manufacturing and logistics. Theories of migration and industrial development that emphasize employment in services, information technology and hi-tech production in American cities tend to obscure patterns of re-industrialization and obscure areas in which de-industrialization never "finished" or simply never quite took place. Against readings that conceptualize American cities' industrial and demographic changes as components of "neoliberalism" or a new phenomenon of "globalization," I explore industrial and demographic shifts in the Seattle-Tacoma-Bellevue Metropolitan Statistical Area as local expressions of long-form, always-global capitalist development trends, in which ever-expanding value generation via traditionally productive industries remains a central necessity. Using the most recent US Census, State Employment Security Department and Department of Transportation data, I quantify and map the extension of this global productive infrastructure into the Seattle region. I then document the geographic overlap of this productive infrastructure with new suburban zones of

high poverty and high foreign-born settlement and quantify the dependence between these suburban residential tracts and their neighboring industrial tracts using origin-destination data on industry. The result is a picture of the “logistics cities” that exist within “postindustrial” Seattle.

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Introduction

Review of Existing Literature

Much has been written on the long-term industrial and demographic shifts that accompanied the restructuring of global capitalism after the crises of the 1970s (a short list would include: Harris 1996, Harvey 2007, Smith 1996, Piore 1980, Sassen 1988, 1990, 1991). Within the United States, an enormous amount of work has been produced exploring the rise of service industries within major metropolitan zones, including both high-wage producer services and low-wage services performed largely by migrant laborers. But less research has been done after the immediate period of restructuring (in the 1980s and 1990s) had succeeded in concentrating these new service industries. In many areas, the picture seems to simply stop (see: Beyers 1991, Beyers and Alvine 1985, Gibson 2004, Gray, Golob and Markussen 1996, Haug 1991, 1995, and Hughes, Holland and Wandschneider 1991). These works established an analytic foundation for studies of the region, and that foundation's focal point was the central city and its concentration of services. Because of this focus, however, the analytic foundation for the peri-urban areas (aside from, arguably, the hi-tech suburbs around Bellevue) is much less firmly established. Neither geographically nor theoretically central, these areas have remained understudied, despite significant demographic changes that have occurred over the last few decades.

In part, the existing research cited above was ultimately incorporated into formal institutions, to the extent that it appears today as both common sense and an integral part of global business management. The picture doesn't necessarily stop, so much as transfer out of theory and into administration, as work once done in largely academic settings was taken up by

private consulting firms, local government and the analytic wings of large digital-era conglomerates—the activity of theorizing was itself restructured by the very industrial restructuring it had analyzed. In Seattle, Gibson (2004) documents local politicians, planners and business leaders’ attempts to remake the city in order to accommodate producer services, health care, education and hi-tech industries, all couched in the terminology of building a “post-industrial” Seattle, soon to become a “global city.” At the theoretical level, this transfer into official discourse seems to have delayed further inquiry into new dynamics within industrial development, especially as they relate to newer demographic shifts.

Throughout the ‘80s and ‘90s, this type of research proliferated. Sassen (1988, 1990, 1991) and Piore (1980) are two of the hallmark figures in this literature, exploring industrial and demographic restructuring, respectively. Sassen (1990, 1991) has argued that, in the high-GDP regions, the new global division of labor developed in the post-70s era is necessarily accompanied by the increasing centrality of service work and the geographical concentration of economic activity, particularly producer services, in “global cities” such as New York, London and LA. Noyelle and Stanback (1984) take a broader view, emphasizing how economic restructuring not only concentrates corporate headquarters in these “global” urban centers but also creates cascading effects, in which mid- and low-level headquarters arise in a new “urban hierarchy,” with the entire corporate complex leading to the general expansion of markets. Piore (1980), Sassen (1988) and Harris (1996) have argued that this phenomenon also creates a “dual labor market,” as low-wage, often migrant labor is required to sustain the basic operation of the high-wage service core.

Waldinger and Lichter (2003) and others have contributed to this body of research through extensive ethnographies in key global cities identified by the literature. Meanwhile,

others, such as Beyers (1993) and Coffey and Bailly (1991) have further defined the relevant variables and honed the analytical frameworks that are deployed in this research by sharpening definitions of the “producer services” as an industrial category and understanding exactly how these services operated in given regions.

In both the Pacific Northwest and the Seattle Metropolitan Area specifically, we have a clear picture of how industrial restructuring was initially distributed after the deindustrialization of the region, at least until the early 1990s. This picture is consistent with the findings of Sassen, Piore, Harris, Waldinger and Lichter elsewhere. In general, we see a concentration of producer services and hi-tech production paired with a growth in lower-end service work, shifting a significant share of the economic base of the metro area and its greater region from manufacturing and resource extraction to the service and hi-tech sectors by the end of the 20th century. This picture is provided at the Metropolitan Statistical Area, state and regional scale in reviews by Beyers (1991), Beyers and Alvine (1985), Brown and Hultquist (2013), Golob and Markuson (1996), Haug (1991, 1995), and Hughs, Holland and Wandschneider (1991). For Seattle itself, Gibson (2004) gives an extensive account of the restructuring of the downtown urban core from the 1970s through the 1990s.

Additional demographic overviews of the Seattle region are offered by Berube and Kneebone (2013), Felt (2012) and Langston (2012), alongside the long-term overviews given by Morrill (2011, 2013). An array of topics are also covered in Brown and Morrill (2011), reviewing both demographic and industrial trends within the region, including overviews of China-Seattle relations, case studies on the gentrification and development of specific neighborhoods, and reviews of overarching demographic trends. All of this work gives a location-specific focus to the broader literature on segregation (Philpott 1978) migrant settlement

(Harris 1996), urban revitalization (Hyra 2012) and the growth of suburban poverty (Holliday and Dwyer 2009). Berube and Kneebone (2013) provide the most detailed case study within the Seattle Metro Area, but do not strongly connect the observable demographic trends to any aspects of industrial restructuring in the region.

The demographic shift over the past twenty years has been significant within the Seattle Metro Area, and within South King County specifically. The municipalities that make up the southern part of the county (many only recently incorporated) have transformed from predominantly white, middle class suburbs to diverse zones for the settlement of new foreign-born immigrants, as well as destinations for poorer residents displaced by development in the urban core. As of the last census, cities like Tukwila (36% foreign born), SeaTac (31%), Renton (28%) and Kent (26%) have some of the highest percentages of foreign-born residents in the State, outmatched only by the (predominantly Hispanic) migrant populations in Washington's agricultural hinterland (Langston 2012). This demographic composition is in stark contrast to those same cities' profiles circa 1990 (Morrill 2011, "Mixed Metro...").

According to data gathered by the Migration Policy Institute (2014), foreign-born residents in Washington State have increased from 322,144 in 1990 to 916,399 in 2012, an increase of 284% over a little more than twenty years ("Washington"). Much of this growth is still predominantly Hispanic migration to the rural parts of the state, but the Seattle Metropolitan Area and King County specifically have seen a substantial portion of the increase as well. Unlike the agricultural migrant population, however, King County exhibits enormous diversity when it comes to the origins of its foreign-born residents, with large numbers of migrants coming from every inhabited continent and no single group in clear majority. Using the same groupings as King County demographer Chandler Felt (2012), the county's foreign-born migration shows

clear diversity in origins: Southeast Asians predominate (at 70,065 in 2008), followed by East Asians (67,000) and Mexicans (48,820). These three largest groups are then trailed by South Asians (33,845), Eastern Europeans (33,200), Africans (28,025), and North and Western Europeans (29,147), with Canadians (18,054), Central & South Americans (15,812) and Australia-Pacific Islanders (6,745) constituting the smaller migrant groups (Felt 2012).

This increase in migrant settlement coincides with a suburbanization of poverty in the region, consistent with national trends in the geography of poverty (Berube and Kneebone 2013) and with a similar trend toward suburban settlement for newly-arrived migrants (Singer, Hardwich and Brettel 2008). The last three decades have seen poverty growing fastest in suburbs. The especially rapid growth of suburban poverty in the 2000s has resulted in a national shift in poverty's overall center of gravity, as the suburban poor "now account for the largest poor population in the country," even while poverty rates remain marginally higher in cities and rural communities (Berube and Kneebone 2013, p. 3). This trend has made the suburbs, rather than the inner city, "home to the largest and fastest-growing poor population in the country," (ibid. p. 18).

The Seattle Metro Area mirrors the national pattern. This is most visible in South King County, where the same time period has seen an explosion in foreign-born settlement. In the Seattle Metro Area, the foreign-born population grew from 150,152 in 1980 to 516,941 in 2006, an absolute increase of 366,789 individuals (and this number likely underestimates the true numbers, since many may be undocumented). As a percentage of total population, the foreign-born more than doubled, from 7.2% in 1980 to 15.8% in 2006 (Singer, Hardwich and Brettel 2008). As the research by Felt (2012) and Langston (2012) above shows, many of these migrants settled in the southern suburbs. Berube and Kneebone (2013) argue that as much as 19% of suburban poverty growth between 2000 and 2009 was accounted for by foreign-born individuals,

and that number nearly doubles to 32% when counting for all individuals in foreign-born-headed families (Berube and Kneebone 2013, p. 150, footnote 28).

Insufficiency of Existing Literature

Of the existing research, the academic literature on industrial restructuring in the region slows significantly in the 1990s as the prominence of hi-tech and producer services becomes publicly acknowledged and academic reports are replaced by city- state- and business-led alternatives (documented by Gibson 2004). At larger scale, the “global cities” literature continues to build on its key tenets. Sassen’s most recent book (2014) expands the scale and scope of the divides identified in her earlier work on dual labor markets and the bifurcation of services in the restructured economies of the post-1970s period, but it takes the fundamental dynamics as given, simply adding in ecological catastrophe as yet another push-factor in the overall process. None of this original literature returns to the “post-industrial” or “global” cities identified earlier and asks whether or not they might be re-industrializing, or whether they may have failed to fully de-industrialize as predicted.

On the demographic side, there is an abundance of good, contemporary research showing new demographic trends, particularly the suburbanization of poverty (Berube and Kneebone 2013) and migrant settlement (Singer, Hardwich and Brettel 2008). The problem here is not theoretical ossification, so much as the lack of an overarching, integrated theory capable of tying these demographic shifts to related industrial changes. Whatever insufficiencies it may have, the global cities and dual-labor market literature at least made the connections between demographic and industrial trends a central focus of research. The current demographic work is largely

engaged in by policy think-tanks such as the Brookings Institute, where demographic trends are understood at a certain distance from political restructuring, usually mediated strongly by political policy. Many of these reports (including Berube and Kneebone's 2013 hallmark study) are essentially policy papers, and do not concern themselves with global economic trends or shifting industrial employment and value composition.

Probably the most important failure of the existing literature, however, is its short-sightedness when it comes to large-scale trends in the development of global capitalism. All of the literature above takes a particular (and short-lived) period in American history as a sort of standard from which the post-1970s restructuring would then diverge. For industry, this means the decrease of "traditional" employment sectors like manufacturing and the rise of services. For demography, this means the decomposition of the white post-war suburb and the gentrification of the inner city. These baselines are taken for granted, and are rarely placed within any longer historical arc. In general, this literature tends to overemphasize the differences between the "neoliberal" period (Harvey 2007) and previous cycles within global capitalist development. This theoretical mistake has been termed the "golden age illusion" (Weber and Rigby 1996), due to its reliance on the false baseline of post-war Keynesianism.

There is an abundance of existing literature on questions of migration and global economic development that do not make these same theoretical presumptions. This work comes from multiple sources, and only a brief overview is possible here. Carey McWilliams (1939) offers the historical hallmark of such research on migration in his documentation of the agricultural industry in California. In Seattle the best existing historical overview is given by Klinge (2007), especially in its account of the city's long-term southern slum settlements such as the original Skid Road and Seattle's Hooverville. For industrial change, the technological

trends are outlined by Walker and Storper (1991), while the large-scale global changes are documented by various other scholars in the Marxist tradition, including the World-Systems theorists (Wallerstein 1974, Arrighi 2009, 2010, Silver and Arrighi 1999, Silver 2003), the Brenner school (Brenner 2006, Wood 2003), and scholars such as Paul Mattick Jr. (2011).

These are only a handful of such works, but they point at the possibility of a different conceptualization of these shifts, which place them within long-term norms and trends within a global capitalist economy, rather than as divergences or transformations from an arbitrary post-war baseline. At the same time, many of these works only exist at the largest global scale. It is often difficult to translate long-term trends and global networks into a coherent narrative at regional or local levels. The scholars above, then, tend to offer few counterpoints to dual-labor market or global cities theories, despite varying levels of conflict when it comes to the interpretation of global trends.

Goals of this Study

With this in mind, my aim in this thesis is to take the spirit of these larger-scale analyses and apply them to the local scale. I will attempt to update the picture of industrial restructuring in Seattle, questioning the centrality of “post-industrial” industries to the city’s current employment composition. I will also attempt to link the area’s demographic changes to these industrial shifts.

The Seattle Metro Area is an ideal location to apply this research. First, with concentrations of producer services (Beyers 1991) and hi-tech industries (Haug 1991 and 1996) located in and around a “spectacular city” carefully designed with global competition in mind

(Gibson 2004), Seattle epitomizes the “post-industrial” city and has built its image around this. Seattle is also a unique migrant settlement zone that is likely more prefigurative of future migration in the US as a whole. Among all the 21st-century gateway cities, emerging, pre-emerging or re-emerging, the Seattle Metropolitan Area is one of the few that has more than 15% foreign-born population and a diverse migrant stream. Nearly all the other metro regions that saw significant increases in their migrant populations between 1980 and 2006 (areas such as Phoenix, Dallas, Las Vegas and Orlando) were South or Southwestern cities where the Hispanic population made up a significant majority of the immigrant population (Singer, Hardwich and Brettel 2008). By contrast, as Felt (2012) shows, Seattle’s growing migrant population is relatively more diverse. Only a handful of other cities, such as Atlanta and the San Francisco Bay Area, follow a similar pattern.

Most importantly, Seattle has also always contained “logistics cities,” defined in more detail below. Underneath the intentionally crafted imagery of “post-industrial” transformation (see Gibson 2004), the region’s traditional logistical industries (such as warehousing, transportation and utilities) did not disappear. As global supply chains were re-centered around factory complexes in China’s special economic zones, Seattle’s position relative to Pacific Rim trade became an essential asset. While Japanese capital was being funneled into the downtown core (Gibson 2004), the rest of the metro was being rebuilt to accommodate new commodity flows to and from China. On Deng Xiaoping’s first visit to the United States in 1979, Seattle—at that time still reeling from the Boeing Bust—was one of the handful of places he visited outside of Washington DC (Royer 2013). In that same year, Washington state founded a China Relations Council and the first Chinese cargo ship to visit any port in the US for thirty years docked at the Port of Seattle, despite the embargo (Wilhelm 2011). By 1996, the State of Washington had

opened an office in Shanghai and a number of trade agreements had been secured at the port. By 2010, the total value of Washington state exports to China was more than \$10 billion (See: “Chronology...”). These new international relations would become central to the Seattle metro area’s changing industrial structure, particularly in and around major ports and rail yards, where they translated into strong shares of employment in the logistics industries.

A central argument of this thesis will be that the dual-labor market theory does not properly account for such growth of employment in logistics, which represents the direct integration of a region into global productive infrastructure. **I will demonstrate that, though the Seattle area has seen an overall decline in manufacturing and logistics employment shares compared to its well-documented boom in services and information technology, it has nonetheless retained and restructured its traditionally industrial functions, sometimes in a new form. This may be understood as re-industrialization or simply the failure to fully de-industrialize, per the expectations of literature that emphasized the role of producer services at the expense of the productive and circulatory industries. Alongside the rise of services in the central cities, the region seen the construction and/or retention of distinct “logistics cities” on the periphery. These “logistics cities,” taking the form of distinct industrial and demographic clusters within the MSA as a whole, are the focus of this study.**

In what follows, therefore, I will begin with a review of new literature on the “logistics city.” I will then use regional economic data to review the industrial variables of interest, perform a series of cluster analyses and finally identify super-clusters and corridors of logistics employment within the Seattle Metropolitan Statistical Area (MSA) in an attempt to define

which parts of the city are primarily purposed as “logistics space.” Throughout this study, the Seattle MSA boundaries used by the Puget Sound Regional Council will be used as well. Though these boundaries include a number of rural and entirely unsettled areas within the eastern tracts, these tracts still contain employment values. It is also important to use these boundaries for comparability purposes, both when making historical comparisons (some of these rural tracts may once have had industrial activity in the form of natural resources industries) and when making comparisons to other metropolitan complexes, in which more industry may be concentrated in these more “rural” areas (as in China’s Pearl River Delta, for example).

This will be followed by a review of the region’s demographic composition, using an array of secondary sources paired with a similar series of cluster analyses to identify super-clusters of high poverty, high foreign-born population and high shares of workers employed in logistics. These demographic super-clusters will then be compared to the industrial data, showing a geographic overlap between the region’s new zones of suburban poverty, migrant settlement, and the location of logistics industries. Finally, this will be paired with a study of Origin-Destination data, showing the employment dependence between demographic and industrial super-clusters, primarily in south King County. The result is a picture of the metro area that cannot be fully accounted for by the global cities and dual-labor market theories of industrial change or migration under “neoliberal” or “post-industrial” conditions, due to its persistence of industrial activity and the quantifiable linkage between clusters of immigrant settlement and employment in these particular industrial clusters.

Section I

Logistics

Preface: Logistics Cities

Seattle has always been a gateway. Beginning as little more than a timber milling supply chain linked to a bay, its first industrial structure facilitated the extraction of natural resources out of the rural hinterland of the Pacific Northwest. Soon, this early infrastructure was repurposed as the supply chain shifted northward, the city becoming a key node in the transit of commodities and labor between the Klondike gold fields and the continental United States (Klinge 2007). Today, Seattle's position relative to Pacific Rim trade routes and interior agricultural goods and natural resources has facilitated a revival of its logistical heritage. Behind popular narratives of the hi-tech "global city," there sits a second city, much older than the first. This is Seattle, the logistics city.

Logistics, as a topic of study unto itself, has enjoyed a recent revival in geography and Marxist theory more generally. Deborah Cowen's (2014) recent book, *The Deadly Life of Logistics: Mapping Violence in Global Trade*, is at the current apex of this trend in Geography proper, while Jasper Bernes' (2013) "Logistics, Counterlogistics and the Communist Prospect," has become a regular touchstone for recent debates within contemporary Marxist circles.¹ These

¹ See also Alberto Toscano's two articles (2011 and 2014), offering counter-points to Bernes' positions.

circles often overlap within the discipline, with a session at the 2015 meeting of the Association of American Geographers focused on “Logistics and Power,” reviewing texts by Cowen, Bernes and others. Much of this interest has even begun to bleed over into more mainstream leftist outlets, exemplified in articles such as Joe Allen’s “Studying Logistics,” in *Jacobin* (2015), which examines the rise of new logistics nodes in cities such as Memphis and Louisville, the domestic hubs of FedEx and UPS, respectively.

Despite its novelty, this literature is often returning to much older debates within economic geography in order to gain insight into the particular patterns of urbanization and industrial restructuring that we are seeing today (see Cowen 2014 for the most explicit references). In the late 1960s and early 1970s, recognizing the limits of Central Place Theory, alternate urbanization models focusing on “Gateway Cities” (Burghardt 1971) and “Corridors” (Whebbel 1969) were theorized. Today, the primacy of logistics infrastructure and “flexible” systems of production and labor deployment make these classical debates highly relevant, since they allow for a restructuring of urban and industrial development around the “gateways” and “corridors” which Burghardt and Whebbel argue arise from the translation of market logic into space. But, whereas these older debates had strong quantitative dimensions, much of the current literature on the rise of the “logistics city” is relatively devoid of rigorous attempts to quantify and clarify what is meant by a logistic city and how (or where), exactly, logistics infrastructure shapes and is shaped by the metropolis itself.

The literature that *has* focused on quantifying economic restructuring has done so not for logistics industries, but instead for the coupling of high-end and low-end services. This is the common formula of the “global cities” literature (Sassen 1991), alongside numerous works critiquing the rise of finance and subsequent development of the “neoliberal” urban landscape

(Harvey 2007, Smith 1996). Though rigorous, this work often fails to account for the true scale and scope of the supply chains that were under construction at the time that these hallmark texts were being published. The global cities literature takes as its theoretical centerpiece the revival of core downtown zones, with accompanying gentrification and the bifurcation of employment into a “dual labor market” (for an overview see: Massey et. al. 1993). There is certainly work within these fields that extends beyond this, but the profits and employment shares within the service industries remain the essential kernel of this literature, both theoretically and in terms of the variables deployed to analyze American cities. What remains unexamined in these pictures, however, is the construction of vast logistical spaces outside these central “global city” zones.

This is a particularly glaring omission, since it is precisely the revitalization of urban cores and the accompanying gentrification processes that have begun to force the poor out of these cities entirely and into border regions and decaying postwar suburbs—where they live adjacent to or within this new logistics space. The demographic aspects of this “suburbanization of poverty” has begun to be quantified, documented and theorized, as summarized above and explored below. But its accompanying industrial restructuring, in the form of the logistics city, lacks the same rigorous quantification and documentation, even while it enjoys a theoretical revival.

The focus here will be on the basic identification and quantification of this logistics space within the Puget Sound Region. The logistics city is, essentially, the concrete extension of global productive networks—the “global factory”—into a certain region. It is also one form taken by the *reindustrialization* or *not-quite-deindustrialization* of the US economic landscape, despite persistent myths of a “postindustrial” economy (see Kotkin 2012 and 2013). Seattle itself is representative of this reindustrialization or failure-to-fully-deindustrialize, sitting on *Forbes’* list

of new “manufacturing boomtowns,” with 13% employment growth in manufacturing between 2009 and 2013 (ibid. 2013).

Logistics *is not* simply the distributive networks that transit already-manufactured products to end-consumers at retail outlets, though such networks certainly compose a significant portion of the process. In a broader sense, logistics infrastructure envelopes this end-consumer import-distributive function, but also includes the warehousing of goods for export and retail consumption elsewhere, the export of raw materials for processing and industrial consumption elsewhere, the intermediate processing of commodities (milling was the traditional example in lumber supply chains in the region, replaced today by various packaging, finishing and especially food processing procedures), the recycling of industrial material, consumer goods and excess generated by the producer services in the urban core (i.e., electronics, paper documents for shredding, etc.), the manufacturing industries producing various products essential to this logistics infrastructure (from Boeing planes to the cardboard boxes produced at the Tharco plant in Algona), the wholesale trades and utilities that coordinate all of these commodity flows, and, finally, the deployment of flexible labor itself via contracting and staffing agencies. Even industries serving an almost exclusively “local” market tend to exist within a mesh of these logistical networks, without which they would cease to function.

Ultimately, “logistics” designates infrastructure focused on accelerating productive turnover while keeping commodity flow as liquid as possible—it is the extension and coordination of factory production across larger terrains and the more direct fusion of end-distributive functions with production and processing. The construction of logistics infrastructure—or the reinvention of older industrial spaces along these lines—entails the creation of urban “**logistics spaces**,” *in which the predominant economic activity of a given area*

within a city is devoted to this production-processing-distribution supply chain. This supply chain does not exist in the abstract, however. It is not purely “flows,” nor the algorithms that manage them. The supply chain takes form in space, and thereby helps to shape the broader urban structure of which it is a part. Recognizing the supply chain as a concrete spatial form allows us to locate it, to sound out its shape and to identify its various veins, choke points and frontiers.

In what follows, it will obviously be impossible to perfectly quantify what is and is not a “logistics” industry based on pre-categorized data from government statistics. Meanwhile, the tendency toward corporate decentralization may overestimate the expansion of these industries in the same way that it may overestimate the expansion of producer services, as functions formerly yoked together under a single corporate banner become nominally different companies, even while the functions themselves may not have increased that much in quantity or intensity. Another unavoidable risk is the invisibility of many who work within this logistics space, who are often poorly counted by official statistics. This is, of course, the case with undocumented migrants, but it is equally true of other workers whose jobs have simply been informalized to such a degree that they may not appear to work within any one industry, recorded instead (if at all) as “self-employed” and “temporary” contractors—these types of workers, exemplified by the West Coast port truckers and the numerous (non-)employees of warehouse staffing agencies, deserve a more singular study. Nonetheless, I offer below an approach that appears at least functional and tends to match up with more intuitive understandings of the region’s industrial geography.

For my purposes, I will attempt to identify logistics “super-clusters.” Here I define a **logistics space** as an area in which *the predominant economic activity is directly devoted to the*

integrated production-processing-distribution supply chain. This is not a simple matter of zoning, but a much more complex question of the collective, embedded, embodied experience of a space, including how it relates to the spaces around it and structures the greater urban environment. I will primarily use employment share data to identify these spaces, because employment (as opposed to gross output, total value, etc.) covers the experiences of many people spending time within the given area (at work), and higher concentrations of employment also infer higher magnitudes of economic activity, and therefore imply that the space itself is geared *toward* that economic activity. Aside from employment share data organized by both place of work and place of residence from the Puget Sound Regional Council’s 2013 Covered Employment Estimates, the Census LODES Origin-Destination tables for 2013, and the 2013 5-Year American Community Survey, I will also use data on the location of fixed infrastructure (sea and airports, freight traffic, railroads, rail yards) taken from the Washington State Department of Transportation and compare these clusters to the metro’s official “Manufacturing Industrial Centers,” designated by the Puget Sound Regional Council.

I specifically identify logistics “super-clusters” as spaces that exhibit a convergence of high employment shares in Wholesale Trade, Transportation and Warehousing, Utilities (these three altogether classed as WTU, following the practice of the Puget Sound Regional Council), and Manufacturing. Though WTU itself covers much of what is meant by “logistics” infrastructure, using this classification alone will tend to ignore the processing component of supply chains, as well as the actual production of the commodities that compose them—such as cardboard boxes, Styrofoam, refined petroleum, shipping containers, airplanes, etc. Again: logistics designates an extension of the productive infrastructure as much as the distributive.

Rather than simply lumping Manufacturing in with WTU, however, I will look instead for where concentrations of Manufacturing employment *overlap* with concentrations of WTU employment, and where the combination of these two tend to compose large shares of a census tract's total employment composition. This will help to distinguish more delimited, isolated or marginal manufacturing spaces from their more inter-linked counterparts, situated amidst a dense overlay of globally-coordinated value production. It will also help to distinguish several of the region's long-lasting "traditional" manufacturing zones, such as the Boeing plant in Everett, from its resurgent logistics spaces—so long as the old zones have *remained* predominantly devoted to manufacturing alone. Even if they may ultimately be producing "logistical" transit infrastructure such as airplanes, the goal here is to distinguish where more general logistics spaces (mixing numerous circulatory and productive activities) have arisen, rather than to discover where all production somehow related to global production networks takes place.

The data used for the industrial component of this analysis comes from the Puget Sound Regional Council, which draws from the Washington State Employment Security Department's Quarterly Census of Employment and Wages (QCEW). This data measures employment by place of work, not place of residence. In the demographic section below I will use an alternate data source in order to examine the same industries by place of residence. I use the most recent (2013) datasets and boundary data for the census tracts in the entire Seattle-Tacoma-Bellevue MSA portion of the Puget Sound Region, composed of Snohomish, King, Pierce and Kitsap counties. This is accompanied by a few select geographic datasets from the Washington State Department of Transportation (WSDOT), showing freight lines along rail and road systems in the region. All statistical analysis was conducted in ESRI ArcMap 10.2.

Part 1: Methodology

In order to identify and quantify super-clusters, I will use a series of fairly straightforward methods. To start, I will simply review the distribution of employment within the region in the relevant industries by mapping employment shares and Location Quotients for WTU and manufacturing employment. Next, I will look for clustering, using a Global Moran's I followed by a Local Moran's I for both WTU and Manufacturing employment shares. The Local Moran's I will give a concrete sense of how and where the two clusters overlap. After this, I will explore the relationship between the two variables by running a global Ordinary Least Squares regression, followed by a Geographically Weighted Regression, focusing on the predicted values and the local r-squared values for each tract generated by the regression models.

The final step will be the overlaying of information gathered from all these techniques—but particularly the cluster analyses—in order to create two new boundary data layers, both portraying the region's logistics super-clusters. The first will be a conservative estimate, emphasizing the nodes in the clusters. The second will be a more liberal version, emphasizing the extension of the clusters along freight lines. The first looks at logistics “nodes,” while the second examines the logistics “corridors” that extend from these nodes. High-freight road systems, active railroads and the region's Manufacturing Industrial Centers will be mapped alongside these super-clusters, to give a sense of how these features mutually reinforce each other.

In order to get the most accurate local data, for this section I have not used the larger-scale national economic data, but rather the datasets aggregated by the Puget Sound Regional Council, originally gathered by the Washington State Employment Security Department (ESD).

The industrial data used below (for both 2013 and 1995) comes from the Puget Sound Regional Council's tables on Covered Employment Estimates by Tract. In each of their Covered Employment tables they include this description of data gathering methods in the "metadata" tab:

Data is received near year end from the State Employment Security Department (ESD) for the first quarter of that same year. Supplemental information from Boeing, OSPI, and governmental units from the same period are collected directly by PSRC and used as distributions of the jobs totals reported by ESD. Duplicates, temporary staffing agencies, ski resorts, out-of-area records, and unlocatable records are removed from the dataset. Major sector employment totals by county from the initial ESD dataset are used as control totals, and applied proportionally to each record's employment data to arrive at a total matching that of ESD. (Accessible at "Covered Employment Estimates")

In the "Data Remarks" section they also note that "Covered Employment" is not the entire workforce, but typically "has represented 85-90% of total jobs," since it "excludes self-employed workers, proprietors, CEOs, etc., and other non-insured workers" (ibid.). This is an important note, as it is reasonable to expect that the Transportation and Warehousing Industries may have greater shares of workers who fall under these categories. This data, then, can be expected to return more conservative results than might be the case in reality. The same problem likely does not exist for Manufacturing, where it is reasonable to expect that far fewer workers fall under these categories.

The dataset also includes two types of null values. In the first instance the nulls (listed as dashes or zeroes in the tables) are entirely residential tracts with no employment, or largely residential or hyper-specialized tracts where no employment in a given industry. In the second

instance the nulls are marked by asterisks, and they are not true null values but instead the result of data suppression for confidentiality purposes. The metadata's "Data Remarks" section describes the procedure:

Data from individual employers is not shared; where aggregate employment values represent fewer than three reporting firms, or when a single employer accounts for more than 80 percent of jobs, the value is withheld (in these tables, replaced with an asterisk). Additionally, since grand totals are included in the table, an additional suppression is made in any industrial category or geography with a single suppressed value, to prevent disclosure through subtraction.

Certain corrections have been made by the PRSC to ensure that large employers such as Boeing and the University of Washington appear within the dataset, even if one of their facilities may compose more than 80 percent employment within a given tract. But these suppressed values are unfortunately somewhat common in the data, especially in tracts with smaller employment numbers, where it is more likely that one firm will compose more than 80% of the data, or where the tract may have fewer than three firms in a given industry. Many tracts have at least one industry in which data has been suppressed.

A series of supplemental maps will help to dispel the problems raised by both the zero values and the suppressed values. Map 0.1 displays total employment (not employment shares) in WTU, to give an impression of the absolute number of jobs and their distribution. Maps 0.2 and 0.3 show the suppressed values in WTU and Manufacturing, respectively. It is clear that suppression is occurring in many tracts, and appears to be particularly prevalent in more rural tracts. Some suppressed values appear in small clusters, the most noteworthy being the WTU

suppression cluster in the Everett area. Both, however, exhibit far less suppression in the southern suburbs. Maps 0.4 and 0.5 show the actual zero values (not suppressed) in WTU and Manufacturing, respectively. WTU has remarkably few zero value tracts, while Manufacturing, as is to be expected, shows many zero values.

Faced with these second nulls, I had three options. The first would be to assume that, since the nulls represent suppression of high share values, it would be reasonable to interpolate high employment shares in their place in some randomized fashion. The second would be to simply be conservative and render these nulls as zeros in the data. Since they are already eliminated from the tract total employment (per the description above), this would retain the share values of the other industries in that tract. There was also the third option of eliminating all tracts with an asterisk in *any* industrial category, but this would remove too much useful data for the other industries in that tract.

Ultimately, I considered the interpolation option to be far too open-ended to pursue. It would entail too much data creation, and could easily be used to falsely inflate my cluster analyses. Though some of the smaller tracts may be falsely dropped by rendering them into zero values, this second option seemed more conservative. If the clusters are retained even with the dropping of these values, it simply shows that they are, indeed, robust. If the dropped values exist amidst the clusters, the Local Moran's I should still pick up the existence of the clusters, but may transform some of tracts surrounding the dropped values into High-Low outliers. In the final data used here, then, these asterisks have been converted to zero values. All of the analyses below were performed on the full dataset, including tracts with zero values (true zeroes + converted zeroes), except for the regressions, which were performed once on all tracts and once on only tracts with non-zero values for either WTU or Manufacturing.

Even with this choice made, I was still concerned about the existence and prevalence of these suppressed values. In order to ensure the validity of the cluster analyses performed below, I drew on a slightly different data source in order to produce an alternate set of Anselin Local Moran's I cluster analyses for comparison. For these alternate cluster analyses, I utilized the Census Bureau's LEHD Origin-Destination Employment Statistics (LODES), Workplace Area Characteristics files for Washington State in 2013. The LODES data draws from the same QCEW data, but does not include suppressed values. Instead of simply replacing suppressed values by zeroes, as I have done, a computational process is used to interpolate statistically significant data in the suppressed-value tracts. Using this data source will allow me to compare my method of dealing with the suppressed value to an alternate one. Maps 0.6 and 0.7 show the results.

When compared to Maps 1.7 and 1.8 below, it's clear that both data sources are producing very similar patterns. The WTU clusters in both are concentrated in the suburban cities south of Seattle and adjacent to Tacoma, with a spare few exceptions. One difference lies in exactly which tracts these clusters are centered on. The only major difference might be some of the detail in the Tacoma area, with my results below producing a cluster of different shape and size than that seen in these supplementary maps, particularly for the Manufacturing clusters. In the end, neither the WTU nor Manufacturing variables produce significant clusters not visible in my cluster analyses below. This gives me confidence that my method of dealing with the suppressed values, by converting them to zeroes, is a valid option that produces workable (if slightly more conservative) results. These results show patterns that actually exist within the region's employment structure.

Part 2: Employment Distribution

Maps 1.1 through 1.6 display the region's basic distribution of employment, first through the simple depiction of employment share by tract for WTU (1.1) Manufacturing (1.2), FIRE (1.3) and Retail (1.4), and then via the calculation of Location Quotients for each tract's share of WTU (1.5) and Manufacturing (1.6) employment. The Location Quotients are calculated by taking a local employment share from the individual tract and dividing it by the same employment share at a larger scale, in this case the MSA as a whole. The equation is as follows:

$\left(\frac{v_1}{t_1}\right) / \left(\frac{v_2}{t_2}\right)$ where v_1 is equal to the lower-scale variable, in this case the WTU or

Manufacturing employment share of the census tract, t_1 is the total of the lower-scale variables, in this case the total employment in the census tract, v_2 is the higher-scale variable, in this case the WTU or Manufacturing employment share of the MSA, and t_2 is the total of the higher-scale variables, in this case the total employment in the MSA. The Location Quotients thus give a sense of which sub-units of the given region have higher or lower values of a given variable than the region itself, and by what magnitude. Calculating Location Quotients for counties has been used previously by Beyers (1991) to show trends in service employment within the Pacific Northwest as a whole. Here, I do the same thing, but at the MSA scale, to look at local specialization.

From these maps, it is clear that a number of tracts farther south in the region have high WTU location quotients, alongside one strong cluster in the north. Manufacturing is more decentralized, with nodes of high LQs distributed in all four counties that compose our regional picture. The maps of employment share basically match this, but give a slightly more distributed

impression, where WTU employment in particular appears to be spread more widely across the region. These maps give us an intuitive sense of clustering, but it is necessary to follow this with a more rigorous attempt to show the existence of industrial clusters.

Part 3: Cluster Analysis

In order to more accurately determine where clustering exists, I used two Moran's I measures. First, I ran a global Moran's I to examine whether clustering exists at all. The global Moran's I equation is as follows:

$$I = \frac{n \sum c(X_i - \bar{X})(X_j - \bar{X})}{J \sum (X_i - \bar{X})^2}$$

In this equation, I is the spatial autocorrelation coefficient, n is the number of areas in the study region (the number of tracts), J is the number of joins between these areas (the joins between tracts), c is a pair of contiguous areas (a pair of contiguous tracts), X is a value for an area (in this case employment shares), and X_i and X_j designate contiguous areas on either side of a join (a pair of tracts on either side of a join).

What the equation does, then, is systematically computes ratios of “nearness” from the combination of all possible contiguous pairs and then comes up with a global ratio based on the sum of all these combinations. The autocorrelation coefficient is compared to a normally distributed Z statistic and expected value of I in order to determine its significance. Values in excess of the expected value indicate positive spatial autocorrelation, in which either high or low values exhibit clustering. Values that fall under the expected value indicate the absence of

clustering. Since the Moran's I measure ideal can be computed using spatial joins as a variable in the equation, it is ideal for use on polygons such as census tracts, since it allows for varying size yet also takes into account multi-relational joins. This makes it a superior measure for my purposes, when compared to simple distance or grid-based measures of clustering such as nearest-neighbor, Quadrat or Getis-Ord General G.

Once it was determined that there was clustering, I then ran a Local Moran's I for both WTU and Manufacturing shares. The Local Moran's I is derived from the global Moran's I, but it is a local indicator of spatial association. Its equation is as follows:

$$I_i = \left(\frac{X_i - \bar{X}}{\frac{\sum i (X_i - \bar{X})^2}{N}} \right) \sum_j W_{ij} (X_j - \bar{X})$$

In this equation, I_i is the local indicator of spatial autocorrelation (LISA), N is the number of areas in the study region (the number of tracts), X is a value for an area (in this case employment shares), X_i and X_j designate contiguous areas on either side of a join (a pair of tracts on either side of a join), and W_{ij} is a matrix of weights. If you sum all of the I_i values you will get the original Global Moran's I spatial autocorrelation coefficient.

The benefit of the local's Moran's I for my purpose is that it is performed for each tract with weights designed relative to that tract. This allows both for modification of weights according to the tract's unique characteristics and it allows each tract to be assigned a cluster value, which takes four forms: High-High Cluster, Low-Low Cluster, High-Low Outlier or Low-High Outlier. The first two designate a tract with high values surrounded by other high values or

low values surrounded by low. The second two designate individual tracts with high values surrounded by tracts with low values, or individual tracts with low values surrounded by high values, respectively. This returns not only a confirmation of clustering, but also map-able data of where clusters for each industry exist.

Since my units of analysis are census tract polygons, I performed the global Moran's I with the conceptualization of spatial relationships set to "contiguity edges corners," which signals that joins are to be understood both along polygon edges and at corner points, ensuring that individual tracts are compared to all contiguous tracts around them. I also standardized by row, which calculates weights for each tract based on the number of neighbors it has according to the spatial relationships conceptualization. This allows for some correction in the size difference found in the tracts. For WTU employment, the calculation returns a Moran's I value of .196, with a z-score of 9.467 well above the critical value of 1.96 at 95% confidence, signifying a strong clustering of tracts with high WTU share. For Manufacturing employment the calculation returns a Moran's I value of 0.177 with a z-score of 8.40, also well above the critical value of 1.96 at 95% confidence, signifying a strong clustering of tracts with high Manufacturing share.

It's clear that clustering exists, but the global Moran's I doesn't actually show where it exists in any detail. The results are spatially auto-correlated, but for a detailed look at the distribution of this clustering in space, I then used an Anselin Local Moran's I. Here, the procedure was performed with the conceptions of space set to the same as above. The Local Moran's I produces four categories in its output: High-High clusters, Low-Low clusters, High-Low outliers and Low-High outliers. Any tract listed as a High-High cluster is a geographic unit (here a tract) of high variable value (in this case employment share) that is surrounded by a

sufficient (per spatial conceptualization settings and weights) number of high value units. A Low-Low cluster is a geographic unit of low variable value that is surrounded by a sufficient number of low value units. A High-Low outlier is a geographic unit of high value surrounded by a sufficient number of low value units. A Low-High outlier is a geographic unit of low value surrounded by a sufficient number of high value units.

The output can be seen in maps 1.7 and 1.8, the first showing WTU clusters and the second showing Manufacturing clusters. The result has clear echoes of the map of Location Quotients and employment shares, but is now more specific in its ability to show which tracts, exactly exist within High-High or Low-Low clusters. Here, WTU clusters have as strong concentration in the south, with one small cluster in the north. Manufacturing clusters are more widely distributed across the region.

There are likely a multitude of factors that contribute to this clustering. The development of industry within a region emerges from a particular confluence of historical factors, shaped strongly by physical geography, property values and political planning procedures. In one sense, the clustering here seems redundant. Obviously, we will not see strong clustering within largely residential tracts, and the end result seems as if it could easily be predicted from a political zoning map. Zoning, however—or any single factor—cannot fully account for the precise shape of these clusters, and examining them without the residential, information technology, producer services or retail-dominated tracts (i.e., eliminating zero shares) would actually be asking a very different question about clustering *within* the clusters identified here. Instead of asking about clustering in the region as a whole, this analysis would only return results for clustering within tracts that have WTU and Manufacturing employment—essentially looking at clusters within the clusters. Leaving residential and retail tracts intact makes far more sense for my purposes.

These Local Moran's I clusters will become the basis for constructing the super-clusters in the final section below. Prior to this, however, I attempted to further quantify the relationship through regression analyses, with ambiguous results, detailed in the next section. The intent was to help to give a sense of the strength of the association between the two variables, rather than simply their geographically overlapping clusters. Unfortunately, the unevenness of the data makes this sort of correlation difficult to perform.

Part 4: Regression

Since I have here defined logistics super-clusters as the co-existence of high WTU and Manufacturing employment within an agglomeration or strip of census tracts—alongside freight lines or distribution hubs—it is useful to experiment with a statistical method that can give us a numerical sense first of the general strength of the correlation between high WTU employment shares and high Manufacturing employment shares and, second, of the local strength of this correlation in different regions. Regression models serve this purpose well. I employed the standard Ordinary Least Squares (OLS) method to get a sense of the general correlation, then followed this with a Geographically Weighted Regression (GWR) in order to zoom in to look at the local strength of this correlation. What the GWR provides is a way to quantify the “overlay” effect that we observed above, where clusters of high Manufacturing employment seemed to sit, in certain areas, atop clusters of high WTU employment, all of which were stretched along distribution routes or agglomerated around transit hubs.

An OLS regression sets one variable of interest (the dependent variable) against an array of other variables (the independent variables) in order to chart a line of best-fit between them.

The equation is designed to create a line capable of minimizing the sum of the absolute value of all differences in the observed values from the value predicted by the model. An OLS has, at minimum, two variables of interest, but models can also be multivariate. Here, I used only a simple bivariate model, represented by the equation:

$$y = \beta_0 + x\beta_1 + \varepsilon$$

Where y is the dependent variable, x is the independent variable, the β values are vectors of unknown parameters and ε is an error value.

The basic OLS model I created used the natural log of WTU employment share as the dependent variable and the natural log of Manufacturing employment share as the independent variable. Since these were my central variables in a traditional OLS regression, it was important to find a way to normalize them to meet the assumptions of the regression model. In order to do this, I had to create a subset of my total dataset, in which all tracts where either WTU share or Manufacturing Share were equal to zero (including the converted suppressed values) were eliminated—this way I could just compare tracts that have employment in either of these categories, essentially examining patterns *within* the clusters, rather than across all tracts (a map of the subset data is provided in the GWR below). Once the subset of the data was created, I then log-transformed both variables, since they were strongly positive-skewed. The resulting model was statistically significant, and it met the requirements of OLS regression (see appendix A for the original OLS output). At the same time, it warns about non-stationarity. This is not a surprise, given the results of the Moran's I test. In the context of regression, this suggests that a GWR will be more suitable.

The model that is produced by the OLS is as follows:

$$LOG_WTU = -1.739 + 0.423 (LOG_MAN)$$

The Adjusted r-squared of this model is .239, and the Joint Wald Statistic (used because the Koenker (BP) Statistic is significant) is statistically significant, with a p-value of 0.000. The map (1.9) of standardized residuals produced by the reduced dataset will only have slightly over 560 tracts analyzed (out of 768 total), giving a relatively fragmented view of the spatial relationships present. This map does, however, correct for the predominance of residential and retail tracts identified above. What is essentially being tested here is a comparison of largely industrial tracts to one another. It is clear from the map that the tracts with high shares of manufacturing and WTU employment generally have values that sit higher than the predicted values of the model, with a clear cluster of higher values around the port of Seattle. But no geographical pattern is apparent, and many tracts with lower share values also sit above the predicted values.

Both the general Moran's I and the Anselin Local Moran's I above demonstrated strong clustering within the data, and the OLS performed on the subset of data also warned of spatial auto-correlation. Though the OLS model had a non-negligible r-squared for a simple bivariate model, it's reasonable to suspect that a GWR would much return much stronger adjusted r-squared values in certain areas, and strong predicted values where the clusters actually lie. It should also display where high levels of manufacturing employment are not accompanied by high levels of WTU employment (and vice versa).

The GWR is essentially the same as the OLS, with two key differences. First, it is essentially based on local views of regression, as viewed from each data-point (in this case, from

each tract). The GWR then, is actually a *series* of regressions, performed for each data-point (tract). Second, GWR uses a continuous surface of parameter values, weighted by their relative distance (this can be conceptualized in many different ways) from the data-point (tract). This weighting can be done in different ways, set by the bandwidth and kernel choices. The most common is a negative exponential function of squared distance, so that as distance increases the relative influence on the data-point decreases. Here, I have used an adaptive kernel, better suited to units with variable numbers of neighbors, and the standard Akaike Information Criterion (AICc) bandwidth.

The GWR equation is as follows:

$$y_i = \beta_{i0} + \sum_{j=1}^p x_{ij}\beta_{ij} + \varepsilon_i$$

Where y_i is the dependent variable for location i , x_{ij} is the observation on variable j at location i , the β values are vectors of unknown parameters at location i , the summation is performed for p independent variables, and ε is an error value at location i .

First, I performed a GWR on the untransformed (and therefore non-normal) variables for all the tracts, including those with zero values—meaning both true zeroes and suppressed values converted to zeroes (see maps 1.10 and 1.11). Using the full data, including zero values, it's clear that both local r-squared and predicted values increase consistently in areas of South King county, specifically within the Seattle Metro area's southern, inner-ring suburbs, such as Kent. This makes sense, given the zoning overlap between high shares of WTU and Manufacturing, compared to the absence of either in residential and retail tracts. The maps of the model using the full dataset are not fragmented like those using the reduced dataset, and, in fact, they return a

very familiar picture when compared to the cluster analyses. The violation of normality here is ambiguous. For descriptive purposes, this regression is still informative, despite the violation. For any sort of inferential modeling, it would be essential to zoom in to the individual tracts, each of which has its own regression model relative to surrounding tracts—these individual regressions may or may not violate normality, depending on the surroundings.

Using the log-transformed variables here reduces the data-set beyond any utility, since it breaks geographic contiguity between tracts almost entirely. Instead, when I then ran the GWR for the (still untransformed) variables on the subset data where zeros had been removed, the predicted values remain high in this area (see map 1.12), signaling that the actual values here lie above those predicted by the linear model—evidence of a concentration of values above the norm. However, this subset of data produced *opposite* results for the local r-squared values (see map 1.13). The r-squared appears weakest where the predicted values are strongest—and these are the areas with high employment shares. So even though the predicted values are high here, the model itself is less reliable in precisely these locations. There is also a northeast-southwest spectrum to the data. The reason for this may simply be that the model is far better at predicting the transformed values for tracts with low values because there is less variation in these values. Low shares will tend to converge around similar numbers. By contrast, tracts with higher employment shares may not match as well, even if both values are still high. But another potential problem is simply that the removal of the tracts with zeroes in either manufacturing or WTU employment shares broke the spatial continuity necessary for a GWR to function properly. The northeastern tracts may have the highest adjusted r-squared values simply because they are large tracts and a key neighbor has been eliminated, meaning that they are now contiguous with only one or two other tracts.

Other than this, it's unclear what might be causing the phenomenon in the reduced data with the transformed variables. It is worthwhile to remember here, however, that this regression is only testing within industrial tracts—it is not returning a quantification of the overall relationship, with the norm of residential and retail tracts taken into account. It is performed for the sake of comparability, but is not the ideal procedure. Either way, the r-squared values from the GWR are not going to provide any overarching quantification. The predicted values give us a more reliable quantification of the correlation between Manufacturing and WTU employment shares which define our super-clusters.

Part 5: Freight Routes and Super-clusters

Super-clusters have already emerged based on data from global cluster analysis, local cluster analysis, OLS regression and GWR. For the final step in the industrial analysis, I manually put together two unique data layers that allow me to map them in detail and look at the characteristics of the tracts that compose them. By doing this, it also becomes possible to examine changes in these clusters over time and to compare these super-clusters to clusters of demographic variables.

The Anselin Local Moran's I clusters were the raw material used to manually compose the logistics super-clusters. Essentially, these super-clusters are clusters of clusters, equivalent to an overlay which includes the overlapping Local Moran's I clusters and excludes non-overlapping clusters. Alone, this would be an insufficient method. But it is bolstered by both the OLS regression and the GWR's predicted values, despite the ambiguity of the latter's r-squared values, and it is mirrored by the Location Quotient data. With these other methods informing the

process, the manual construction of the super-clusters is justified. Looking at the two Anselin Local Moran's I maps, I selected the tracts which have both High-High and High-Low cluster values for both WTU and Manufacturing. The WTU clusters tend to extend farther out than the Manufacturing clusters, even where they overlap. This is useful data in and of itself, and it hints at two possibilities for the super-cluster shapefile, each of which will emphasize different characteristics of the super-clusters.

The first (map 1.14) is more conservative. In this version, I take the overlapping tracts and then add to them only *immediately contiguous* tracts with High-High or High-Low cluster values for WTU Share. I exclude overlapping tracts if they are simply isolated High-Low tracts for either Manufacturing or WTU—i.e, there are no High-High tracts touching them, nor High-High tracts of the other variable overlapping with them. This returns four relatively delimited clusters. The first is around the Port of Seattle (and the Sodo/Georgetown railyards), the second around SeaTac airport, the third around the Port of Tacoma and the fourth around the Auburn/Algona railyards and business park. This version thus portrays the central **nodes** of the region's logistics space, but loses some of its lateral extension along local supply lines.

These nodes are largely seaports, airports, railyards and business parks. But they are also zoning clusters in and around the area's "Manufacturing Industrial Centers" (MICs), as designated by the Puget Sound Regional Council's Vision 2040 report. The MICs are areas where funding priority is given at state, county and local levels "for both transportation infrastructure and economic development" (p. 49) to assist the retention and growth of the industries within the MICs. The Duwamish, North Tukwila, Kent and Port of Tacoma MICs all overlap with the super-cluster nodes. In order to capture the role of manufacturing in shaping these spaces, I've mapped the clusters to show manufacturing share by tract. This shows that all

nodes have at least one strong manufacturing core. Two of the nodes (port of Seattle and Auburn/Algona) have core manufacturing tracts in which manufacturing share is between roughly 34 and 45 percent of total employment. The other two nodes (port of Tacoma and Tukwila/SeaTac/Renton/Kent) have core manufacturing tracts in which manufacturing share is between roughly 20 and 34 percent of total employment.

But just mapping out the nodes misses the way that the logistics space extends and structures greater urban development around these particular economic activities. The second version of the super-cluster map (1.15), then, will try to capture the linear qualities of Seattle's logistics space as it extends out from these nodes. To create this second version, I started from the same High-High or High-Low overlaps, but instead of only including immediately contiguous High-High and High-Low tracts (regardless of overlap), I included *all contiguous tracts* with High-High or High-Low values in manufacturing and WTU (again regardless of overlap). Since the WTU employment clusters tend to spread wider than the Manufacturing clusters, this largely involves including more High-High WTU tracts, which tend to bridge from one node to the other. The result is a more interlinked picture of the super-clusters, with the four previously delimited nodes now almost entirely linked together—though the northernmost node, around the Port of Seattle, still remains more separated from the rest. These are logistics **corridors**. Since zones of WTU intensity extend beyond similar zones of Manufacturing intensity, I again mapped the cluster to display Manufacturing Shares, to give some sense of the internal differentiation of the super-cluster itself. The manufacturing core tracts remain the same, but the new corridor tracts tend to have only low to moderate shares of manufacturing employment, by comparison.

What this second version begins to capture is the extension of this logistics space along high-tonnage freight routes, such as interstates and rail lines. In order to make this clear, these freight lines are mapped alongside the super-clusters. In order to differentiate high-tonnage freight lines from low-tonnage roads, I first took a map of freight traffic from the Washington State Department of Transportation (WSDOT) and simplified it with a clipping procedure to only show routes as they pass through the region. After this, I modified the symbols to only show the “T-1” and “T-2” road classifications, capturing the heaviest freight routes and excluding roads less used for goods shipments. The full classification system is as follows, with the routes of interest marked with an asterisk:

Road Classification	Freight Tonnage
T-1*	More than 10 million tons per year
T-2*	4 million to 10 million tons per year
T-3	300,000 to 4 million tons per year
T-4	100,000 to 300,000 tons per year
T-5	At least 20,000 tons in 60 days

Once this is complete, the second version of the super-cluster map shows the super-clusters stretching along these routes, often being bordered on multiple sides by T-1 roads, with multiple T-1 roads intersecting within the super-clusters, compared to areas outside the super-cluster. The super-clusters are also transected by a number of T-1 and T-2 routes, with certain T-1 roads having endpoints attached to certain features within the super-clusters, particularly at the ports. When I add in the map of active rail lines, again from WSDOT , an even greater intensity of freight traffic becomes visible within the super-clusters. Rail lines transect and border the

super-clusters and again have a number of visible endpoints within the clusters, particularly within high-manufacturing zones.

Part 6: Change Over Time

After producing the shapefiles showing current logistics super-clusters, it is possible to explore the same data over time by comparing the super-clusters above to a second pair of super-clusters calculated from 1995 PRSC data. Unfortunately, earlier data than this is not available in the same format. The process followed was the same as above, minus the regressions. An Anselin's Local Moran's I was used to identify clusters, and then these clusters were overlaid in an identical fashion to produce super-clusters. The 1995 super-clusters are visible in maps 1.16 and 1.17.

Three of the four nodes existed in roughly the same locations in 1995, though their manufacturing cores were slightly different. The first notable change over time is the growth of the node in Tacoma, due to the absence of a manufacturing cluster in 1995 (in 2013, the cluster was a High-Low tract near the port). The WTU cluster in the greater Tacoma area also shifted significantly across the two decades. The second notable change is the complete disappearance of the 1995 super-cluster stretching through Ballard, Fremont, and part of Queen Anne all the way down into Belltown, with most tracts in this node having a strong manufacturing share, all overlain by a High-High WTU cluster. By 2013, only four tracts, two on each side of the waterfront, retain a High-High Manufacturing Cluster, and there are simply no WTU clusters present.

This means that, while a few tracts in the northern portion of the old cluster have retained an influential share of manufacturing, this older industrial zone has shrunk with the growth of downtown development. This is not an artifact of the data suppression, since the 2013 suppressed values (see map 0.2) do not include those that show up as clusters in 1995. The complete absence of a WTU cluster in 2013, then, signifies an even bigger change in the area's employment composition. Essentially, these neighborhoods are no longer logistics spaces at all comparable to the others. At most, they take on a character similar to that of older manufacturing hubs, such as Everett, lacking WTU clusters even while they retain some of their character as traditionally industrial zones. It is notable that this area is located in one (Ballard-Interbay) of the three MICs that, in 2013, do not have high WTU clusters overlapping with their concentrations of manufacturing. This area is, however, the only one of the three to have *had* such a cluster in 1995, only to lose it by 2013. This demonstrates the restructuring of the central city's economy to focus on services and high-tech industries, which was accompanied by the concentration of industrial and circulation activity in the "logistics cities" south of the urban core.

Conclusion

The final result is a clearer picture of the Seattle MSA's logistics space, which is largely concentrated in Southwest King County and West Pierce County. These logistics spaces are clearly different than simple manufacturing zones and exhibit a distinct clustering. Large manufacturing centers such as Everett, though important to the region's manufacturing industry, are not accompanied by similar aggregations of WTU employment, and therefore are not logistics super-clusters. Meanwhile, areas such as Downtown Seattle, the University District, or

Bellevue and its northern suburbs, though economic engines in and of themselves in both hi-tech research and production as well as producer services, healthcare and education, simply do not appear within the framework established here. Much of their basic logistical support networks, however, do extend into this southern logistics belt, where industrial shredding facilities process excess paperwork picked up from the city core, where Amazon, alongside numerous wholesalers, warehouse goods to be shipped elsewhere, and where the abstract computation of Expeditors International, headquartered downtown, takes corporeal form as ports, rail yards, and warehouses—and of course the thousands upon thousands of human hands holding the levers to the machine.

Section 2

Suburban Poverty, Migration and Employment in Logistics

Preface: Inversion and Immigration

It is not an exaggeration to say that, within the space of thirty years, Seattle has seen a nearly one-hundred-and-eighty degree turn in its basic geodemographic composition. The most widely recognized signal of this change has been a series of prominent gentrification processes in the urban core, beginning with the construction of many of downtown Seattle's skyscrapers by Japanese capital in the 1980s, accompanied by massive public-private partnerships geared toward transforming the downtown core into a place for retail and entertainment (Gibson 2004). The trend was continued in Belltown (England 2011) and South Lake Union (Conklin 2013), and today tends to get the most attention in Capitol Hill (Romano 2015), the Central District (McGee 2007), Beacon Hill (Uitti 2015), and the various neighborhoods composing the Rainier Valley (Person 2015). Though given less attention, the phenomenon is also clearly visible in Ballard (Howe 2011) and West Seattle (Balk 2015).

As development rippled outward from the downtown core, the city's traditional ethnic and cultural enclaves were quickly settled by wealthier, whiter residents. Many of these neighborhoods had originally been established via exclusionary racial covenants or less formal means of social exclusion in the post-war period (See Taylor 1994 and the Seattle Civil Rights & Labor History Project's "Racial Restrictive Covenants" and "Segregated Seattle" documents for

more background). In this period, their counterpoint had been the city's prosperous, majority-white suburbs. The development of the urban core, however, would soon see this geodemographic pattern reversed. As rents rose in the inner city, residents who could no longer afford the new prices were forced to find cheaper locations, largely in the south part of Seattle and King County ("Transit Oriented Development..." 2012). Meanwhile, new migrants to the area (both domestic and foreign-born) were likewise priced out of all but a few inner city neighborhoods, and instead settled in many of the same neighborhoods that attracted out-priced renters (Langston 2012).

The southern suburbs had, meanwhile, become a less attractive location for high-income renters and homeowners. The belt of good-paying jobs in manufacturing that had sustained the post-war white suburb decomposed after the Boeing Bust of the 1970s, but rebounded beginning in the 1980s as Boeing recouped its losses. As these industries returned or revived, however, they were also transformed. Much of their infrastructure remained intact and was repurposed to serve supply chains in the changing global economy, as has been shown above, where we see the persistence of the suburban industrial zones in the south. These new jobs in the "logistics" industries (defined above) tended to pay less at the national level (Shierholz and Mishel 2013), including those in manufacturing (Ruckelshaus and Leberstein 2014). Meanwhile, the housing stock, domestic utilities, infrastructure and even industrial equipment had all aged. Much of the current housing, for example, is still the original post-war single-family homes, often not up to modern fire standards and frequently heated on outdated and expensive oil systems (see map 2.0). Adjacent to—and often downslope/downriver from—major interstates, ports and railways, some of these neighborhoods have been exposed to long-term environmental contamination ("Lower Duwamish..."), have low air quality (McClure and Cunningham 2011) and are at the highest risk

for accidental toxic waste spills (Pailthorp 2015) as well as natural disasters (Driedger and Scott 2008).

As mentioned above, this pattern is consistent with national patterns in the “suburbanization of poverty” outlined by Berube and Kneebone (2013). In their work for the Brookings Institute, Berube and Kneebone rank the Seattle-Tacoma-Bellevue Metropolitan area as 15th in the country for percentage point change in its suburban share of poverty between 1970 and 2012, with the share of metro area poor living in suburbs increasing by 19.3%, from 48.3% in 1970 to 67.6% in 2012, or 276,688 of the 409, 239 metro poor population (“Suburban Poverty...”). Their Seattle-Tacoma-Bellevue Metro profile also shows that this process was not a gradual change, but seems to have accelerated between the 2000 Census and the American Community Surveys following the 2010 Census. While the number of poor increased by 30.8% in the main cities of the metro area between 2000 and 2011, it increased by 78.9% in the suburbs over the same time period. Part of this followed from migration patterns, as population change in the city, at 7.1%, was less than half that of the suburbs, at 15.4%. The data also strongly suggests that the “Great Recession” may have played a role in these changes, with official suburban unemployment jumping from 55,672 in Dec. 2007 to 125,912 in Dec. 2010 (“Seattle-Tacoma-Bellevue...”).

Alongside the suburbanization of poverty, immigrant gateways have also shifted to the suburbs (Singer 2008). The Brookings Institute data shows that the suburban (foreign-born) immigrant population in the Seattle-Tacoma-Bellevue Metro Area only increased from 20.6% in 2000 to 23.7% in 2010 (“Seattle-Tacoma Bellevue...”), but this apparently small increase is mostly due to the narrow time frame. Data from the Migration Policy Institute hints that much of the increase in immigration came prior to 2000, with the Seattle-Tacoma-Bellevue “emerging

gateway” more than doubling from 7.2% foreign-born in 1980 to 15.8% in 2006 (Singer 2008, Table 1). This figure, however, is for the entire metro area. The Brookings Institute data signals that the suburbs, in both 2000 and 2010, had at least 5% greater foreign-born population than the metro as a whole. This is further verified by King County Demographer Chandler Felt’s research on “South King County’s Changing Demographics” (2012) and by the Sightline Institute’s research on “Cascadian Demographics” (Langston 2012), both of which confirm that much of the new immigrants settlement has been funneled into the southern cities. Compared to Washington State as a whole, the southern suburban municipalities host some of the highest shares of foreign-born population, equaled only by several cities in the state’s agricultural hinterland, which have high shares of migrant farm workers. Tukwila sits highest, at 36%, more than twice the Metro total, followed by SeaTac (31%), White Center (30%), Renton (29%), Othello (27%), Kent (26%) and Bryn-Mawr Skyway (26%) (See Langston 2012, and further detail is visible in maps 2.7-2.12 described in “Part 3: General Patterns” below). The only exceptions to this pattern are Lynnwood (27%), the sole northern suburb that seems to follow the same pattern, as well as Bellevue (31%) and nearby tech suburb Redmond (29%), the foreign-born populations of which are associated with the hiring magnets of infotech industries like Microsoft and the H-1B visa program (this distinction will become clearer below), and therefore see less overlap with zones of suburban poverty (Langston 2012).

These changes over time have already been analyzed and visualized by others, and I therefore do not include a “change over time” section in my own demographic analysis. Aside from Berube and Kneebone’s (2013) area profiles, or the “Cascadian Demographics” project of the *Sightline Institute*, the changes are also visible in the maps of the Mixed Metro project, which uses Census data to visualize immigration and diversity data for all major US cities between

1990 and 2010 (“Mixed Metro”). Mixed Metro maps diversity and immigrant concentration (classified by area-of-origin) at the tract level, going back to 1990 for race and diversity and 2000 for immigration. Their 2010 data, though slightly older than the data I use below, employs some similar methods and essentially echoes my conclusions, at least for the variables on race and foreign-born origin. One benefit of Mixed Metro’s data is that it allows a more granular view of segregation, classifying by high or low diversity as well as by majority group—and with the possibility in 2000 and 2010 of putting the foreign-born origin overlays on top of this. One interesting feature for the Seattle metro area is the visual clarity of watching pre-existing majority-black (the Central District) and majority-Asian (Beacon Hill) neighborhoods become low-diversity, majority-white areas, adding a more quantifiable verification of the gentrification processes mentioned above. Maybe the most interesting feature, however, is the rise of high-diversity tracts in the south with no majority group. In 1990, the southern cities were almost exclusively low-diversity, majority-white tracts, distinct from the more diverse array of tracts in the central city. By 2010, these same cities are almost exclusively high-diversity tracts with no majority group. In the same time period, much of the central city has clearly lost its diversity, and by 2010 appears more similar to the southern suburbs of 1990 than to the urban Seattle of the same year.

The persistence of high poverty, high unemployment and, specifically, low-wage jobs staffed by migrant workers in a “post-industrial” city is often attributed to the “dual labor market” created by producer services, healthcare, education and high-tech centers (see Massey et. al. 1993, pp.440-444 for an overview using slightly different terminology than Piore, alongside Piore 1980 and Harris 1996 for more detailed accounts). In short, the high-end or “primary” services concentrated in the new “post-industrial” downtown require a complement of lower-end

or “secondary” services to function. These low-end services include occupations such as janitorial work, domestic labor, food preparation, retail jobs, paid for by the producer service firms themselves or simply through the consumer expenditures of the better-paid segment of workers in such high-end services. This proliferation of low-end services creates new incentives for immigration to the area, and the surplus and legal precarity of immigrant labor enables the companies employing these workers to keep wages low.

This theory of the “dual labor market” is not wrong, exactly. When focusing on urban cores, there has indeed been a growth in high-end services paired with a (larger) growth in accompanying low-end services. The problem is simply that this is not the whole picture. When we zoom out from the urban cores, the “post-industrial” city is bordered by the “logistics cities” in which employment in wholesale trade, transportation and warehousing, utilities and manufacturing all remain high shares of total employment, as demonstrated above. More importantly, in the Seattle area many of these new immigrant workers seem to have settled adjacent to the logistics super-clusters described above.

I hypothesize that the “dual labor market” theory tends to obscure this third phenomenon of logistics employment in what can be characterized as either re-industrialized or never-quite-de-industrialized zones, intercut by transit infrastructure and strongly linked to global supply chains. In the sections below, I will outline the overlapping clusters of suburban poverty and immigration with the logistics clusters identified above. I will then identify the constellation of “feeder” tracts sending workers to each of the tracts included in the logistics super-clusters, quantifying their strength (how many workers they are sending) and looking for a similar geographic clustering.

Part 1: Methodology

My demographic analysis will begin with a review of the distribution of key variables associated with suburban poverty, immigrant gateways and employment in logistics industries (defined in the same way as above, but calculated here by place of residence rather than place of work). After this initial review, I will use Local Moran's I measures to identify clustering in these variables, and then to create overlays of the clusters similar to the super-clusters identified for logistics industries. These demographic super-clusters will then be compared to the logistics-super clusters. This will be followed by a series of more rigorous attempts to quantify the relationship between the industrial and demographic clusters using regression models. Finally, I will identify all the "feeder" tracts sending workers in WTU and Manufacturing to the logistics super-cluster tracts, ranking their strength by the number of workers sent to any of these work tracts. All of the data in this section comes from either the 2010 long-form Census or the 2013 5-year American Community Survey, with the exception of the final analysis of "feeder" tracts, which relies on the Census' LEHD Origin-Destination Employment Statistics (LODES) Dataset Structure, Format 7.1, using the 2013 Origin-Destination dataset for Washington State.

Part 2: Key Variables

In attempting to identify clusters of poverty and immigrant settlement, I use a handful of variables in order to portray several dimensions of clustering. The "super-clusters" identified here do not function in exactly the same way as the logistics super-clusters, simply because there is more variation between what is being measured. I also expect that the geographical distribution of these variables will remain slightly more uneven than the employment distribution, since industrial zoning tends to be relatively concentrated, while residentially-zoned areas are

more dispersed and consume more of the space being analyzed. There should also be variation evident from outlying distortions on property values, such as wealthier housing along coasts, hilltops or near other desirable locations, such as Angle Lake in SeaTac or Seward Park in south Seattle. Variation should also arise from the continuing transformation of the southern suburbs, which, despite their new concentrations of poverty, still retain large numbers of wealthier residents, including many workers employed in higher-paying union jobs at Boeing or the seaports.

The three primary variables used to compose the super-clusters will be the share of the tract population below one hundred percent of the poverty level, the share of the tract population that is foreign-born, and the share of the tract that works within Manufacturing and/or WTU industries. Alongside these, I will use a series of secondary variables in order to establish the general patterns for the region. These include the origin countries of foreign-born individuals, the origins of domestic migrants, residents' median income levels, share of total tract population by race, and poverty by race.

Part 3: General Patterns

To begin the demographic analysis, I simply mapped a range of variables to identify basic patterns. Maps 2.1 through 2.4 show the racial geography of the region, with white population majorities (2.1) concentrated in Seattle's north end, Tacoma's waterfront, Bainbridge Island, much of Kitsap county, and most of the rural, exurban and waterfront tracts. In contrast, black population (2.2) is concentrated in southeast Seattle and the closest southern suburbs, particularly Renton, Tukwila and SeaTac, in southwest Tacoma, the tracts surrounding joint base Lewis-McChord and in one small (two tract) concentration in the High Point neighborhood of

West Seattle. Asian population (2.3) is concentrated in South Seattle (particularly Beacon Hill), in and around Lynnwood in Snohomish county, and in Bellevue and its surrounding suburbs. Hispanic or Latino population (2.4) has several apparent clusters. The first and largest is concentrated in Southwest Seattle, in the neighborhoods of South Park and White Center stretching down into the southern suburbs, particularly in Burien and SeaTac. There is another concentration in the Lynnwood-Everett corridor, a very light cluster around Bremerton, several high-value tracts near Bellevue, and a smaller cluster in and around southern Tacoma.

Maps 2.5 through 2.9 show the region's geography of foreign and domestic immigration. The first (2.5) shows foreign born population as a share of total tract population. Higher shares are concentrated in south Seattle, the southern suburbs (particularly SeaTac, Tukwila and Burien), Lynnwood, southern Everett, and in Bellevue and Redmond, with a few smaller groupings in south Tacoma. If I compare this to those born within the US but outside the state of Washington (2.6), it's clear that domestic out-of-state migrants have slightly lower shares in the areas with high foreign born population, but exhibit little clustering beyond this except a few lone high-share tracts in Kitsap county, near Issaquah and in the waterfront tracts of Queen Anne and Ballard in Seattle.

In order to get a better sense of the composition of the foreign-born population, I also mapped data on the total population from different origin countries, continents and regions. Since Mexico is a major feeder nation for most US cities (which also shows up at the single largest country contributing migrants to the region in Felt 2012), I began with Mexico (2.7). The Mexican population is concentrated in southwest Seattle, particularly in the White Center / South Park area, in all of the southern suburbs, and along the I-5 corridor running from Lynnwood through Everett. There are smaller concentrations around the northeast tech suburbs and on

Tacoma's southern edges. Next, I looked at the African-born population (2.8), the majority of whom are from East Africa. This population is concentrated in south Seattle, in Bryn-Mawr Skyway/West Renton, Tukwila, SeaTac, and Des Moines, with a spattering of other, less concentrated groupings on Seattle's northern border, stretching up the I-5 corridor into Lynnwood and Everett. After this, I mapped the Eastern European population (2.9), which is concentrated in Bellevue and the surrounding tech suburbs, the Lynnwood/Everett corridor, and in the southern suburbs, particularly Kent, Auburn and Federal Way.

The Asian migrant population is the largest (as shown in Felt 2012), but, unlike the metro's African or European populations, the area has large numbers of Asian immigrants from most sub-regions of Asia, with the highest numbers coming from South-Central Asia (2.10), followed by East (2.11) and Southeast (2.12) Asia. The number coming from Western Asia (the Middle East) are small by comparison and are therefore not mapped here. South-Central Asian² immigrants (2.10) show the highest numbers in SeaTac, Kent, Bellevue and the surrounding tech suburbs, including the Issaquah and Snoqualmie exurbs. This is an important point, since the clusters of foreign-born population in Bellevue and the tech suburbs are likely related to the H-1B hiring of infotech companies like Microsoft and therefore do not necessarily represent the same dynamics of suburban immigrant settlement seen in the rest of the region or in other parts of the country—and therefore I would not expect this population to overlap with the other primary variables counting the suburbanization of poverty. The East Asian population (2.11) is slightly more distributed. It has a concentration in Bellevue and the tech suburbs, again, but now also a strong concentration in south Seattle (around Beacon Hill), in the Lynnwood/Everett area and in Federal Way. Only with the Southeast Asian population (2.12) does the Bellevue cluster disappear entirely. Here, the concentration is strongest in south Seattle, west Seattle, the southern

² This and the following regions of origin are according to ACS usage, described in Gryn and Gambino (2012), p.1

suburbs, and the Lynnwood/Everett corridor, with smaller groupings in south Tacoma and outside Bremerton in Kitsap county.

Finally, I mapped a series of variables looking at poverty, income and industry by place of residence. The first of these variables was the share of the tract population without a High School diploma (2.13). High shares are clearly concentrated in south Seattle, the southern suburbs, and south Tacoma, with weaker concentrations in the Lynnwood/Everett corridor and the more rural areas. The share of tract population below one hundred percent poverty (2.14) shows a similar, though slightly lighter, concentration. The main difference is a cluster around the university, likely due to students reporting low incomes. When we look at the median incomes (2.15) of each tract, we see the highest incomes concentrated in north Seattle, Mercer Island, Bellevue and the surrounding Tech Suburbs, with lighter concentrations in parts of Kitsap county and the areas of Snohomish county outside the Lynnwood/Everett I-5 corridor. The lowest incomes are seen in south Seattle, the southern suburbs, much of Tacoma and the area around joint base Lewis-McCord. There is also a strip of lower incomes along the Lynnwood-Everett I-5 corridor. The map of share of tract residents working in Manufacturing and/or WTU industries (2.16) shows probably the starkest north-south divide within King County, with the highest shares in south Seattle, the southern suburbs, south Tacoma (and much of rural Pierce county), as well as in the farther northern and more rural parts of Snohomish county.

Part 4: Cluster Analysis

After reviewing the variables, I ran an Anselin's Local Moran's I on the median income variable and on my three primary variables (share below poverty, share foreign born and share employed in manufacturing and/or WTU). The Local Moran's I was run using the same methods

as the industrial analysis above, with spatial conceptualization set to “continuity edges corners” (because the tracts are polygons of varying sizes) and using row standardization. The results are visible in maps 2.17 through 2.20. Compared to the industrial cluster analyses, these demographic features show greater variability, in part because they are measuring very different dimensions and in part because the region’s demographic transition is uneven and ongoing.

The median income clusters (2.17) exhibit some of this variability, with several small or isolated High-High or Low-Low clusters, as well as a couple High-Low and Low-High outliers. In general, however, the region’s income clustering is abundantly clear. Mercer Island, Bellevue, the tech suburbs of Kirkland, Redmond and Bothell, as well as the Issaquah and Snoqualmie area all appear as one large swath of high income clustering. Alongside this, north-central Seattle and parts of north Seattle are also High-High clusters. The Low-Low clusters are largely in south Seattle, the southern suburbs (especially Burien, SeaTac and Kent) and much of Tacoma and Bremerton. There are smaller clusters in Lynnwood, Everett, the International District/Pioneer Square/Yesler area of Seattle and, again, Seattle’s University District, due to students’ low reported incomes.

The poverty clusters (2.18) show a similar pattern but exhibit more variability. The clearest low-low clustering of poverty lies just west of Bellevue and Redmond, in the wealthy exurbs along the foothills of the Cascades. But here the variability becomes clearer, as several solitary low-low clusters are visible orbiting this larger cluster, notably on Mercer Island, in southern Bellevue, the Maple Heights/Lake Desire area east of Renton, and in Maple Valley. The high-high clusters are also more distributed. The largest clusters lie in central and south Tacoma, in southern Kent and western Auburn, in the White Center/South Park and Highline neighborhoods going into Burien, and again in SeaTac and Tukwila. There are also slightly

smaller clusters in Bremerton, south Beacon Hill, Bryn-Mawr/Skyway, the International District/Pioneer Square/Yesler area, and two very small clusters around High Point in West Seattle and in south Everett. In addition, further variability is visible in the existence of Low-High outliers sitting alongside the Low-Low clusters. These are largely on the suburban fringe, and signal neighborhoods that have retained higher value than their surroundings for various reasons. This may be due to natural endowments or simply to the uneven nature of the demographic changes in these areas.

The foreign-born clusters (2.19) show the most consistent, continuous patterns. Almost all of south Seattle and the southern cities (save the waterfront tracts lying on the Puget Sound) see High-High clustering, which also stretches up through Renton and into Bellevue and the tech suburbs. A second cluster is visible in the Lynnwood-Everett corridor, and there are two small isolated clusters in north Everett and South Tacoma. In contrast, the more rural tracts on the outer border of the MSA are consistently Low-Low clusters. It is useful to remember, however, that the nature of these clusters may in fact be very different, as was visible in the review of foreign-born origins above. Though the Bellevue area and the southern suburbs share this clustering, the composition of their foreign-born populations is very different, and their income and poverty clusters are diametrically opposed.

The manufacturing and WTU employment clusters (2.20) are nearly as consistent and continuous as the clustering of foreign-born. South Seattle, the south King County cities and the suburbs south-east of Tacoma are a more or less continuous cluster of High-High values. Central Everett has a cluster, as do the more distant rural tracts in southern Pierce and northern Snohomish counties. In contrast, much of central and North Seattle, alongside Mercer Island, Bellevue, the tech suburbs and the exurbs of the cascade foothills are all included in a continuous

clustering of Low-Low shares. In the central urban tracts of the MSA, this is the strongest north-south divide seen in any of the clusters so far.

Part 5: Super-clusters

The super-clusters composed here (map 2.21) differ from the industrial super-clusters in a few important ways. The most important difference is in the multi-dimensionality of these demographic super-clusters, which measure more combinations of more diverse variables than those used for the industrial super-clusters. There are not two versions of these demographic super-clusters, one depicting nodes and the other corridors, but instead a single version which depicts several combinations of the primary variables. The goal is to display the broad clustering while simultaneously identifying the “peaks” where the different combinations overlap.

The primary variables used for the demographic super-clusters are the Local Moran’s I High-High cluster tracts measuring the share of those below one hundred percent of the poverty level, the share of foreign-born, and the share of those employed in Manufacturing and/or WTU industries. The super-clusters include tracts in which two or more of these variables overlap. The “peaks” are represented by the overlapping of all three variables. The rest of the super-clusters are the three other two-variable overlap combinations (Poverty + Employment, Poverty + Foreign-born, Foreign-born + Employment). In order to emphasize the different dimensions being measured, I’ve used distinct colors for each category. Since one of my major theses argues that there is a connection between the consolidation of logistics industries into a few “logistics cities” and the suburbanization of poverty in the region, the combinations of poverty and industrial employment by residence have been emphasized as more continuous in this color scheme. The “peaks” are colored dark red, and the Poverty + Employment overlays are colored

light red. The Poverty + Foreign-Born overlays are colored teal and the Foreign-Born + Employment overlays are colored green, the slight similarities in color emphasizing the sharing of Foreign-Born population, but the more harsh distinction between these two (as opposed to the dark/light reds) emphasizing the more substantial difference between zones that do and do not have the shared factor of poverty.

The “peaks” of these super-clusters lie very distinctly within the southernmost portions of Seattle and all the southern suburbs save Renton, Des Moines and Normandy Park. The Poverty + Employment overlays patch together and extend the peaks in the southern suburbs, and compose their own super-cluster on the southeastern border of Tacoma. The Foreign-Born + Employment overlays extend between the three/four major peaks, filling in much of the central corridor stretching between all the southern suburbs, now including Renton and Des Moines. The Poverty + Foreign-Born cluster fills in the last few gaps, and also has its own small super-cluster in the International District/Pioneer Square/Yesler area of Seattle, as well as one single-tract super-cluster just south of Everett.

The demographic super-clusters are very distinctly a phenomenon of the southern suburbs in both Seattle and Tacoma, with a few small exceptions (which only exist minus the Employment variable). This hints that the industrial and demographic super-clusters have at least some overlap in space. Such an overlap signals, at the very least, that the city’s logistics spaces are inhabited by different combinations of residents who are under the poverty level, foreign-born and working in the manufacturing and/or WTU industries. It’s impossible to say from this data how those variables are distributed across the populations within the tracts, but given their high proportions and the clear overlap, it is at least likely that individual residents may exhibit two or more of these features. Two things remain to be done, however. First, the intuitive sense

of overlap between industrial and demographic super-clusters within the southern suburbs is insufficient. I will therefore quantify the degree of overlap by comparing the super-cluster tracts side-by-side. Second, simple overlaps do not necessarily show the more substantial connection of employment itself. There is no real evidence here that those who live within the demographic super-clusters actually work within the industrial super-clusters, even if they are employed in the same industries. I will therefore turn to the Census LODES database to examine the origins and destinations of employment patterns within these tracts, mapping both the “feeder” tracts sending workers into the industrial super-clusters and the “receiver” tracts where those living in the demographic super-clusters work.

Section 3

Comparing Industrial and Demographic Super-Clusters

Fifteen census tracts overall are shared between the demographic and industrial super-clusters (see map 3.1). All of these tracts are either on the very southern border of Seattle or within the southern cities. Among the demographic “peak” tracts, four overlap with industrial super-clusters. The first is Census Tract 265 in White Center, running from the south side of Roxbury downward, bordered by Highway 509 on the west. It has a total population of 4,076, a median income of \$23,148, 102 jobs (11.8%) in manufacturing and 29 jobs (3.35%) in WTU. The second is tract 112 in South Park, bordered by the Duwamish on the west and 509 on the east. It has a total population of 4,745, a median income of \$23,221, 1,560 jobs (26.5%) in manufacturing and 1,522 jobs (25.8%) in WTU. The third is tract 284.02 in SeaTac, and includes the airport itself, alongside a swath of residential territory bordered by Military Rd. to the west. It has a total population of 4,791, a median income of \$22,325, 4 jobs (.03%) in manufacturing and 5779 jobs (47.2%) in WTU. The final tract is 297, in the center of Kent, surrounding Kent Station and bordered by Highway 167 on the east. It has a total population of 7,623, a median income of \$23,475, 648 jobs (10.9%) in manufacturing and 1233 jobs (20.8%) in WTU.

These four tracts give some impression of what factors might compose a logistics space. Two of the four clearly include major logistics infrastructure (SeaTac airport and Kent Station), and the other two are bordered by highways that are host to at least T-2 freight traffic (see Section 1, Part 5, pg. 47). Meanwhile, the other demographic super-clusters are that do not

overlap directly with the industrial super-clusters are at least located adjacent to them, stretched along many of the same freight roads and rail lines. All together, the comparison gives the impression that these two super-clusters of industrial and demographic variables compose a distinct space, when combined. But the actual interconnection between tracts remains to be examined.

Section 4

Feeder and Receiver Tracts

In order to begin to quantify the actual connection between the city's logistics infrastructure and its suburban poverty and migrant settlement, I have calculated tract to tract origin-destination tables from the LEHD Origin-Destination Employment Statistics (LODES) dataset, which comes from the US Census Longitudinal Employer-Household Dynamics (LEHD) program. Their OD data files include the number of jobs sent by each census block in a given geography as well those received, broken down by industry ("LEHD..."). It is thus an extremely well-suited tool to locate which tracts are sending workers to the jobs in the industrial super-clusters, and which tracts are receiving workers who live in the demographic super-clusters. I would expect this process to yield results in line with a simple gravity model, in which those who work in the industrial super-clusters will tend to live nearby. I do not, however, take the gravity model as a given, and instead will test this assumption by mapping the LODES data directly.

Maps 4.1-4.4 show the results. The first (4.1) looks at "feeder" tracts, defined as those that send workers into any tract within the industrial super-cluster corridors to work jobs in WTU or manufacturing. The tracts sending the highest number of workers are clearly concentrated within the southern suburbs. They overlap with both the demographic and industrial super-clusters, though they are more broadly distributed than either. In part, this confirms the intuitive assumption that those working in the super-clusters will tend to live nearby. At the same time, the divide between southern and northern tracts within western King and Pierce Counties appears slightly too strong to be accounted for by distance alone—note, for example, the existence of

high outlier tracts southeast of Tacoma, a phenomenon not seen in Bellevue, the tech suburbs or North-Central Seattle, despite a similar distance from the corridors.

There are three versions of the “receiver” tract map (4.2,4.3 and 4.4). Here, “receiver” tract is defined as those that receive workers (at minimum one) from any tract within the demographic super-clusters. The three versions each express the three major dimensions of the demographic super-clusters. Note that the magnitudes being measured increases as the number of demographic super-cluster tracts increases, even though the gradients are consistent across maps to emphasize the relative strength of the receiver tract. The first (4.2) is a map of those tracts receiving workers from the demographic super-cluster “peaks” in which clusters of poverty, foreign-born share and WTU industry by place of residence overlapped. The second (4.3) is a map of those tracts receiving workers from the demographic super-cluster tracts in which clusters of poverty and WTU industry by place of residence overlapped. The third (4.4) is a map of those tracts receiving workers from the demographic super-cluster tracts in which clusters of foreign-born and WTU industry by place of residence overlapped. All exhibit similar characteristics. The tracts receiving the most workers are consistently within the industrial super-clusters. In each map, the outlines of the industrial super-clusters have been overlaid on the map of receiver tracts in order to emphasize this. Meanwhile, there are few receiver tracts that are neither within nor nearby the industrial super-clusters, with one tract in Everett being the only notable exception, receiving 279 workers who live in the demographic super-cluster “peak” tracts.

Section 5

Conclusion

Altogether, the combination of industrial and demographic analyses performed here give a clearer sense of what, exactly, is meant by the existence of a “logistics city.” Theoretically, the concept has been widely applied (Bernes 2013, Cowen 2015, Toscano 2011, 2014) but sparsely measured. The key theoretical texts studying the logistics city rarely even bother to offer a series of possible variables to test their hypotheses. Above, I’ve offered one method of measuring the intensity of logistics space using overlapping employment share clustering. This is not the only method, and it is one specifically geared toward discovering the “logistics spaces” *within* the larger city. The ultimate reliance of a regional economy on logistics infrastructure may be better proved by gross output value, and the degree of integration into global supply chains facilitated by a region’s logistics infrastructure could be measured by the composition and total value of imports and exports that pass through these industries. These are other options available for future work on the topic, not pursued here.

On the demographic side, there already existed a solid bedrock of work studying the “suburbanization of poverty” (Berube and Kneebone 2013) and suburb migrant settlement (Singer et. al. 2008). This work offered a foundation on which to build a more detailed view of the Seattle metropolitan area’s demographic shift. This work also called into question the assumptions of the global cities literature (Sassen 1991) and its attendant dual labor-market theory (Sassen 1988, Piore 1980, Massey et. al. 1993). If the restructuring of American cities after the crises of the 1970s was only centered on producer services, healthcare, education and other services as the new “post-industrial” engine of economic growth, then we would expect to

only see the type of dual labor-market envisioned by this literature. This would appear as a concentration of low-end service work in retail, food service, janitorial services, etc. that more or less overlaps (in the relevant work tracts) with high-end producer services in government, law, infotech, biotech, and FIRE, tending toward a geographic concentration in downtown cores or suburban tech complexes such as Bothell-Mountlake Terrace, Kirkland, Redmond and the rest of the tech corridor stretching west of the University. We might expect to see these low-income service workers living on the urban outskirts and in the newly-impooverished suburbs, commuting into the city to work in services. What the dual labor-market theory cannot account for is the existence of a large, concentrated swath of employment in WTU and manufacturing, where the industrial infrastructure of global production extends directly into the American city—the “logistics city” lying beneath the “global city” mirage. A more focused historical study would be required to determine whether or not this amounts to a “reindustrialization” of the region or simply the continuation, in a new form, of its pre-existing industrial structure. Worthwhile comparisons might be made to the current (re-)industrialization of the American South.

Ultimately, the results of such quantitative analyses must always be explained with a modicum of caution. What has been demonstrated above is the existence of relatively continuous clusters of high employment shares in WTU and manufacturing, as well as the existence of relatively continuous clusters of census tracts with high shares of those below poverty, foreign-born and employed in WTU industries, in several combinations of these variables. These two super-clusters overlap somewhat and are largely adjacent, but this overlapping and adjacency demonstrates little more than the co-existence of large shares of people who have these demographic characteristics alongside a swath of tracts that have a higher concentration of firms specializing in WTU and manufacturing. Alone, this does not even tell us whether or not the

people in these demographic super-clusters are even likely to work in the overlapping or adjacent industrial super-clusters.

The introduction of the LODES data gets past this obstacle, demonstrating a clear connection between the demographic super-clusters as “feeder” tracts for the industrial super-clusters and the industrial super-clusters as “receiver” tracts for the demographic super-clusters. This demonstrates that there is at least a high probability that the demographic and industrial spaces are interconnected, and therefore mutually shape each other, via employment. This also confirms that, against the global city literature’s focus on high- and low-end “post-industrial” services, there is a significant section of the Seattle region, at least, that is very much a part of global production and remains devoted to industrial activity. Even if the LODES data essentially mirrors what we would expect from a simple gravity model, it is significant that the “center of gravity” of these logistics super-clusters also happens to be the center of gravity of the demographic super-clusters. This infers that there may be some more substantial relationship between the national phenomenon of suburbanizing poverty and migrant settlement and the changing industrial structure of American cities in the general direction of greater incorporation into global logistics networks, taking the form of concentrations of WTU and Manufacturing employment in “logistics cities.” This is only an inference, however, and cannot be firmly concluded from the local analysis performed here.

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Appendix A

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Ordinary Least Squares Regression Summary

Summary of OLS Results - Model Variables

Variable	Coefficient [a]	StdError	t-Statistic	Probability [b]	Robust_SE	Robust_t	Robust_Pr [b]
Intercept	-1.739532	0.187021	-9.301285	0.000000*	0.238898	-7.281490	0.000000*
LOG_MAN	0.423847	0.053508	7.921167	0.000000*	0.078977	5.366743	0.000000*

OLS Diagnostics

Input Features:	BothNonZero	Dependent Variable:	LOG_WTU
Number of Observations:	202	Akaike's Information Criterion (AICc) [d]:	599.821261
Multiple R-Squared [d]:	0.238805	Adjusted R-Squared [d]:	0.234999
Joint F-Statistic [e]:	62.744894	Prob(>F), (1,200) degrees of freedom:	0.000000*
Joint Wald Statistic [e]:	28.801932	Prob(>chi-squared), (1) degrees of freedom:	0.000000*
Koenker (BP) Statistic [f]:	14.802771	Prob(>chi-squared), (1) degrees of freedom:	0.000119*
Jarque-Bera Statistic [g]:	15.951307	Prob(>chi-squared), (2) degrees of freedom:	0.000344*

Notes on Interpretation

* An asterisk next to a number indicates a statistically significant p-value ($p < 0.05$).

[a] Coefficient: Represents the strength and type of relationship between each explanatory variable and the dependent variable.

[b] Probability and Robust Probability (Robust_Pr): Asterisk (*) indicates a coefficient is statistically significant ($p < 0.05$); if the Koenker (BP) Statistic [f] is statistically significant, use the Robust Probability column (Robust_Pr) to determine coefficient significance.

[c] Variance Inflation Factor (VIF): Large Variance Inflation Factor (VIF) values (> 7.5) indicate redundancy among explanatory variables.

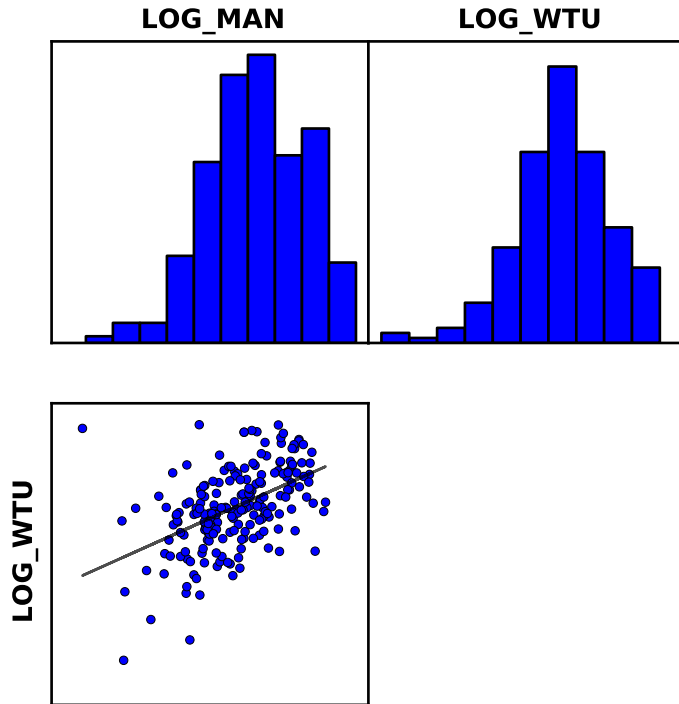
[d] R-Squared and Akaike's Information Criterion (AICc): Measures of model fit/performance.

[e] Joint F and Wald Statistics: Asterisk (*) indicates overall model significance ($p < 0.05$); if the Koenker (BP) Statistic [f] is statistically significant, use the Wald Statistic to determine overall model significance.

[f] Koenker (BP) Statistic: When this test is statistically significant ($p < 0.05$), the relationships modeled are not consistent (either due to non-stationarity or heteroskedasticity). You should rely on the Robust Probabilities (Robust_Pr) to determine coefficient significance and on the Wald Statistic to determine overall model significance.

[g] Jarque-Bera Statistic: When this test is statistically significant ($p < 0.05$) model predictions are biased (the residuals are not normally distributed).

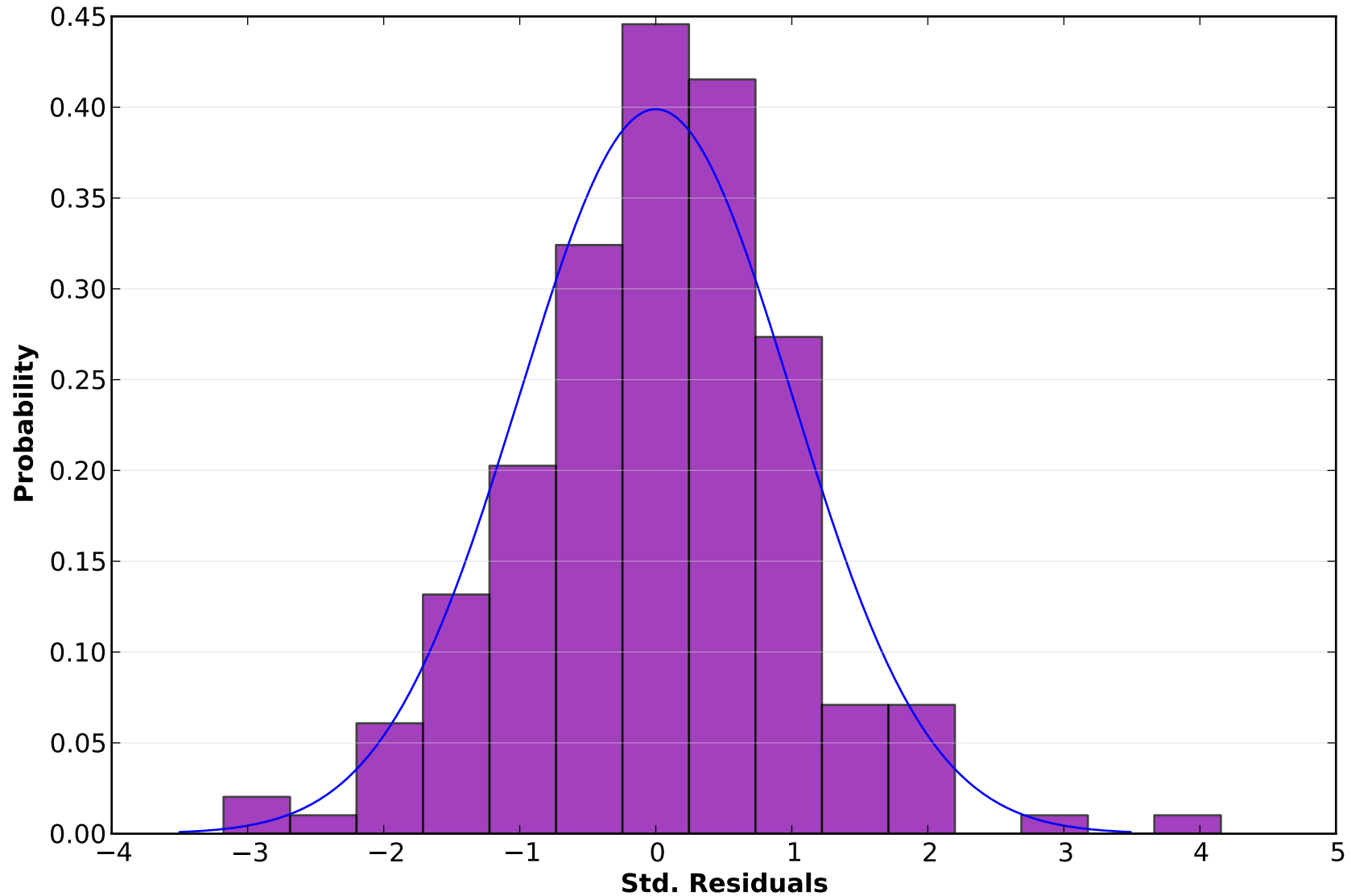
Variable Distributions and Relationships



The above graphs are Histograms and Scatterplots for each explanatory variable and the dependent variable. The histograms show how each variable is distributed. OLS does not require variables to be normally distributed. However, if you are having trouble finding a properly-specified model, you can try transforming strongly skewed variables to see if you get a better result.

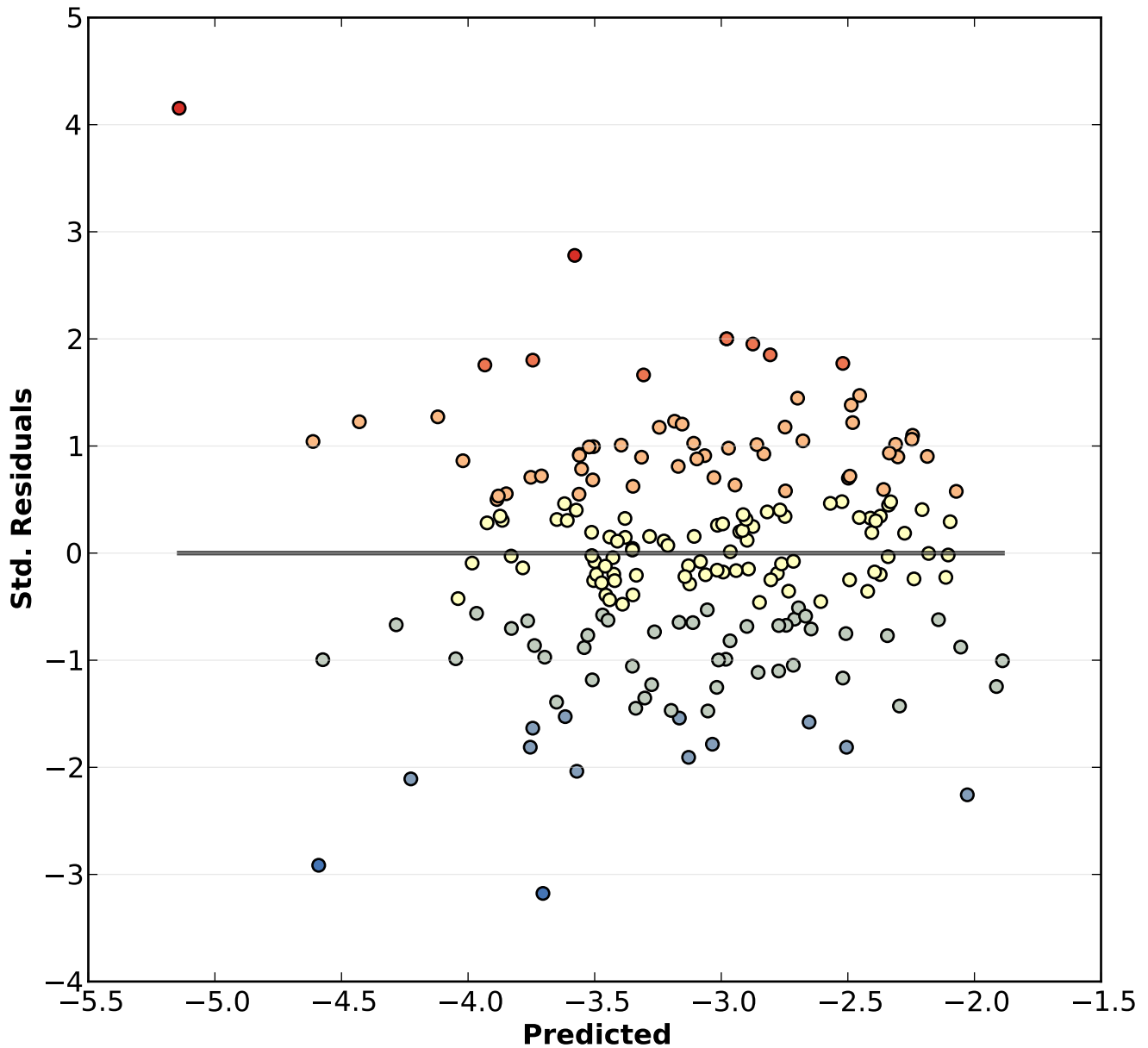
Each scatterplot depicts the relationship between an explanatory variable and the dependent variable. Strong relationships appear as diagonals and the direction of the slant indicates if the relationship is positive or negative. Try transforming your variables if you detect any non-linear relationships. For more information see the Regression Analysis Basics documentation.

Histogram of Standardized Residuals

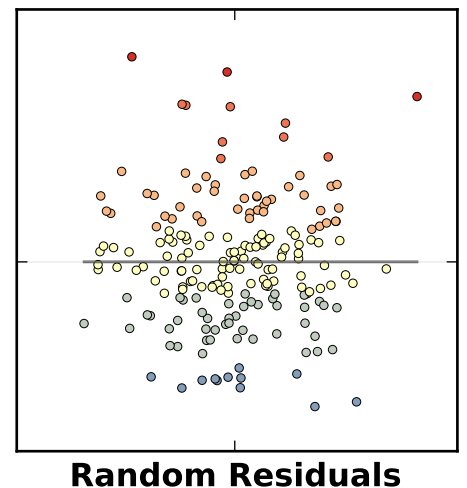


Ideally the histogram of your residuals would match the normal curve, indicated above in blue. If the histogram looks very different from the normal curve, you may have a biased model. If this bias is significant it will also be represented by a statistically significant Jarque-Bera p-value (*).

Residual vs. Predicted Plot



This is a graph of residuals (model over and under predictions) in relation to predicted dependent variable values. For a properly specified model, this scatterplot will have little structure, and look random (see graph on the right). If there is a structure to this plot, the type of structure may be a valuable clue to help you figure out what's going on.



Ordinary Least Squares Parameters

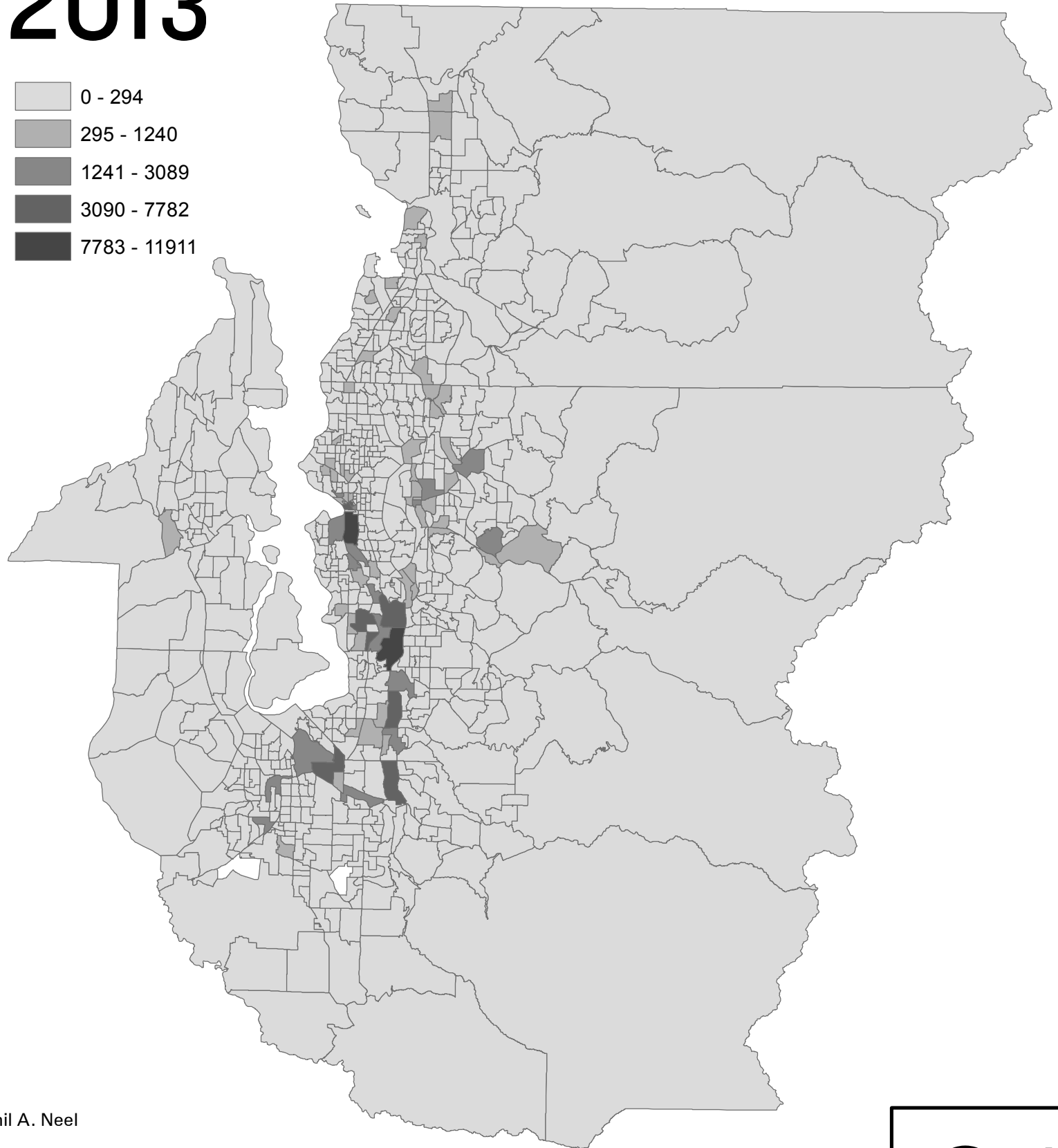
Parameter Name	Input Value
Input Features	BothNonZero
Unique ID Field	UniqueID
Output Feature Class	None
Dependent Variable	LOG_WTU
Explanatory Variables	LOG_MAN
Selection Set	True

Appendix B

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Maps

Total WTU Employment 2013



Phil A. Neel

Puget Sound Regional Council
Covered Employment Estimates 2013

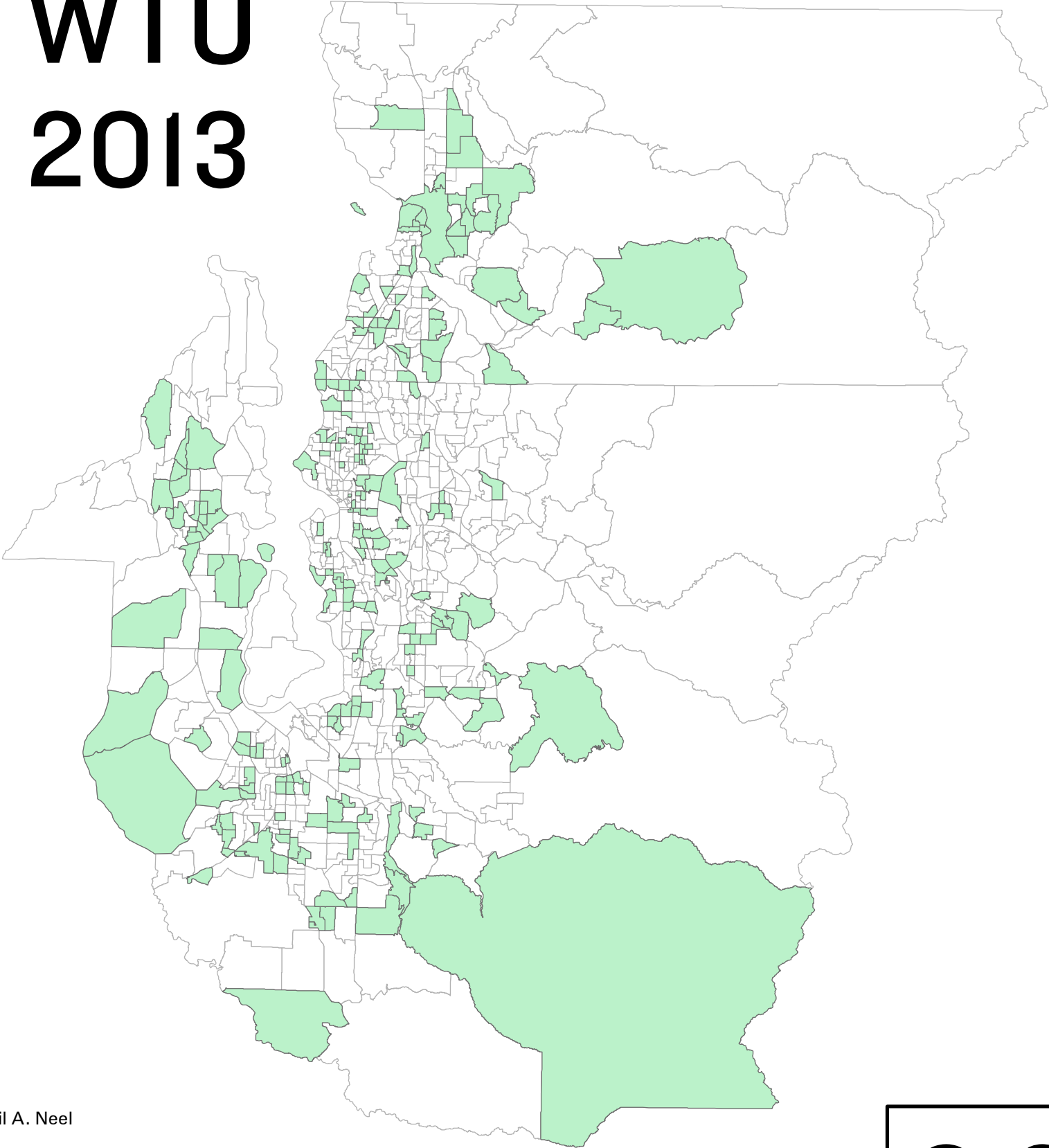
November 28th, 2015

0.1

Suppressed Values

WTU

2013



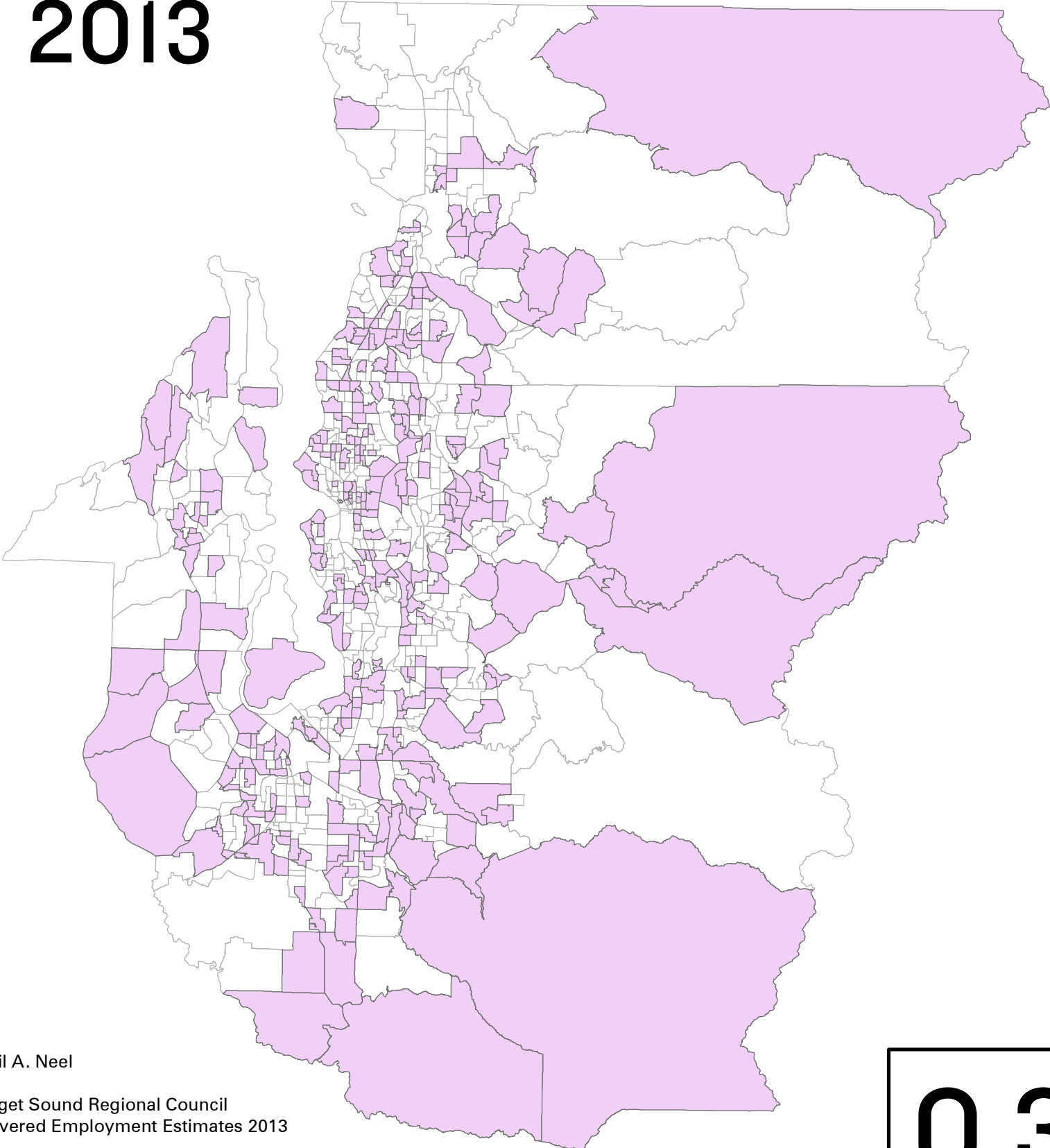
Phil A. Neel

Puget Sound Regional Council
Covered Employment Estimates 2013

November 28th, 2015

0.2

Suppressed Values Manufacturing 2013

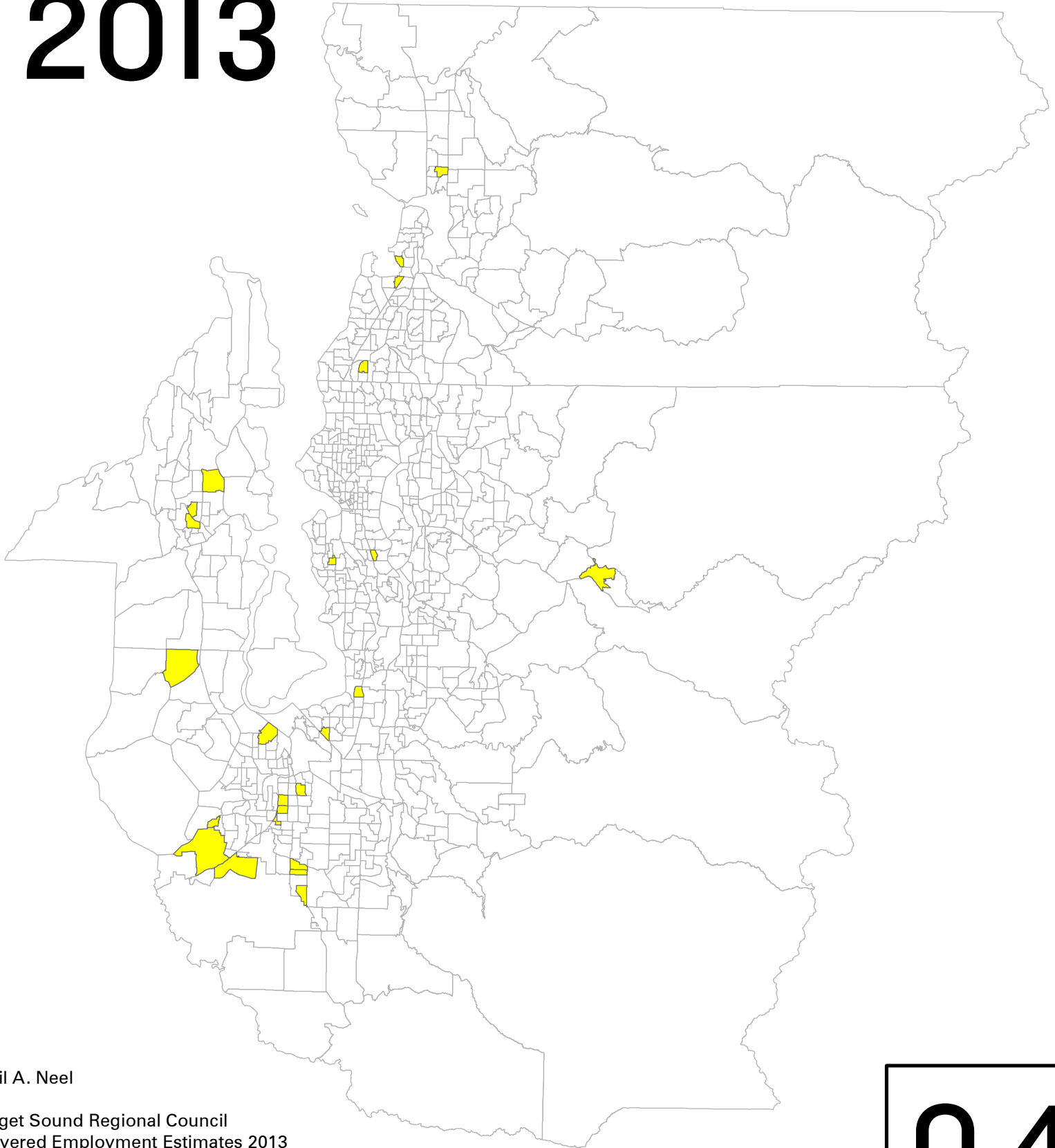


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Puget Sound Regional Council
Covered Employment Estimates 2013

November 28th, 2015

Zero Values WTU 2013



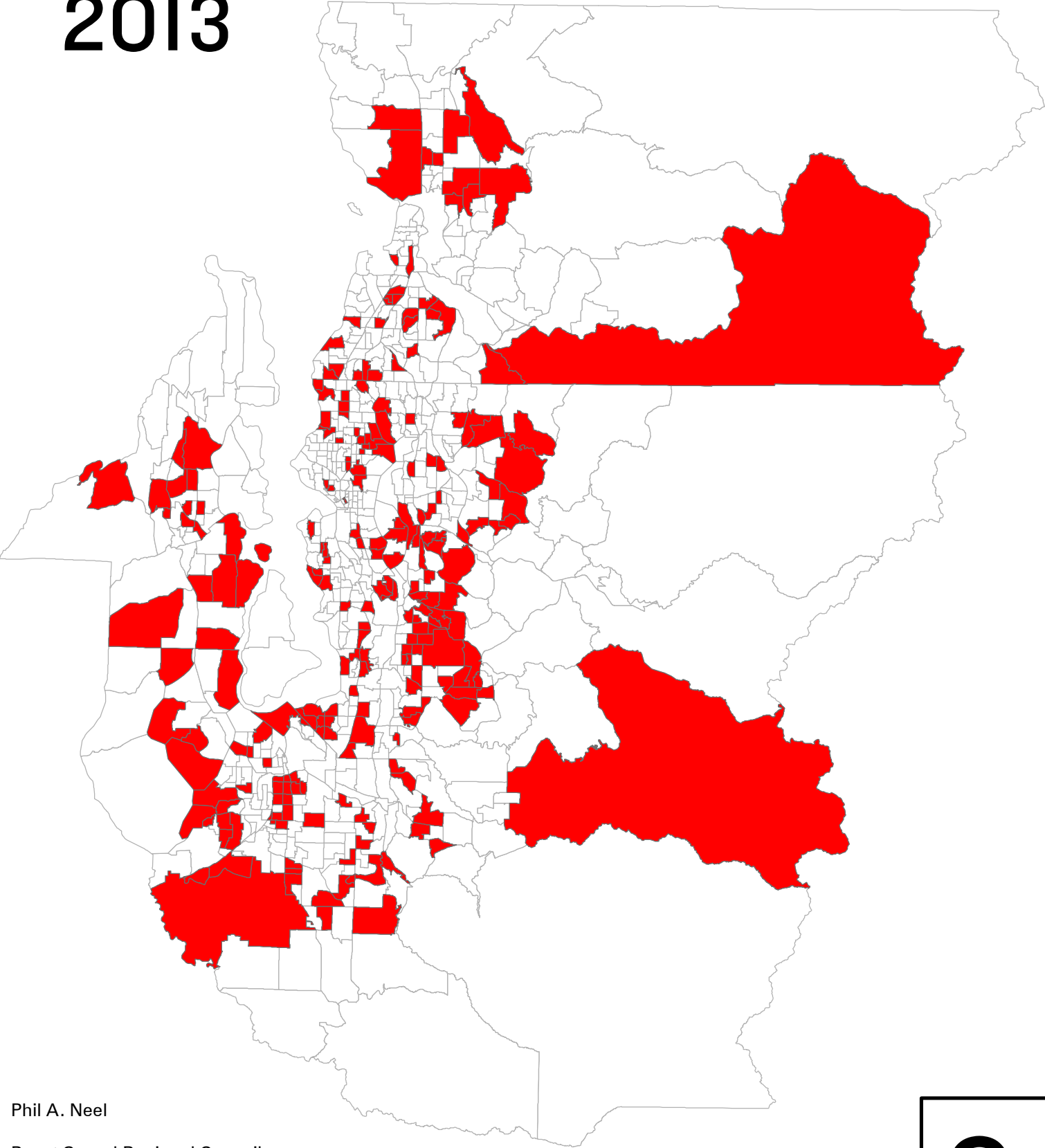
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Puget Sound Regional Council
Covered Employment Estimates 2013

November 28th, 2015

0.4

Zero Values Manufacturing 2013



Phil A. Neel

Puget Sound Regional Council
Covered Employment Estimates 2013

November 28th, 2015

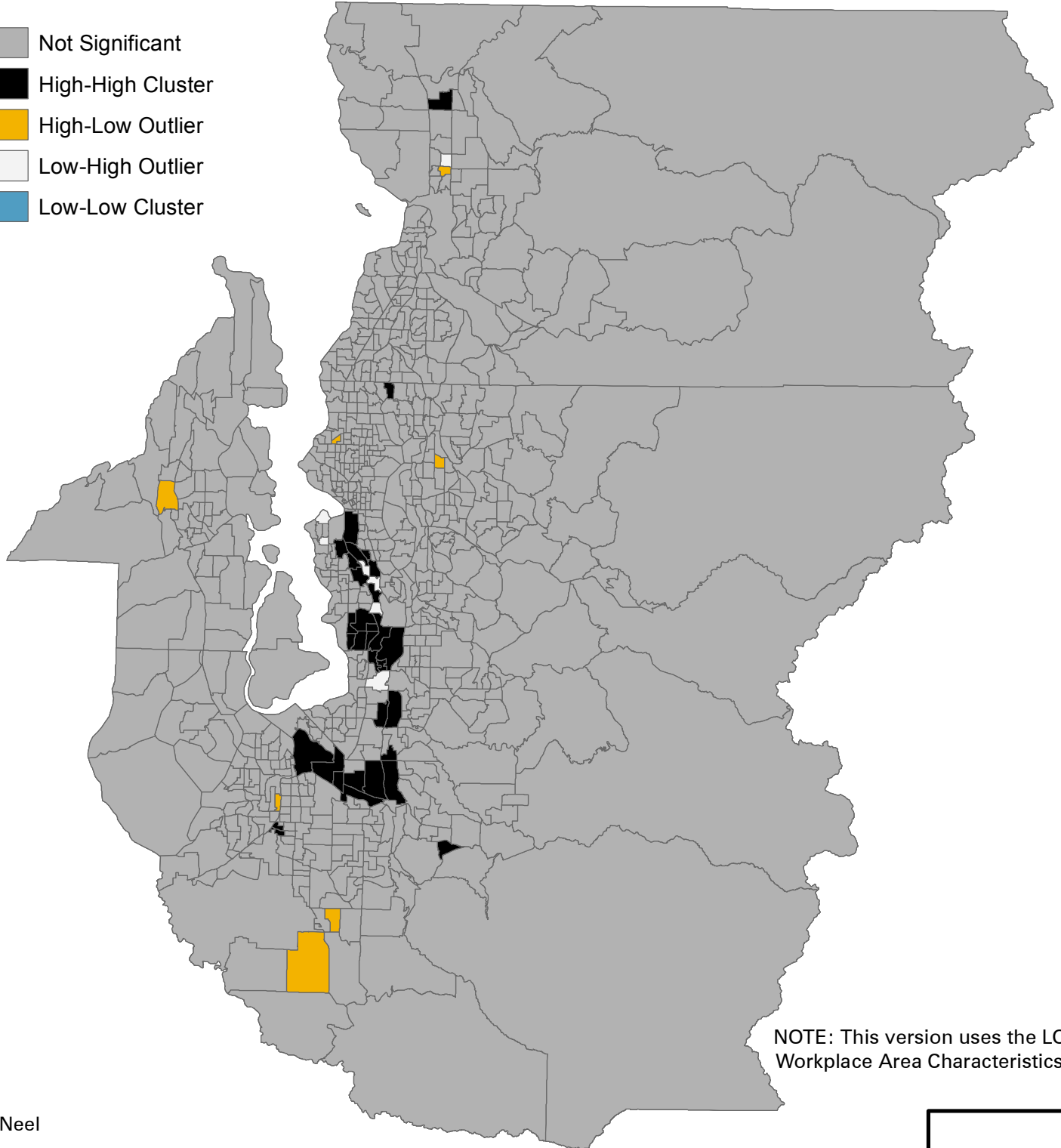
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WTU Clusters

2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized

- Not Significant
- High-High Cluster
- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster



NOTE: This version uses the LODS Workplace Area Characteristics Data

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U.S. Census Bureau; LEHD Origin-Destination
Employment Statistics (LODES), Washington State, WAC Main, 2013

November 28th, 2015

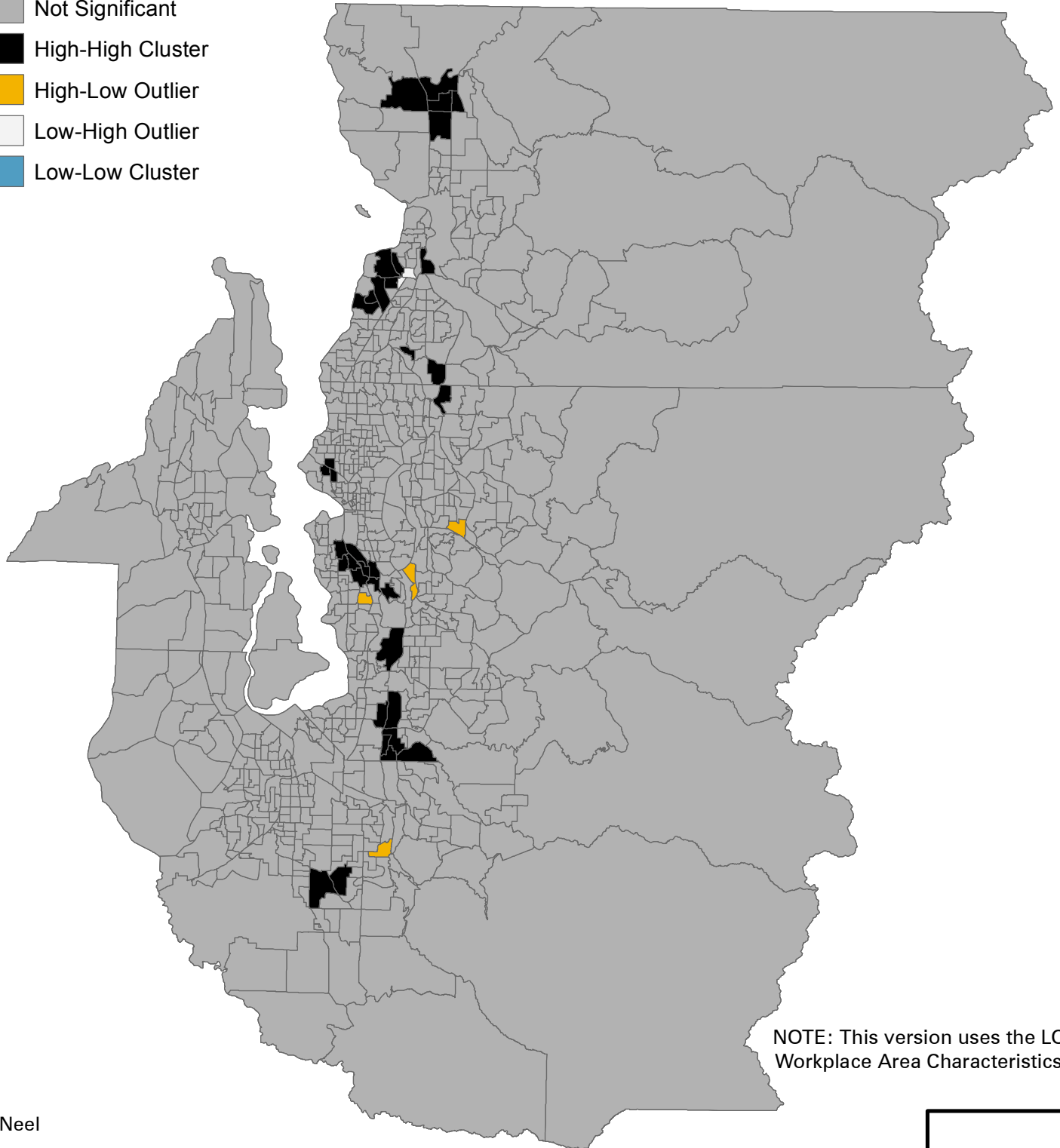
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Manufacturing Clusters

2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized

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- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster



NOTE: This version uses the LODS Workplace Area Characteristics Data

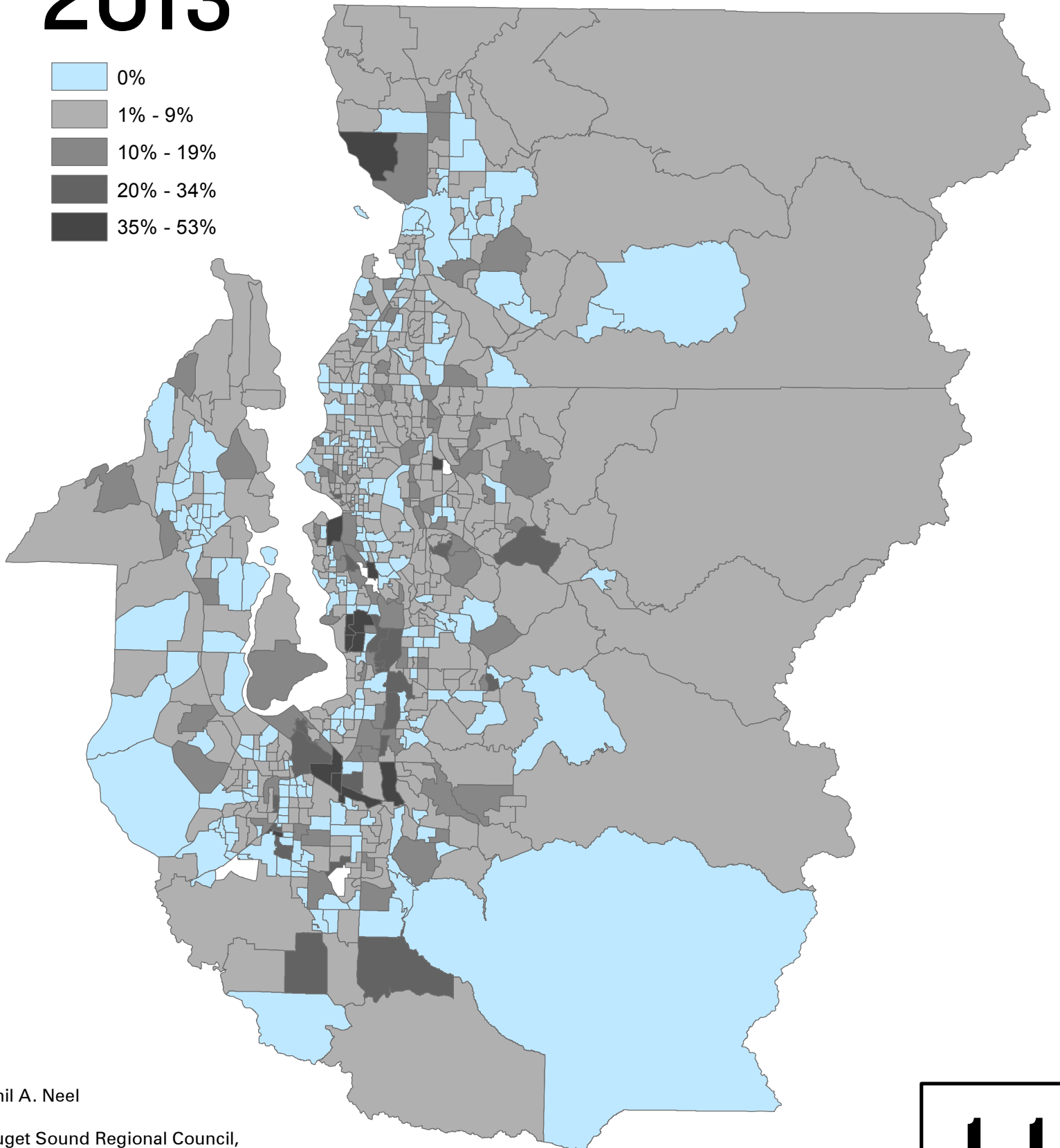
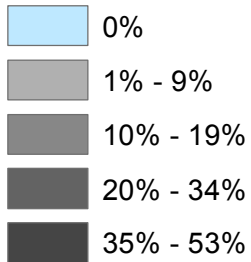
Phil A. Neel

U.S. Census Bureau; LEHD Origin-Destination
Employment Statistics (LODES), Washington State, WAC Main, 2013

November 28th, 2015

0.7

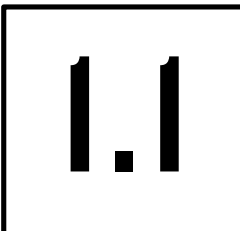
WTU Employment Share 2013



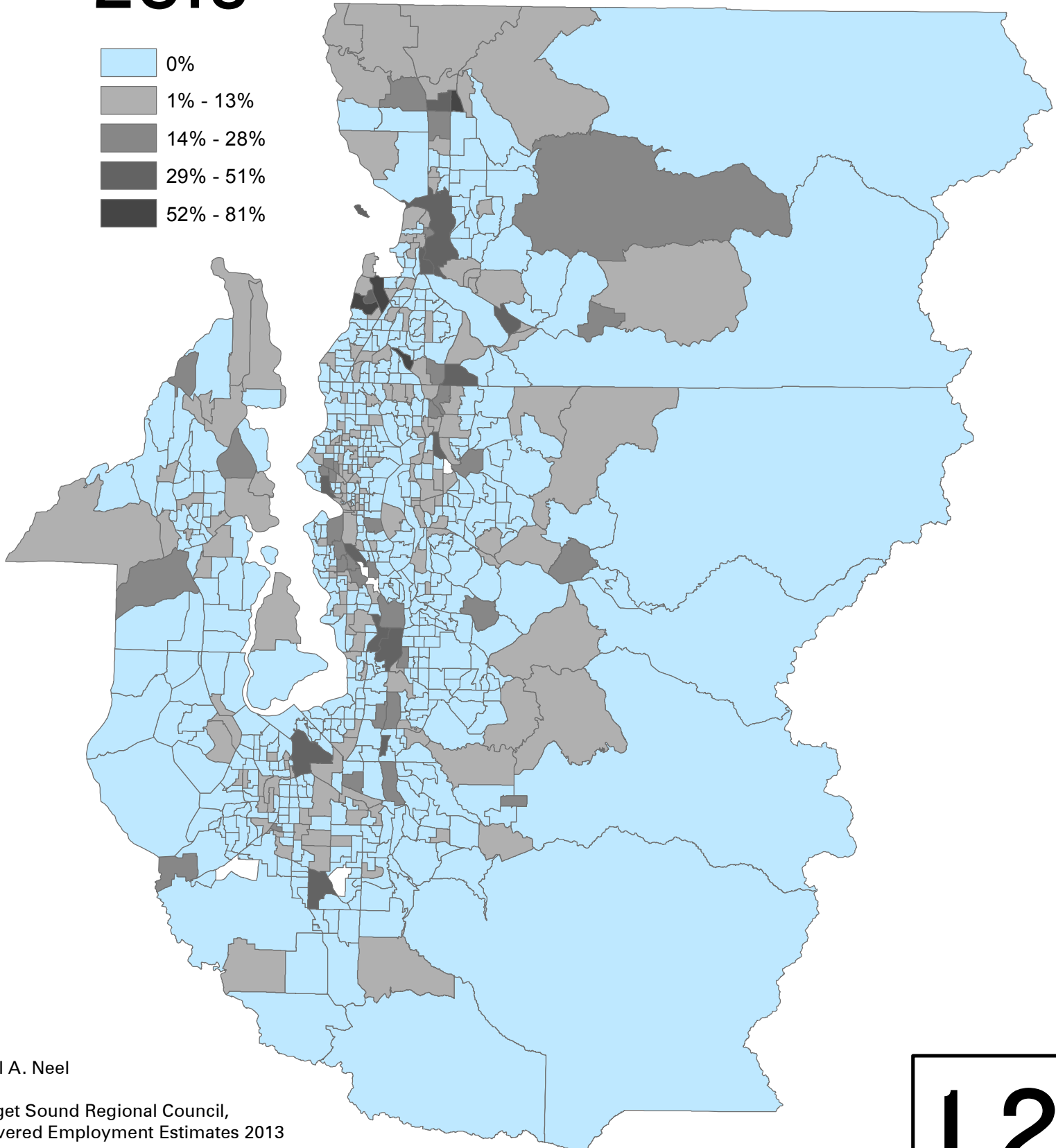
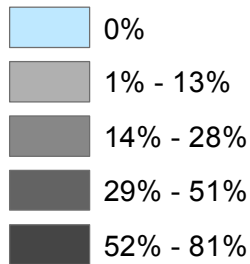
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Covered Employment Estimates 2013

November 28th, 2015



Manufacturing Employment Share 2013



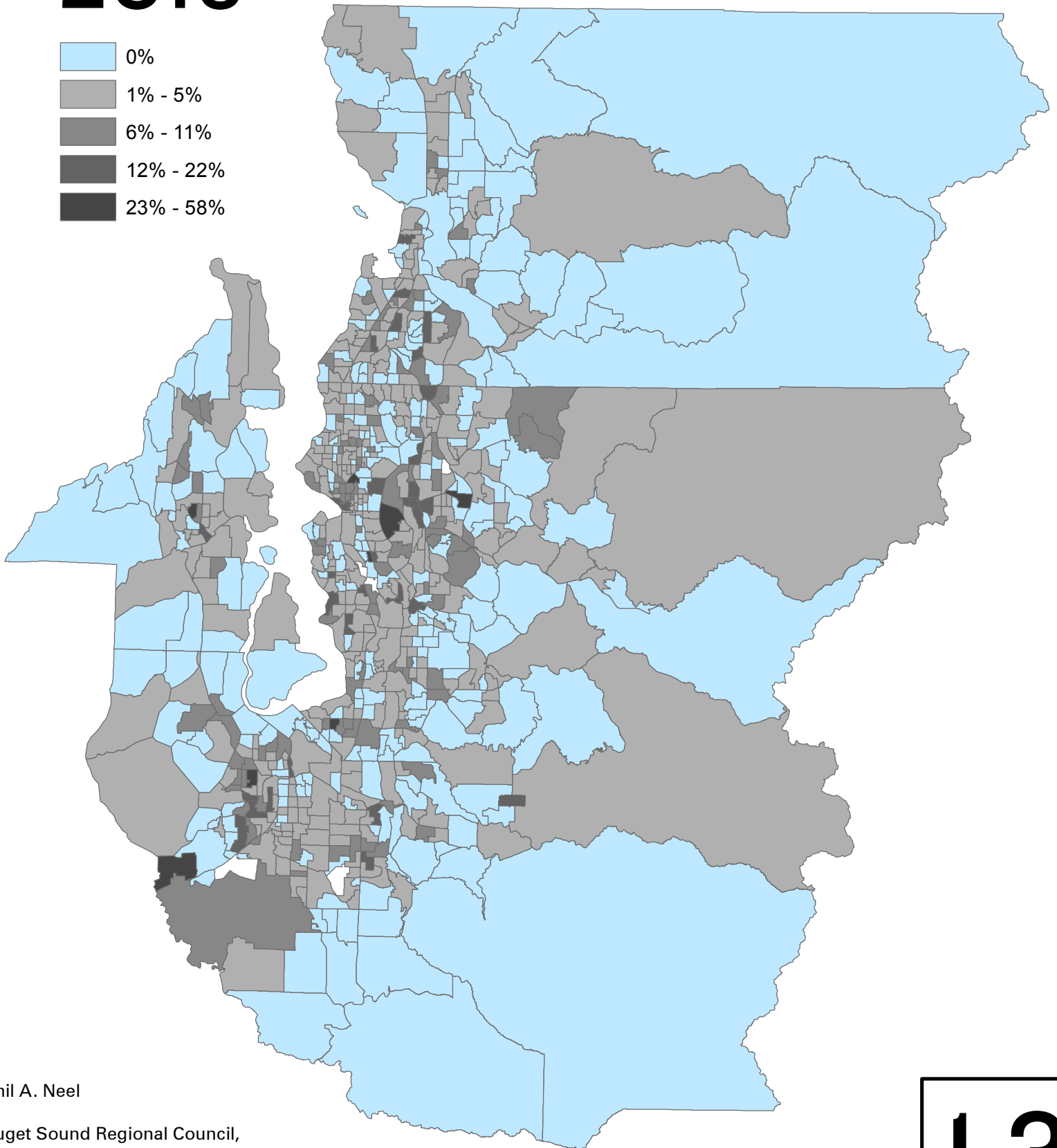
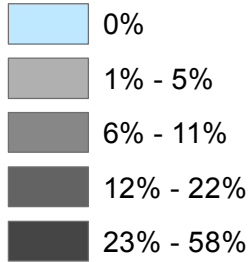
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Covered Employment Estimates 2013

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1.2

FIRE Employment Share 2013



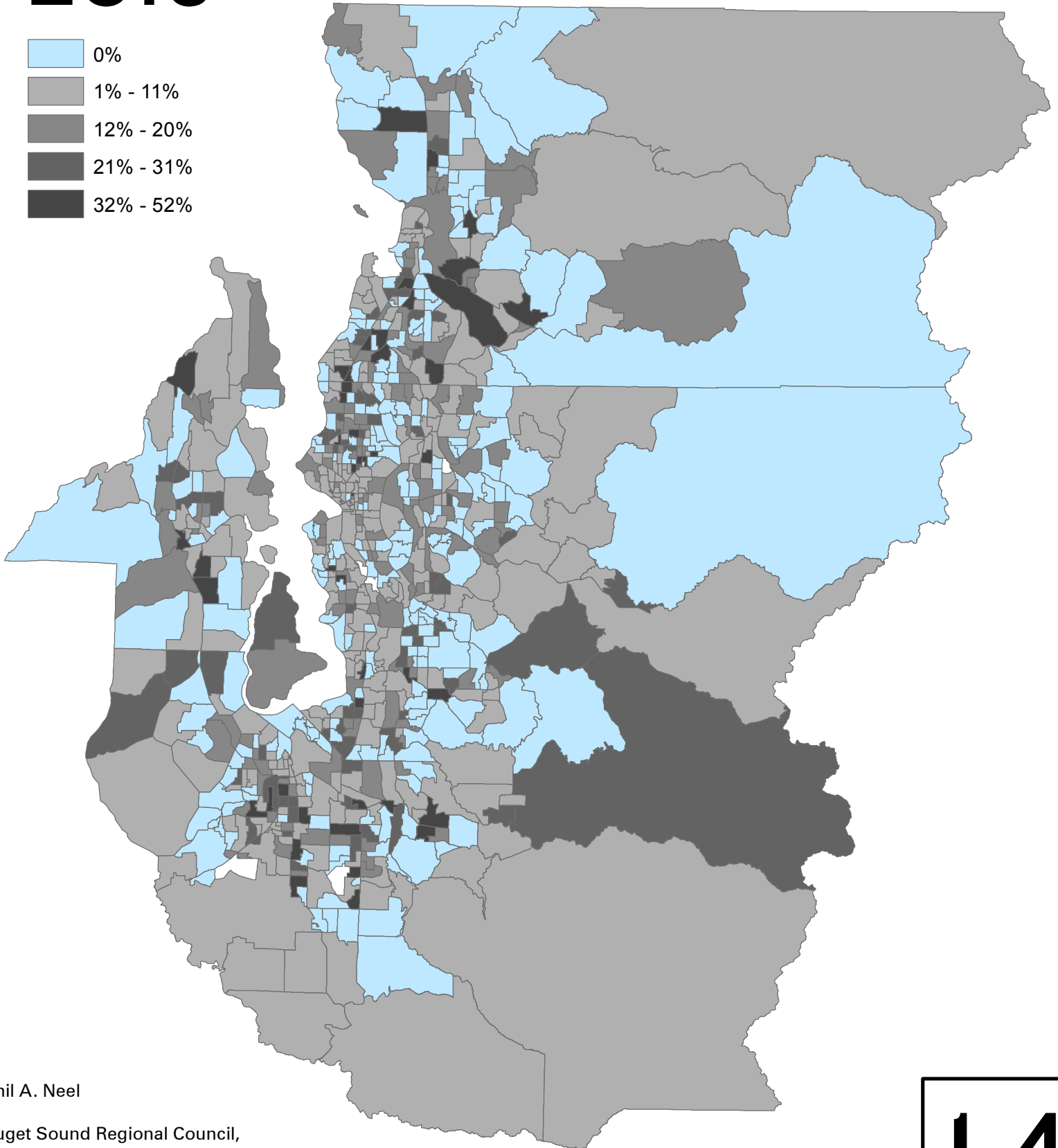
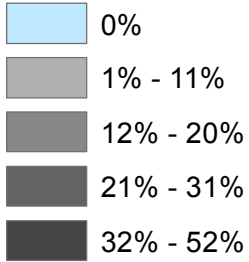
Phil A. Neel

Puget Sound Regional Council,
Covered Employment Estimates 2013

November 28th, 2015

1.3

Retail Employment Share 2013



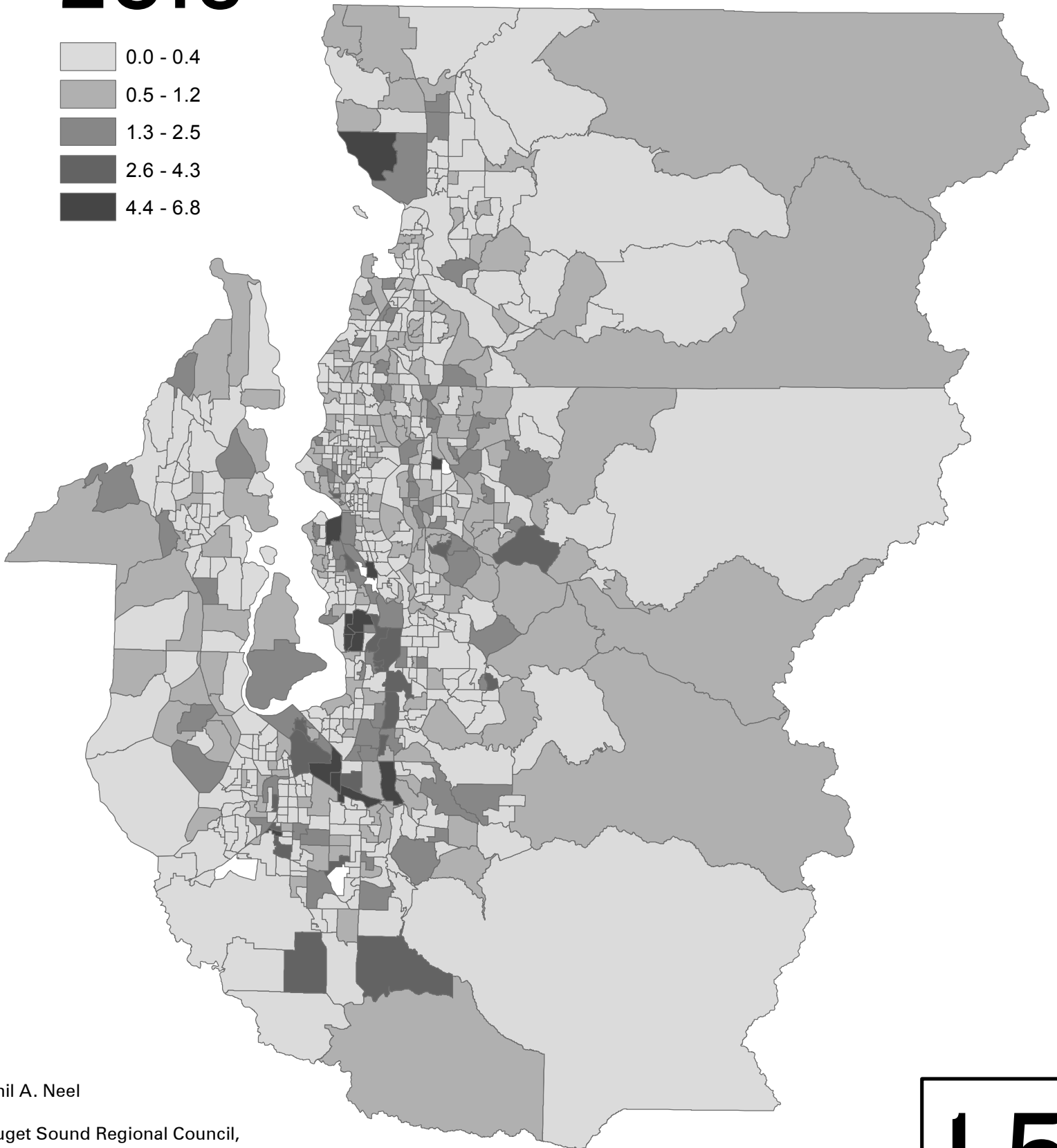
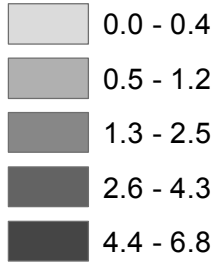
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Covered Employment Estimates 2013

November 28th, 2015

1.4

WTU Location Quotient 2013



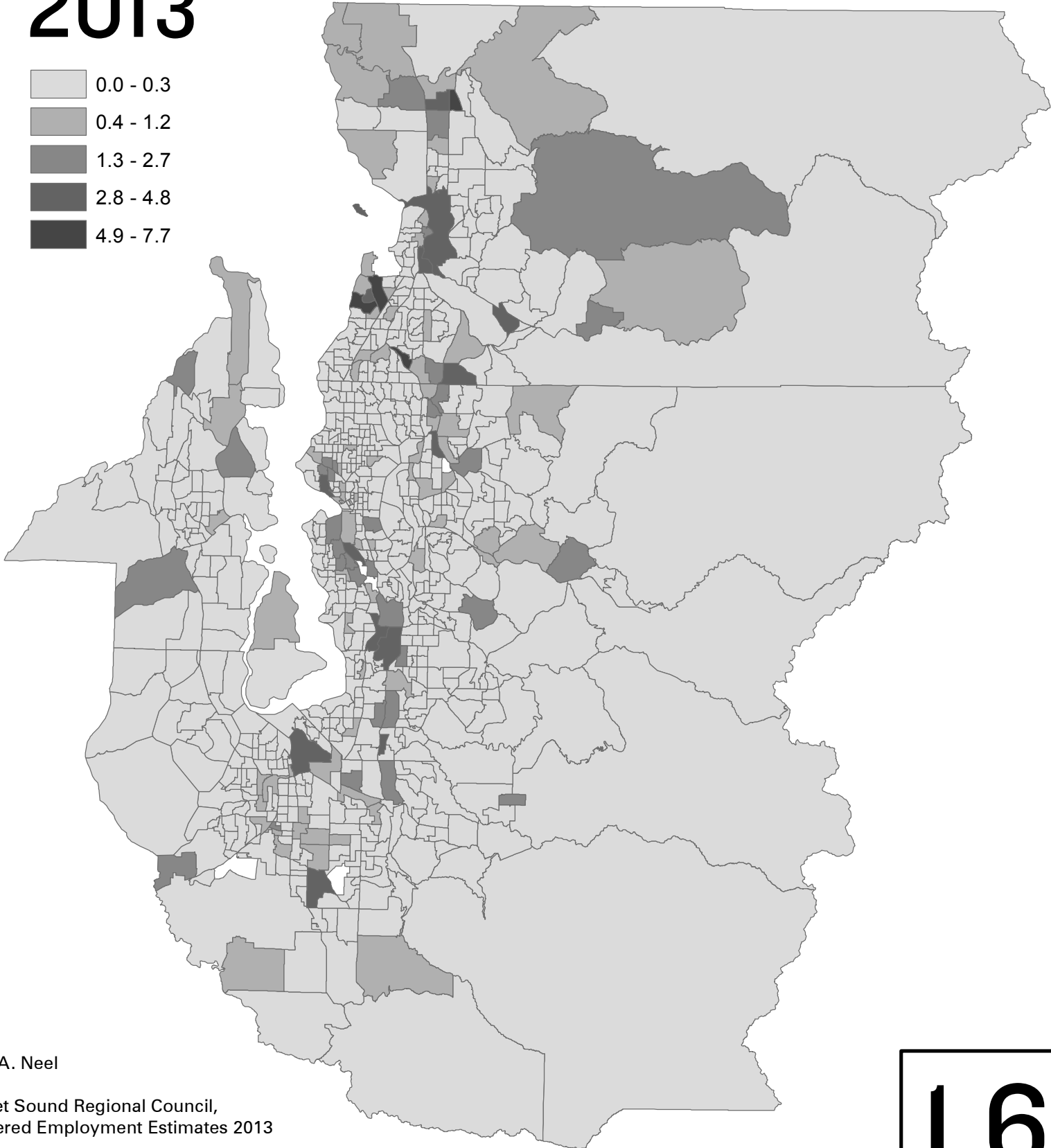
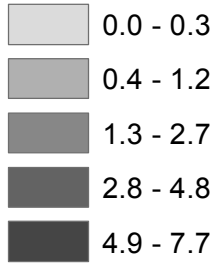
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Covered Employment Estimates 2013

November 28th, 2015

1.5

Manufacturing Location Quotient 2013



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Covered Employment Estimates 2013

November 28th, 2015

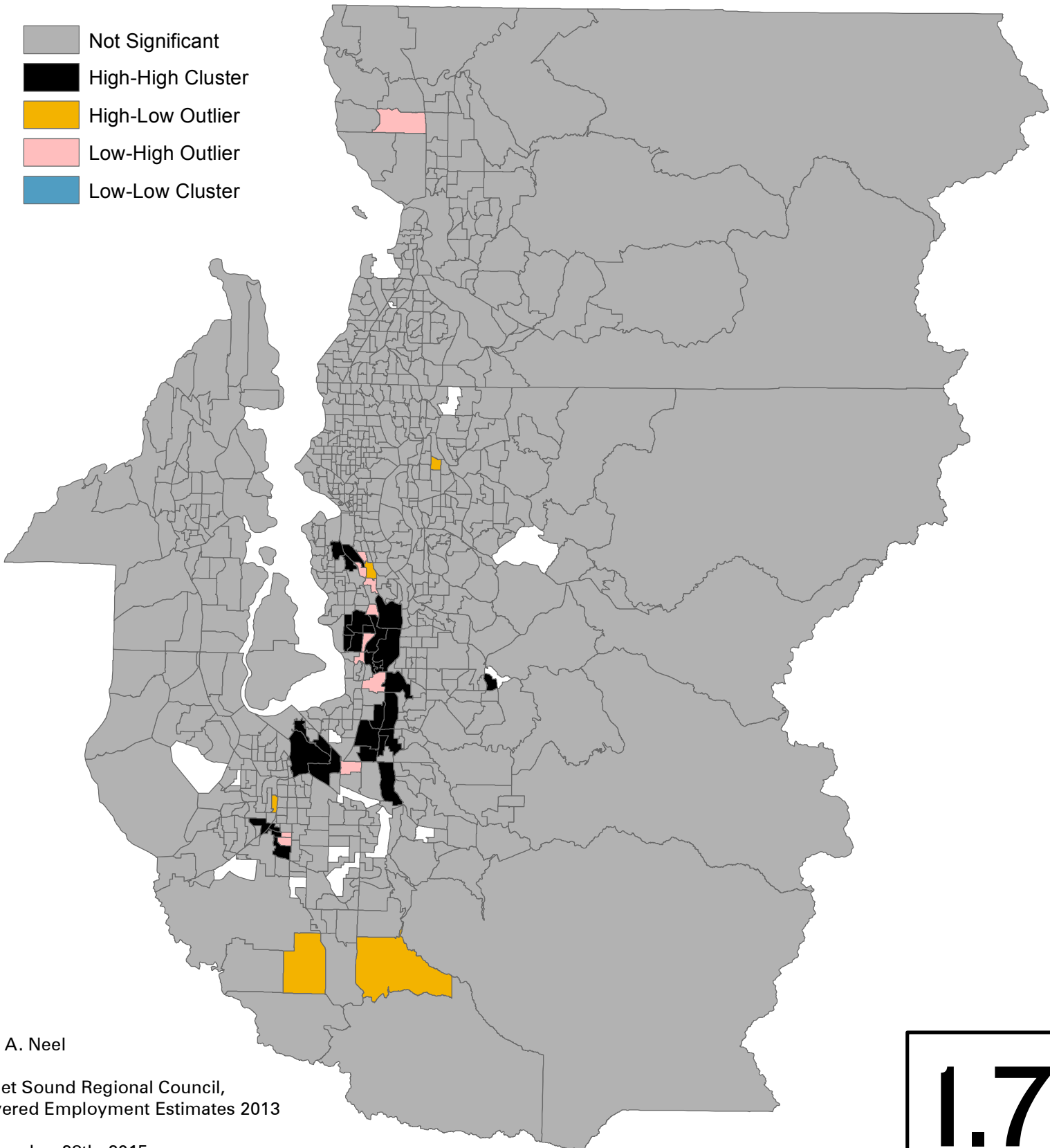
1.6

WTU Clusters

2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized

- Not Significant
- High-High Cluster
- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster



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Puget Sound Regional Council,
Covered Employment Estimates 2013

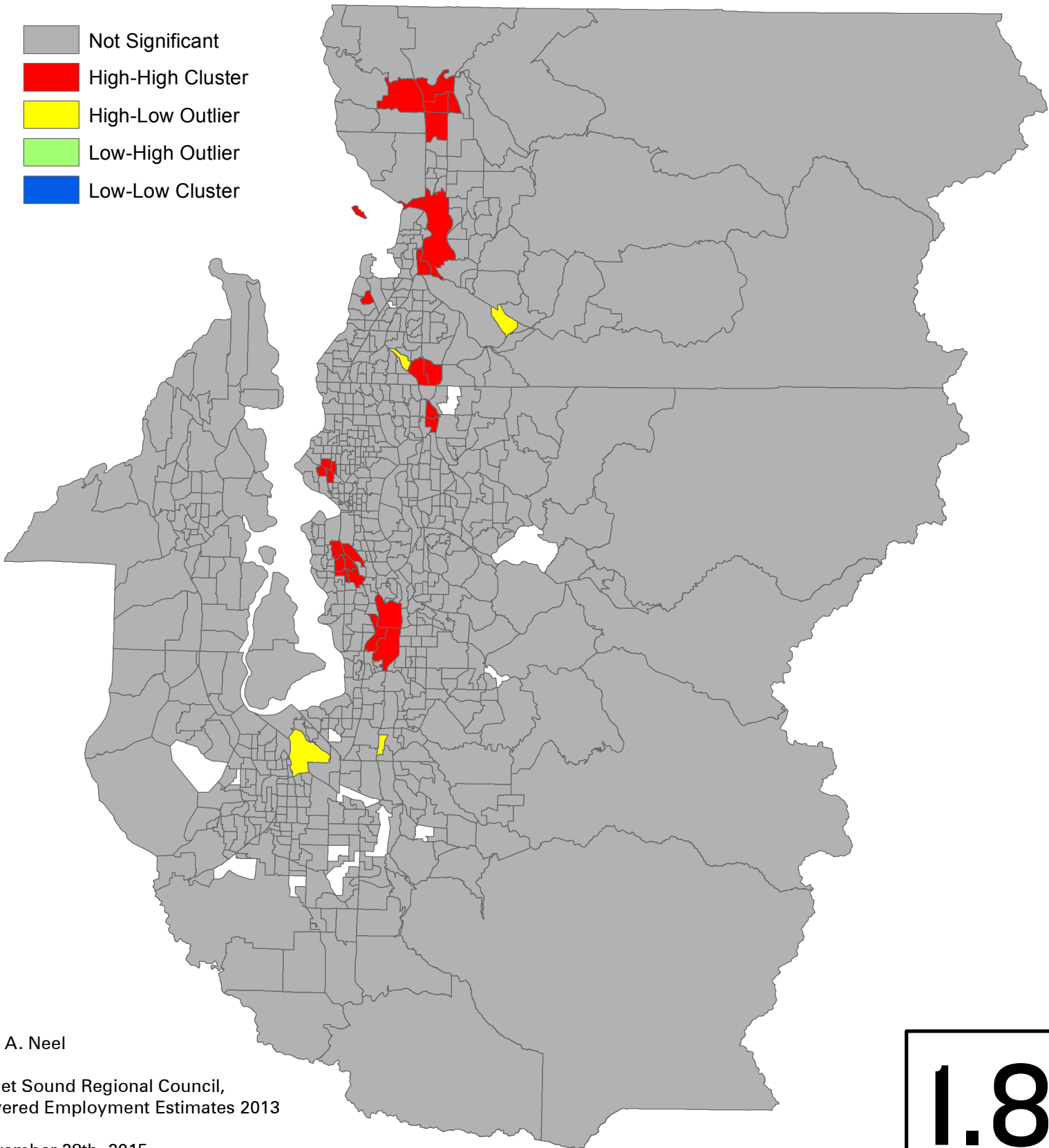
November 28th, 2015

Manufacturing Clusters

2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized

- Not Significant
- High-High Cluster
- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster



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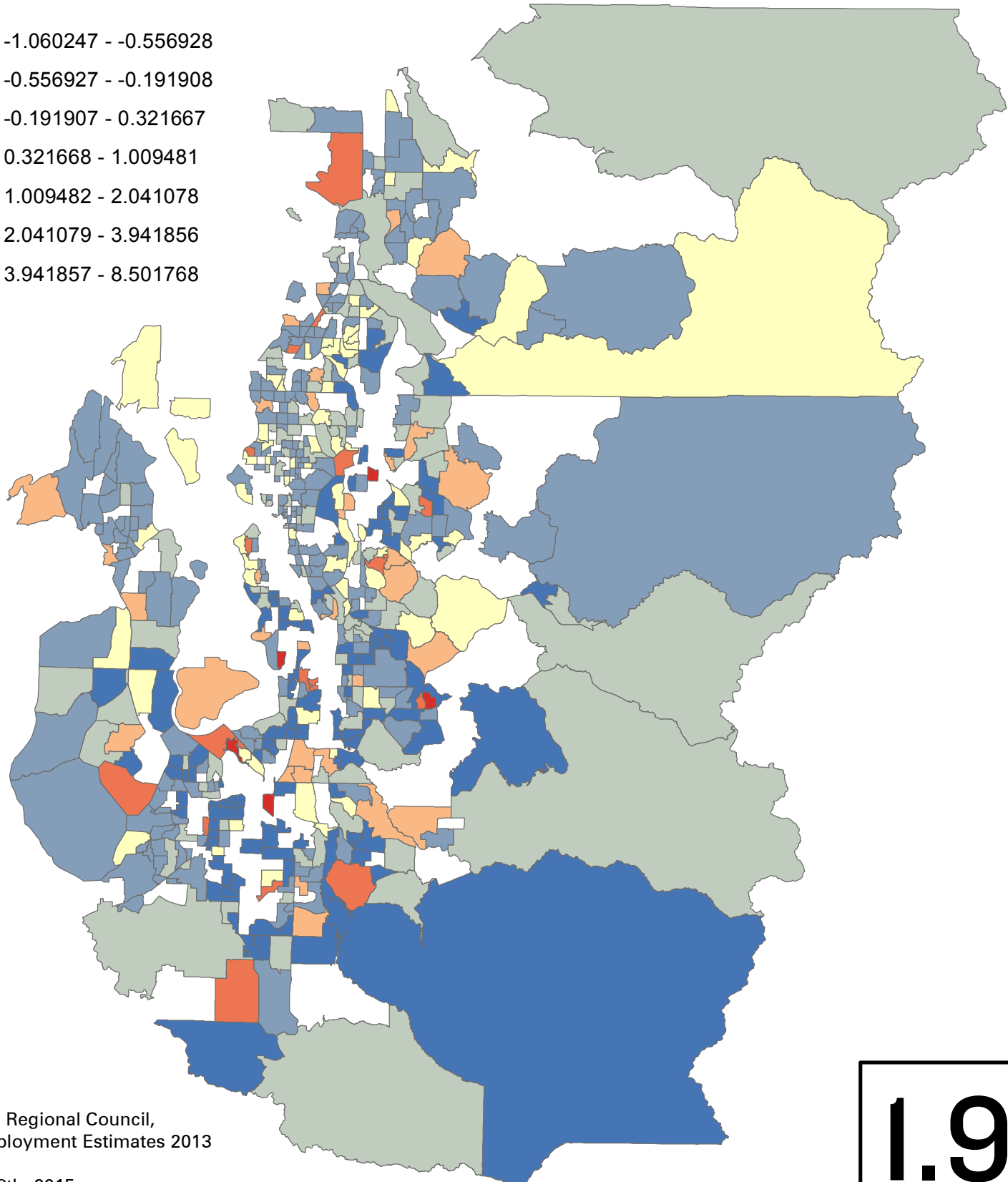
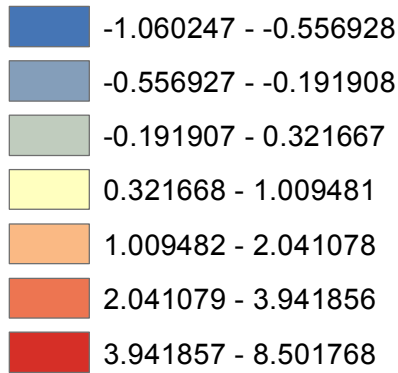
Puget Sound Regional Council,
Covered Employment Estimates 2013

November 28th, 2015

1.8

Standardized Residuals Geographically Weighted Regression

2013 Analysis performed on a subset of total data
in which zero values have been removed



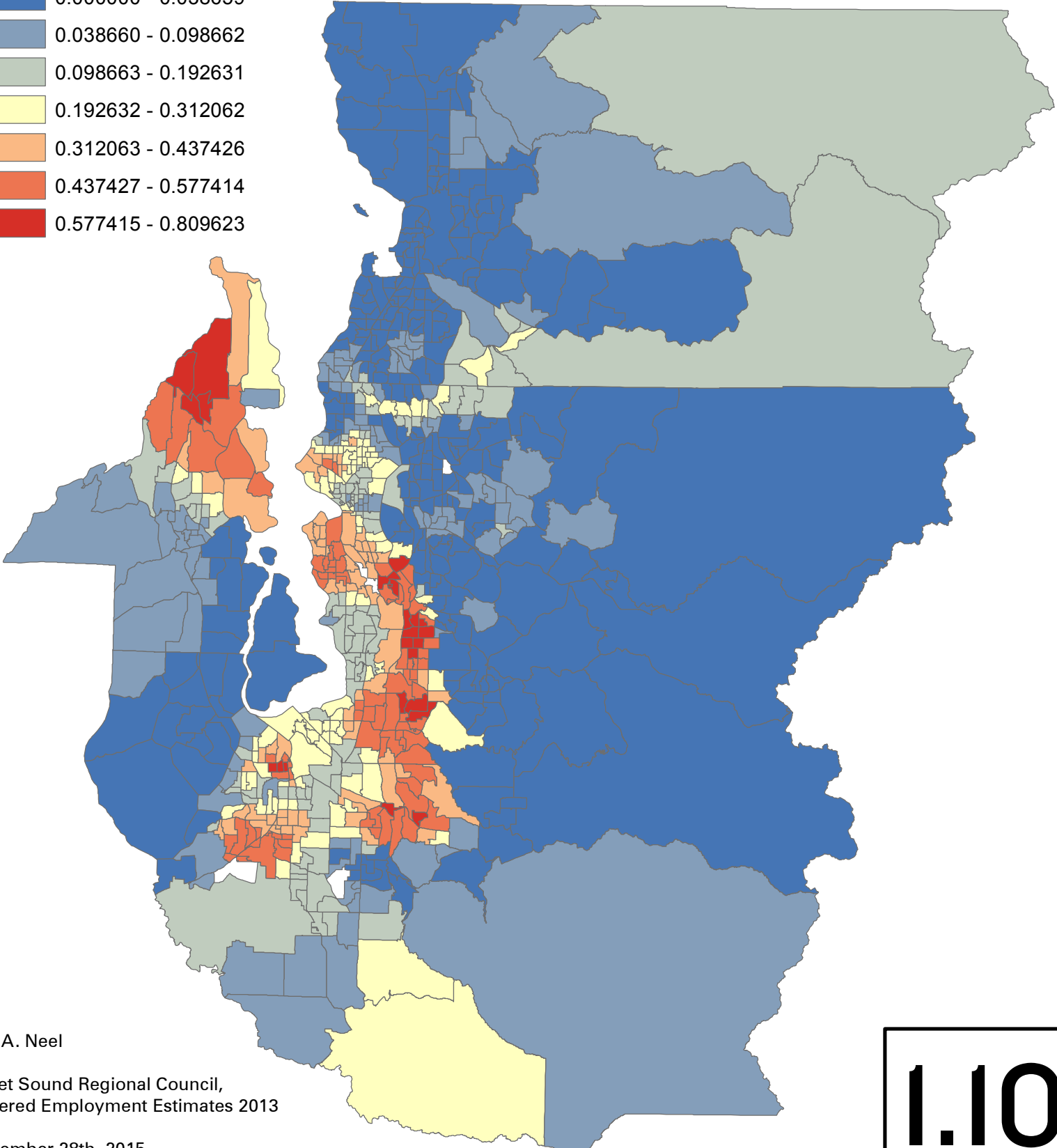
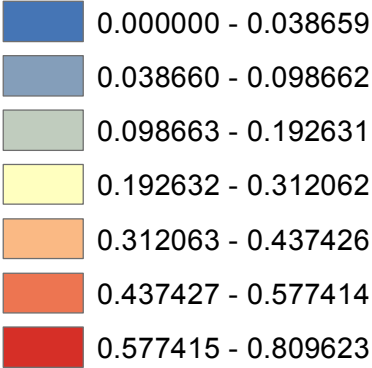
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Puget Sound Regional Council,
Covered Employment Estimates 2013

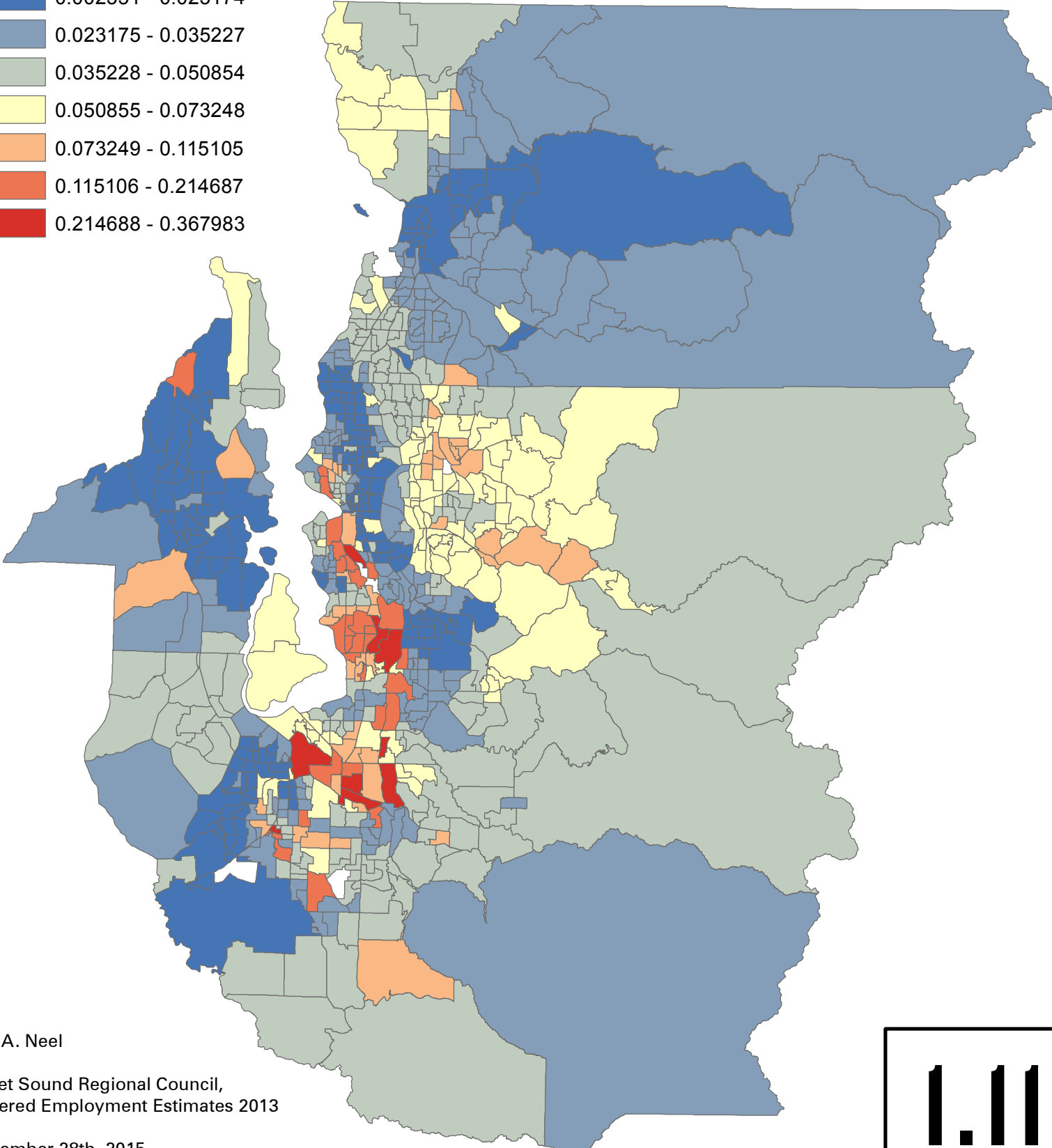
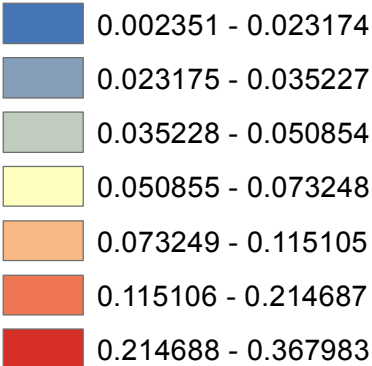
November 28th, 2015

1.9

Local R-Squared Geographically Weighted Regression 2013



Predicted Values Geographically Weighted Regression 2013

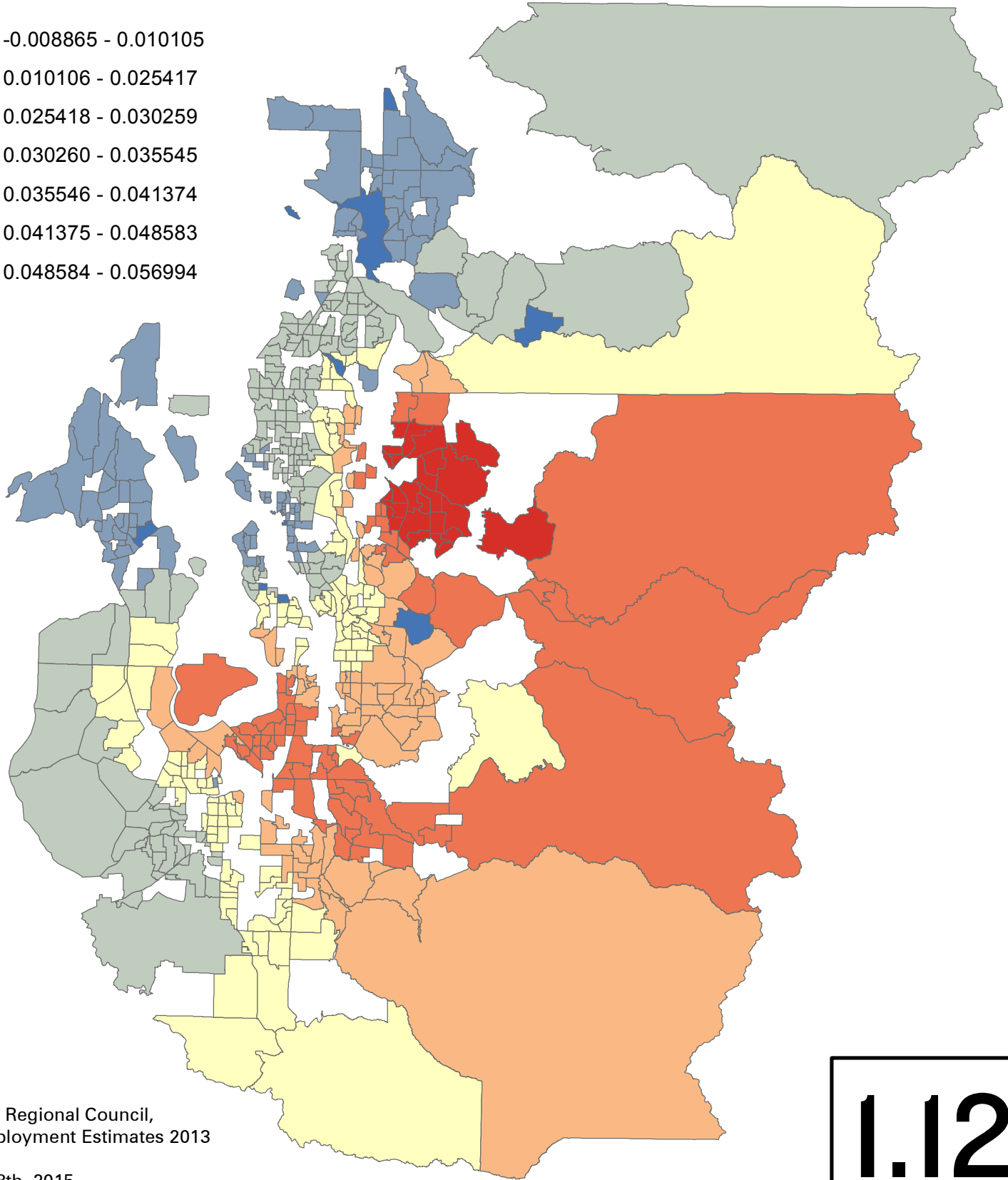
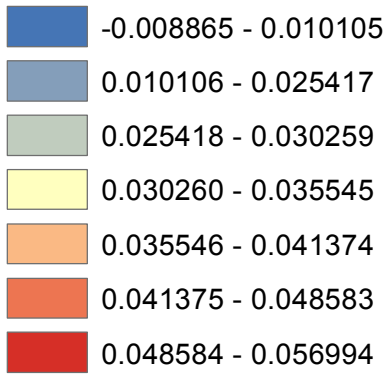


Predicted Values

Geographically Weighted Regression

2013

Analysis performed on a subset of total data in which zero values have been removed



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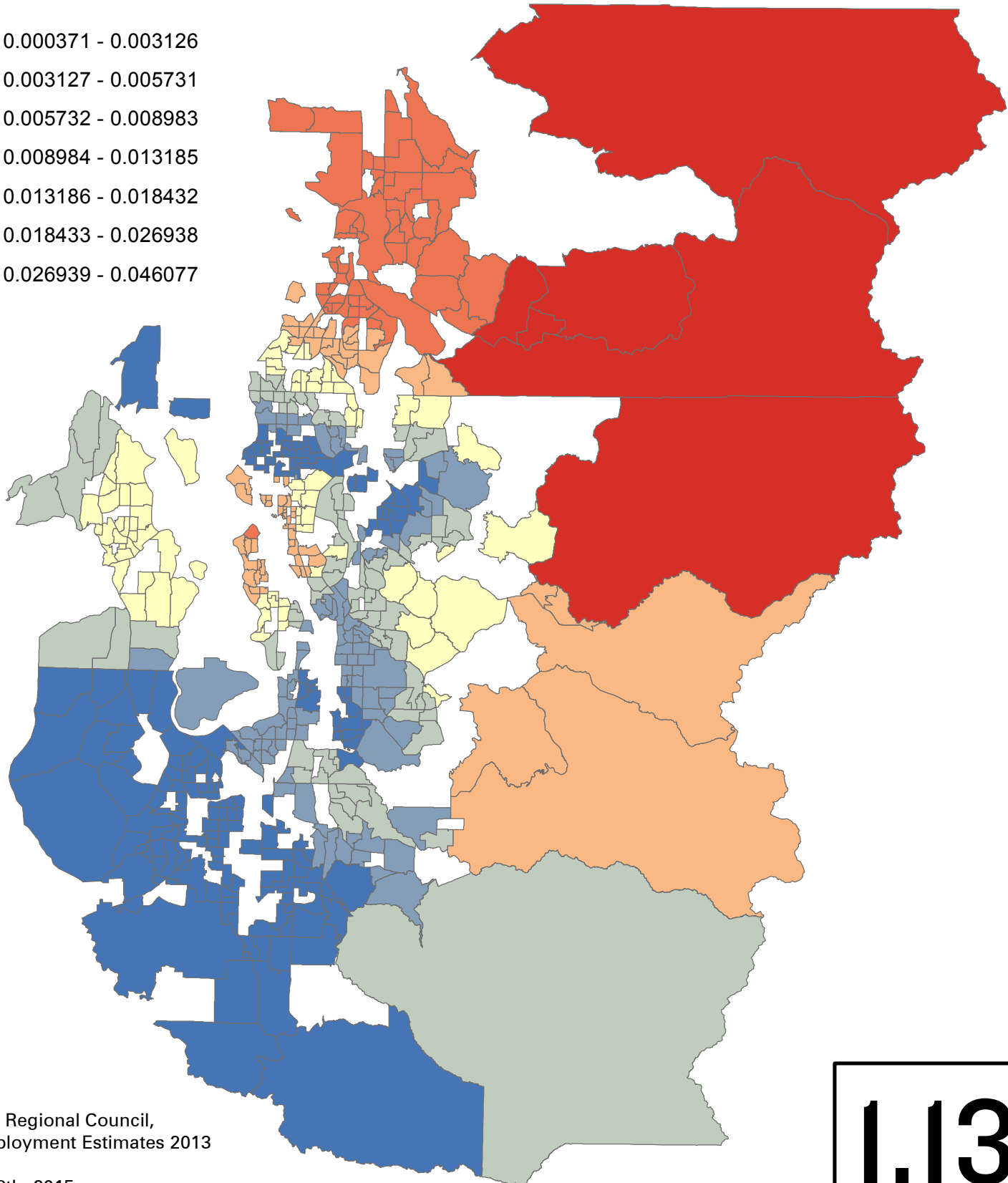
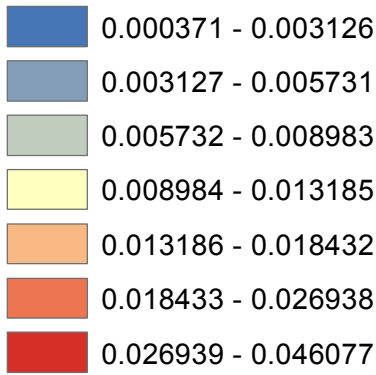
Puget Sound Regional Council,
Covered Employment Estimates 2013

November 28th, 2015

1.12

Local R-Squared Geographically Weighted Regression

2013 Analysis performed on a subset of total data
in which zero values have been removed



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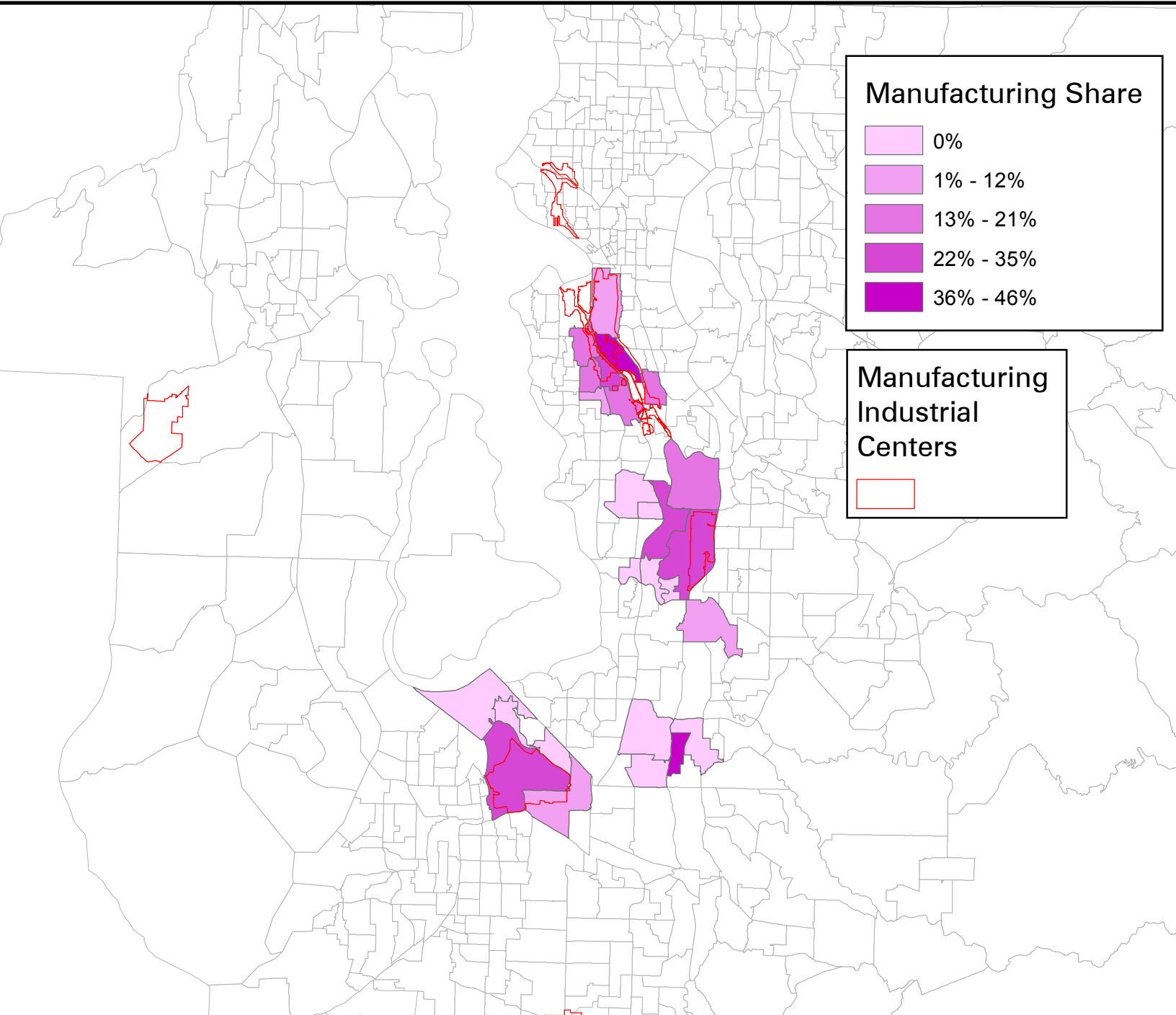
Puget Sound Regional Council,
Covered Employment Estimates 2013

November 28th, 2015

Industrial Super-Clusters

Version I (Nodes)

2013



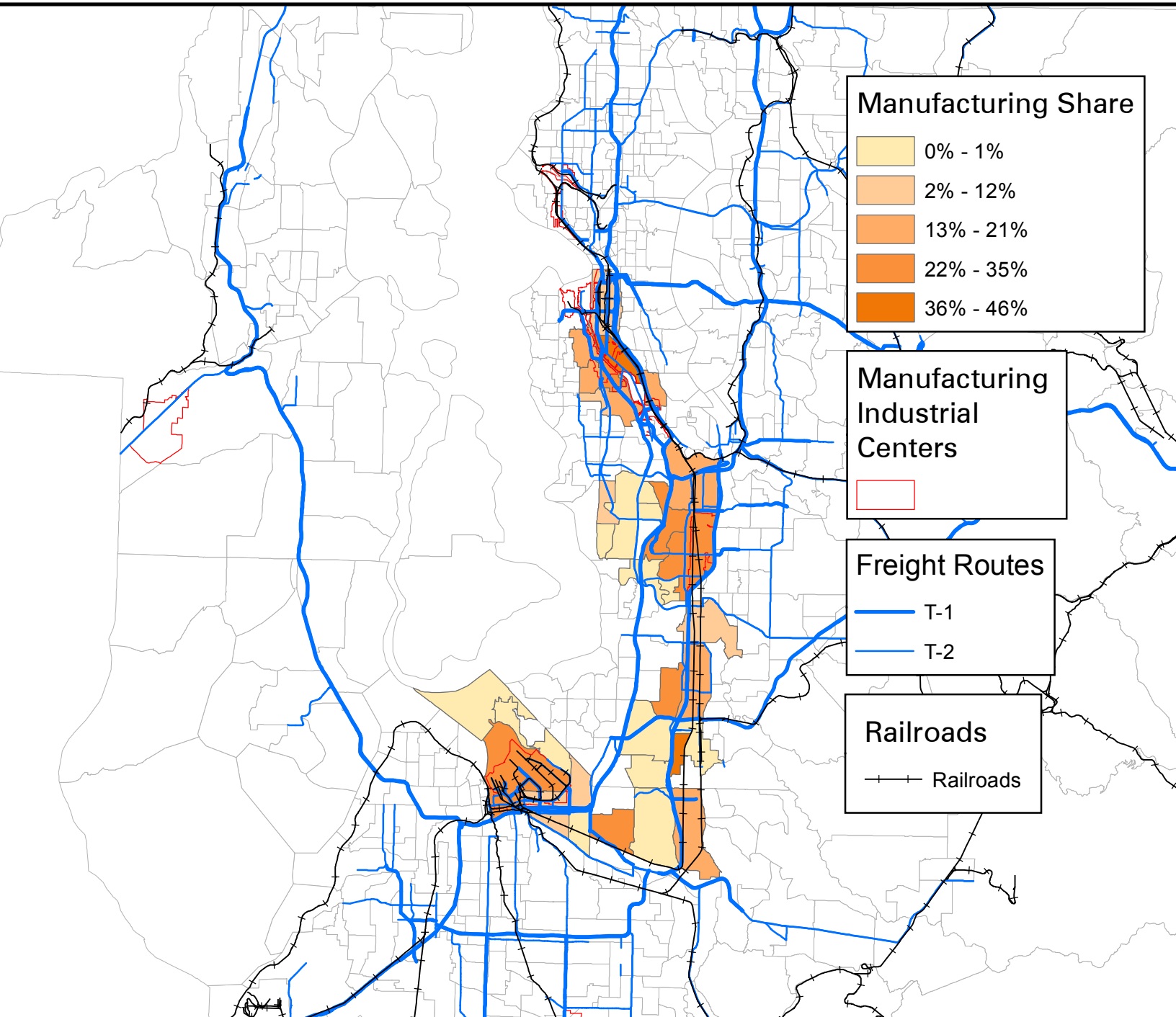
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Covered Employment Estimates 2013

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1.14

Industrial Super-Clusters Version 2 (Corridors) 2013



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Covered Employment Estimates 2013

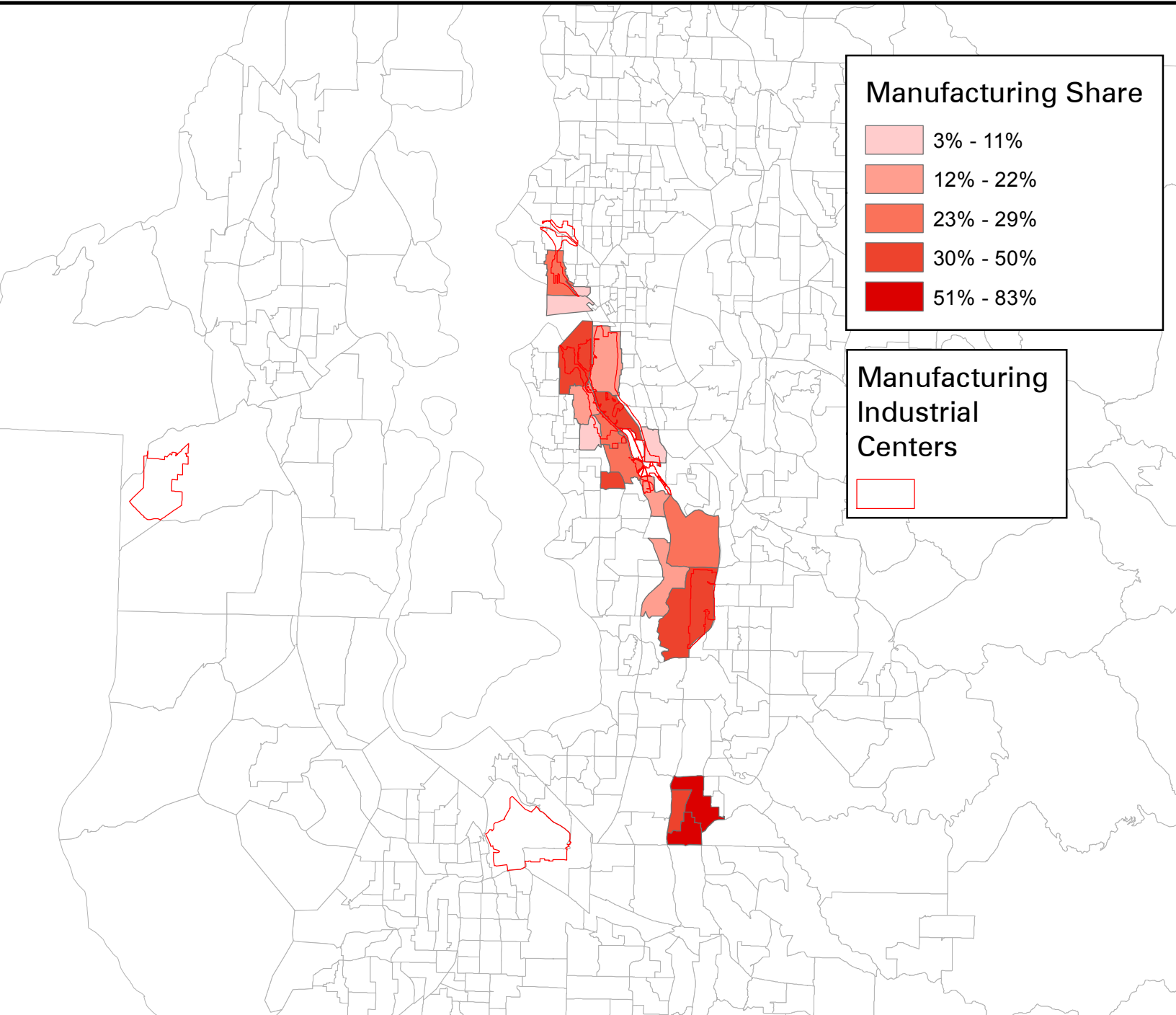
November 28th, 2015

1.15

Industrial Super-Clusters

Version I (Nodes)

1995



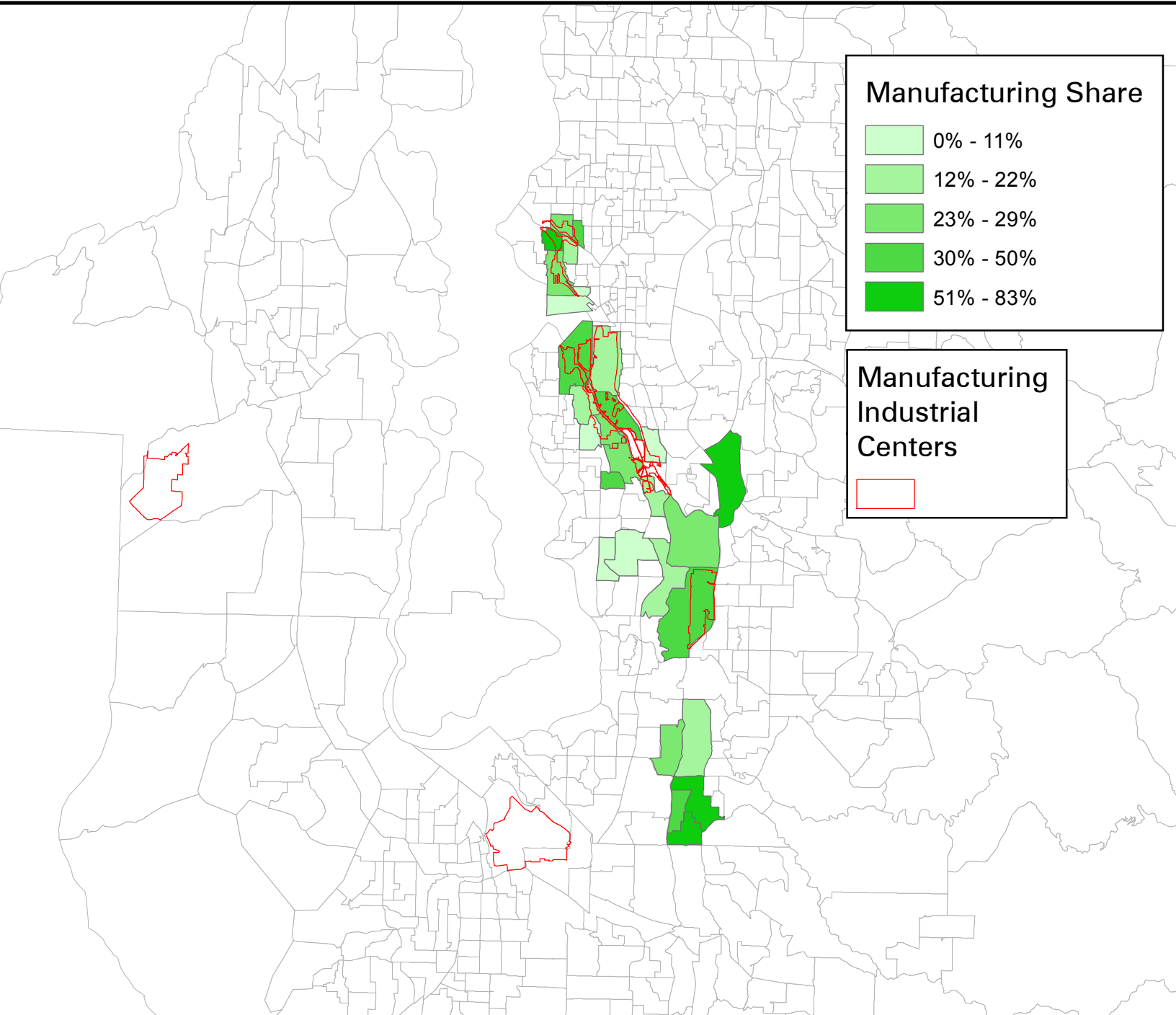
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Puget Sound Regional Council,
Covered Employment Estimates 1995

November 28th, 2015

1.16

Industrial Super-Clusters Version 2 (Corridors) 1995



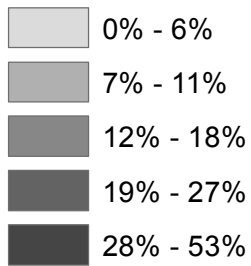
Phil A. Neel

Puget Sound Regional Council,
Covered Employment Estimates 1995

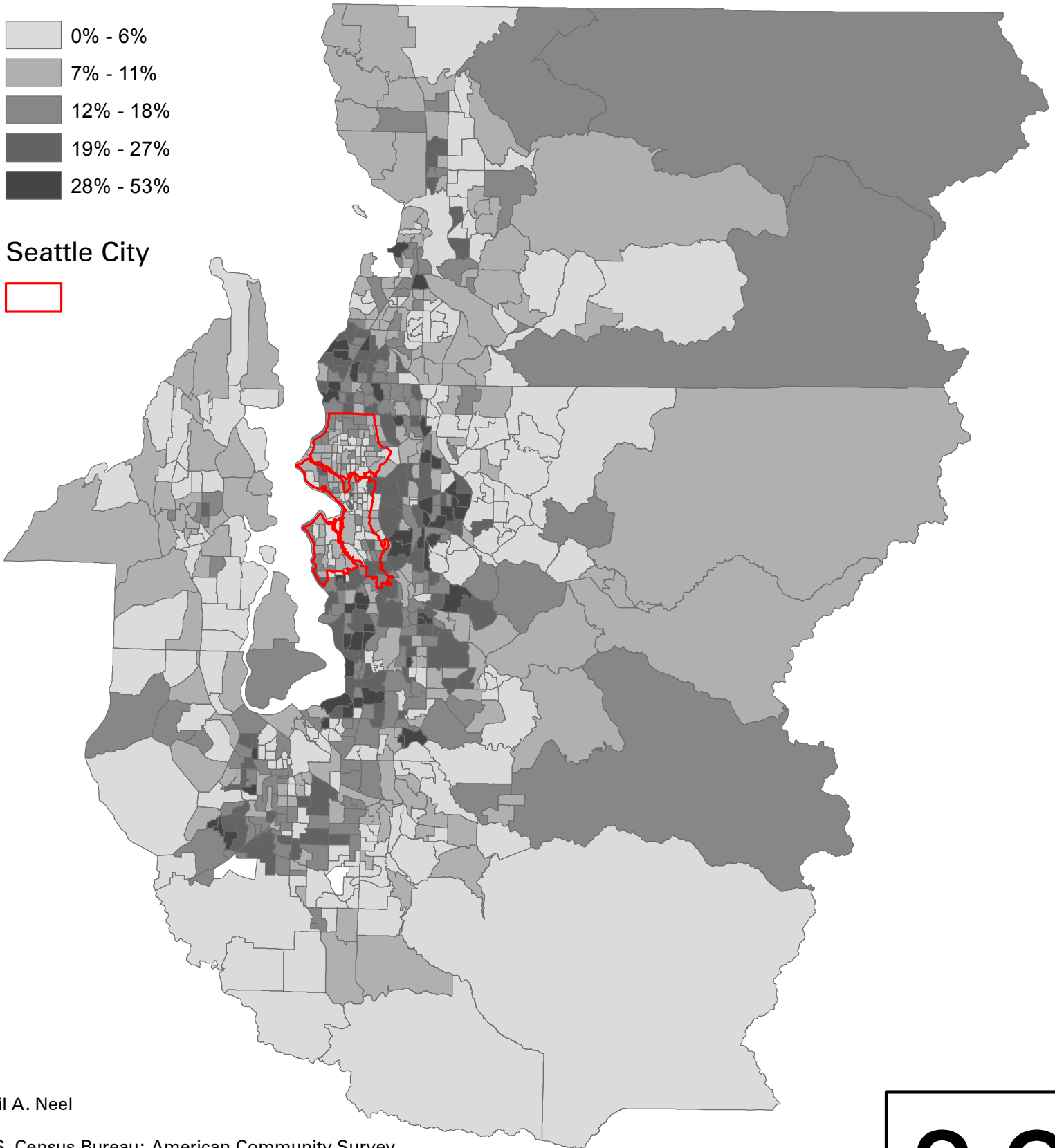
November 28th, 2015

1.17

Share of Total Housing Stock Constructed in the 1960s



Seattle City



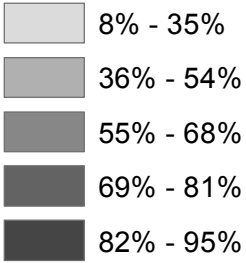
Phil A. Neel

U.S. Census Bureau; American Community Survey
2013 American Community Survey 5-Year Estimates

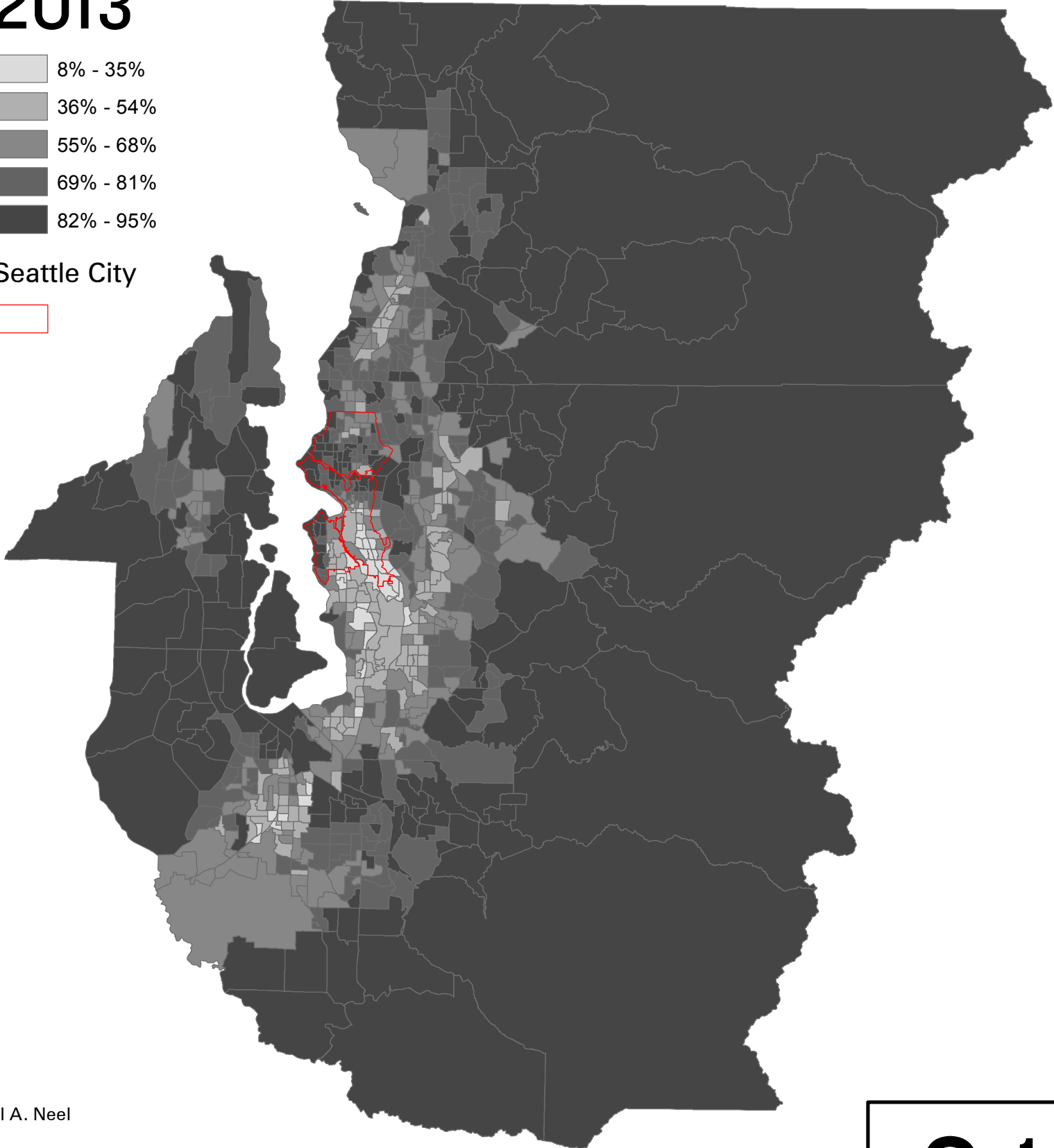
November 28th, 2015

2.0

White (Not Hispanic or Latino) Share of Tract Population 2013



Seattle City



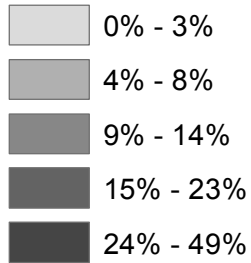
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

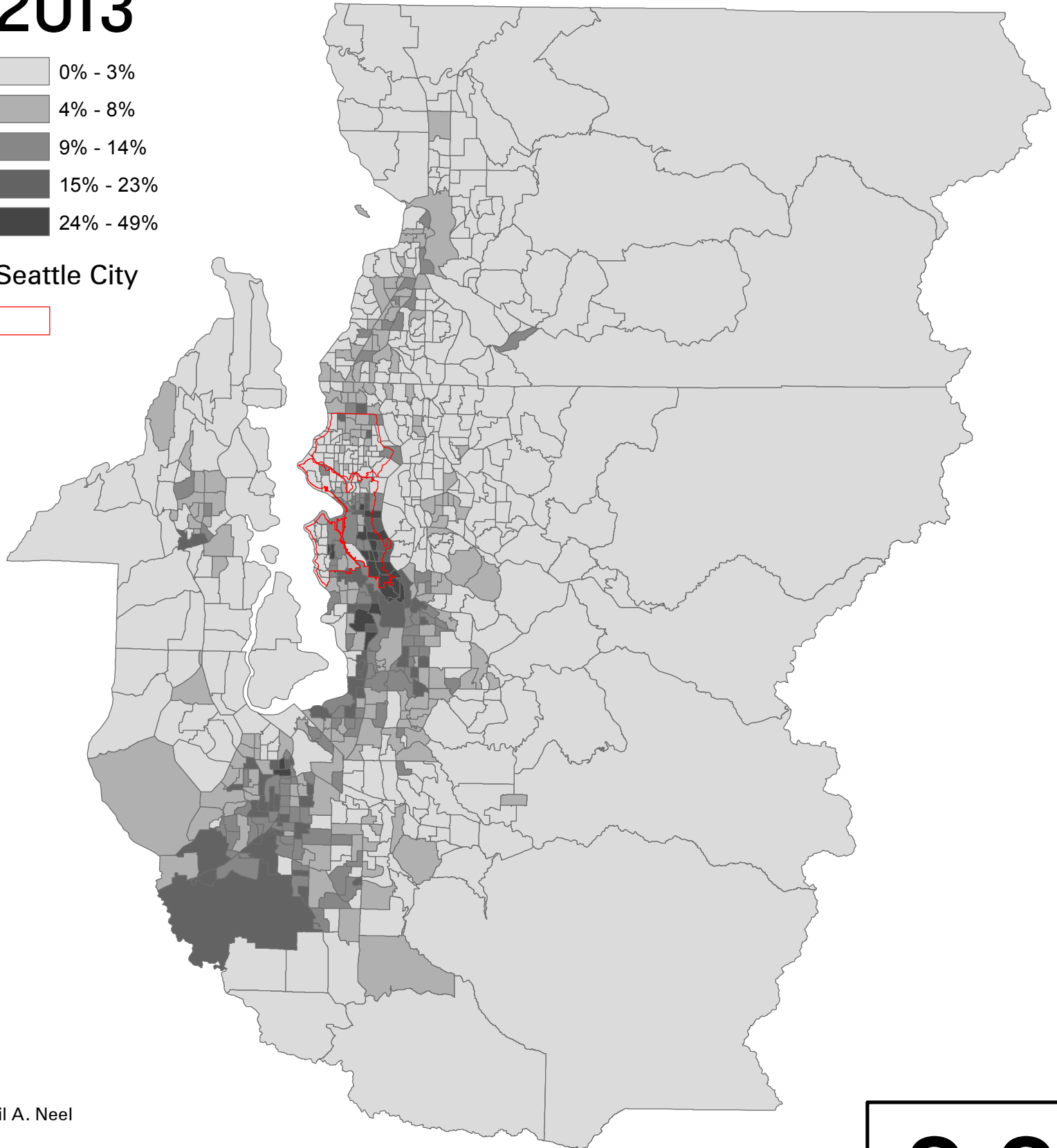
November 28th, 2015

2.1

Black or African American Share of Tract Population 2013



Seattle City



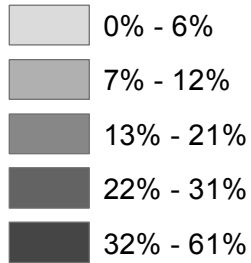
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

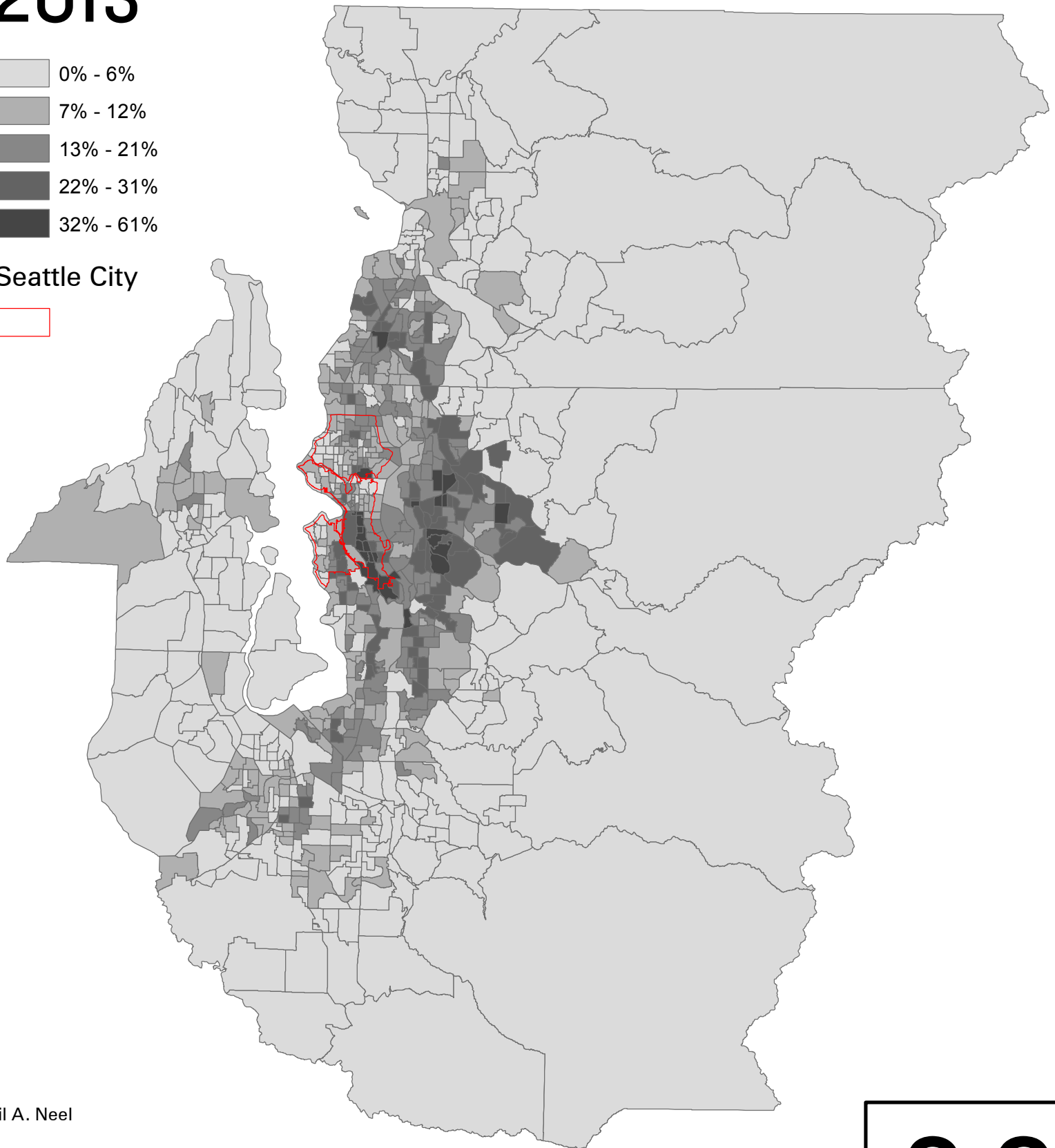
November 28th, 2015

2.2

Asian Share of Tract Population 2013



Seattle City



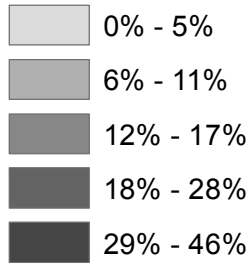
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

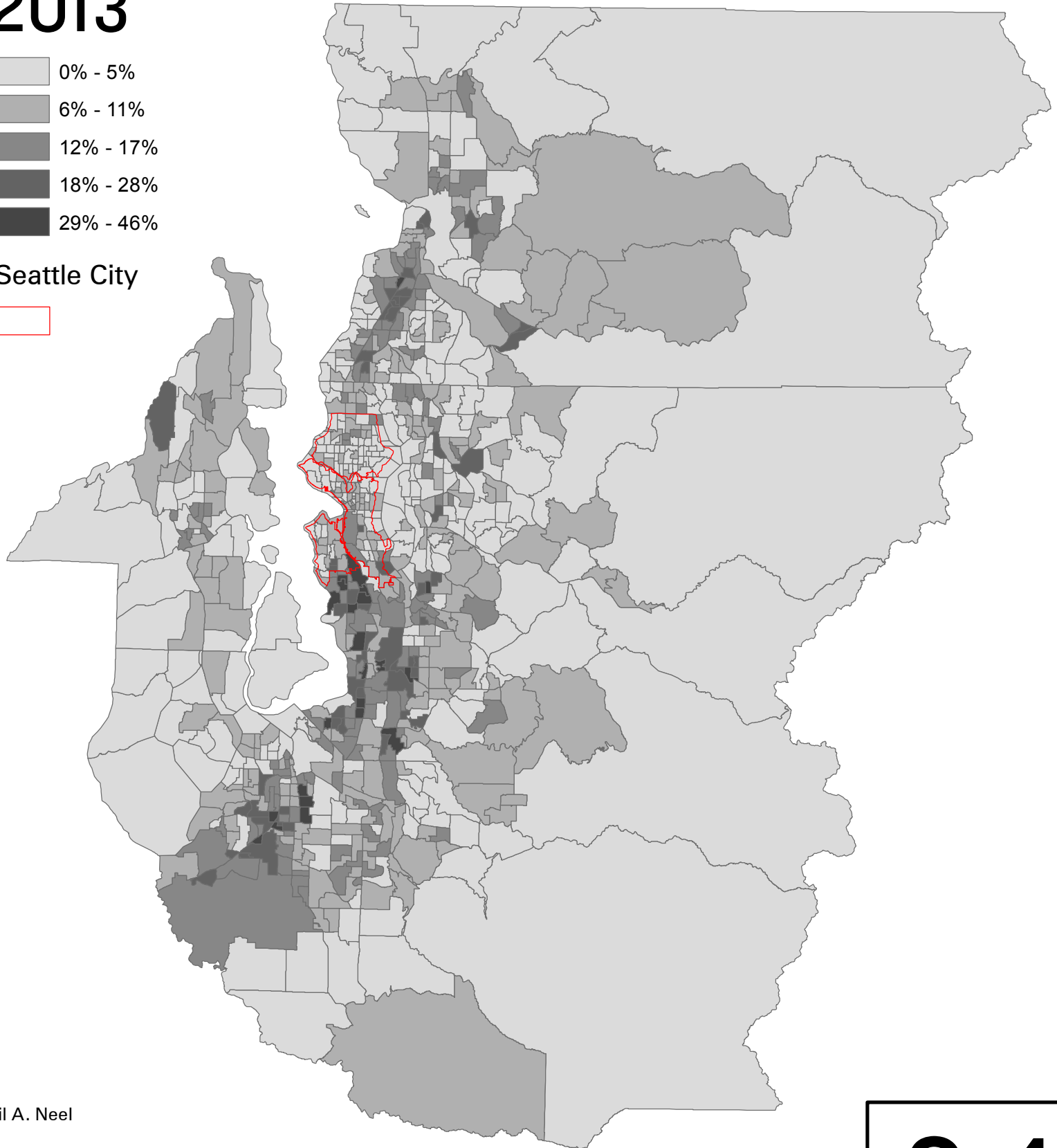
November 28th, 2015

2.3

Hispanic or Latino Share of Tract Population 2013



Seattle City



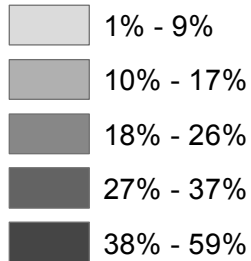
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

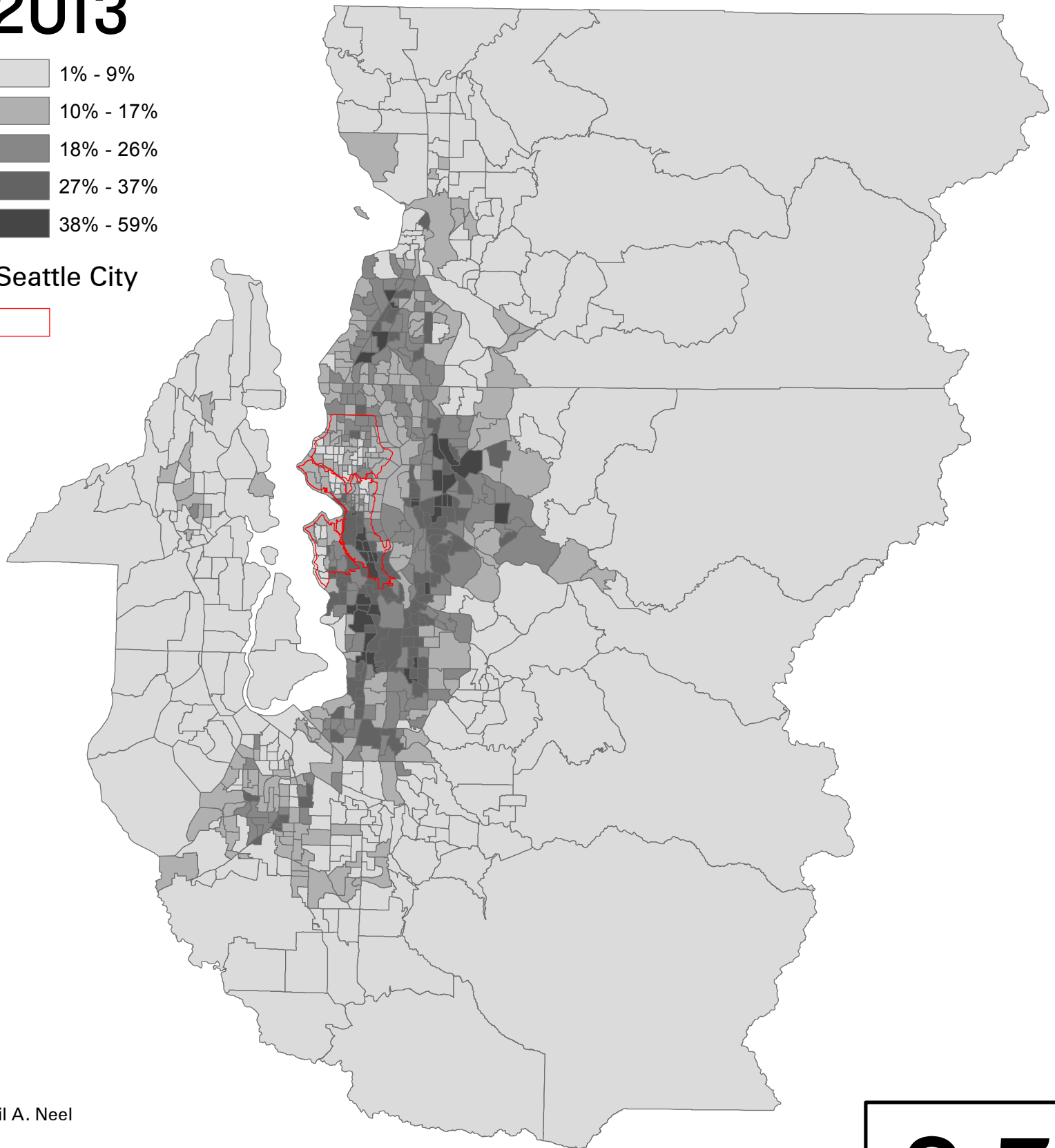
November 28th, 2015

2.4

Foreign Born Share of Tract Population 2013



Seattle City



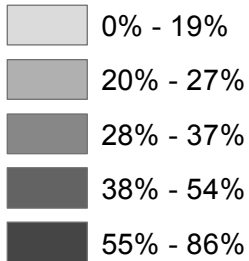
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

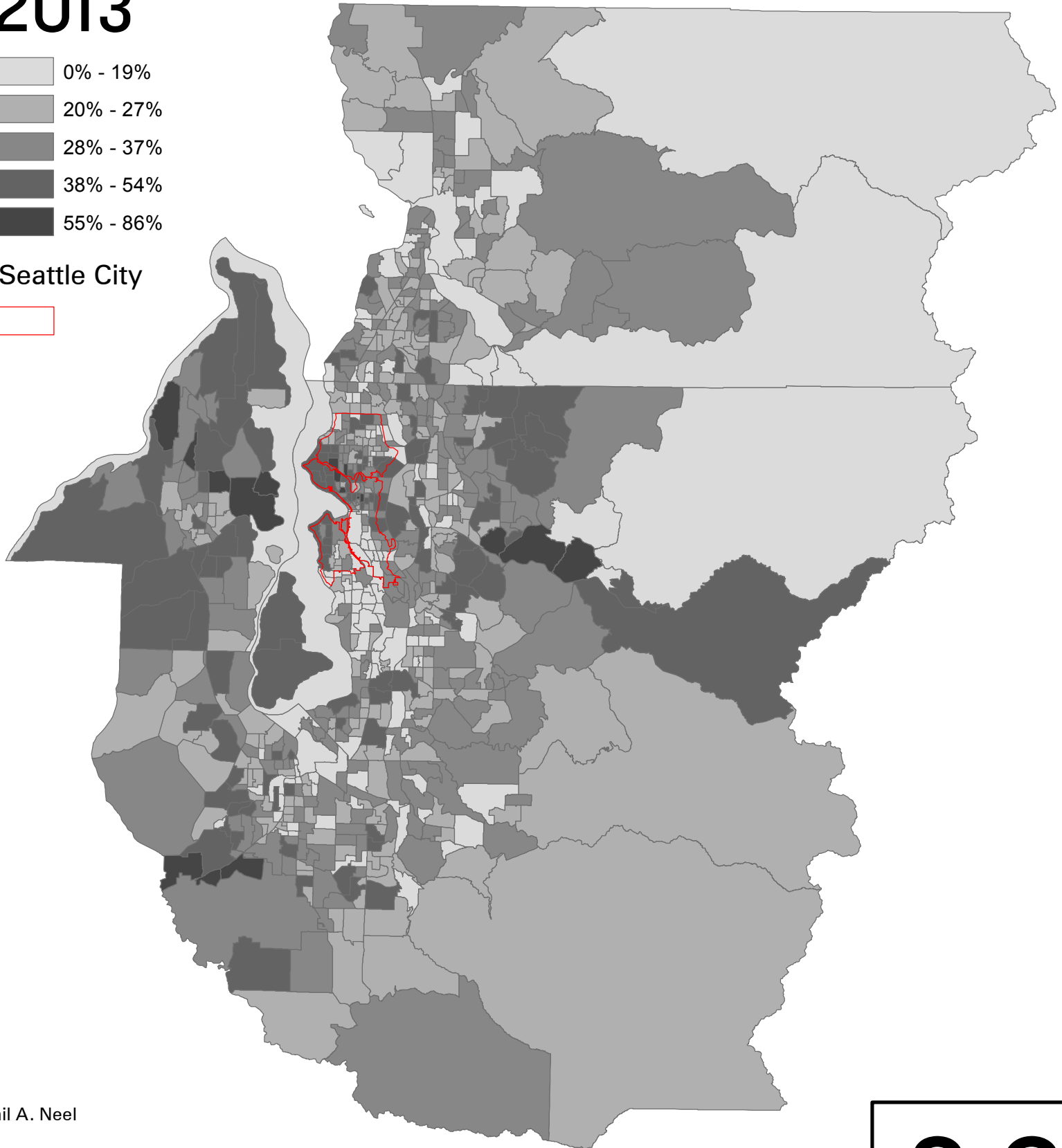
November 28th, 2015

2.5

Native Born, Outside WA State Share of Tract Population 2013



Seattle City



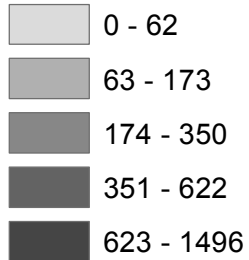
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

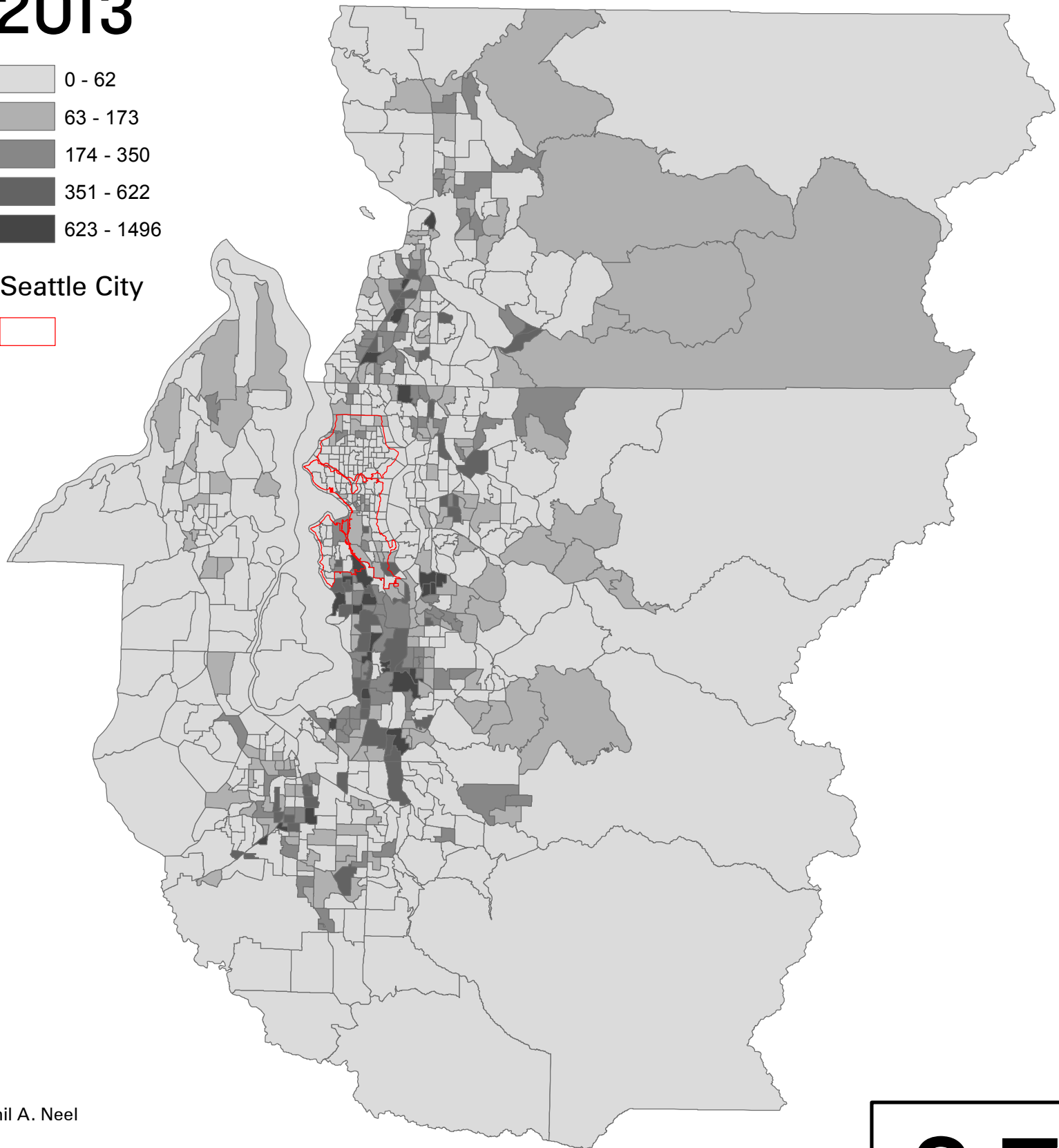
November 28th, 2015

2.6

Total Foreign Born Population Mexican Origin 2013



Seattle City



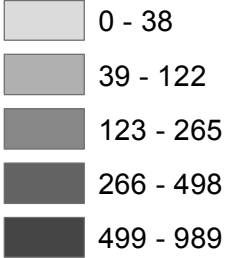
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

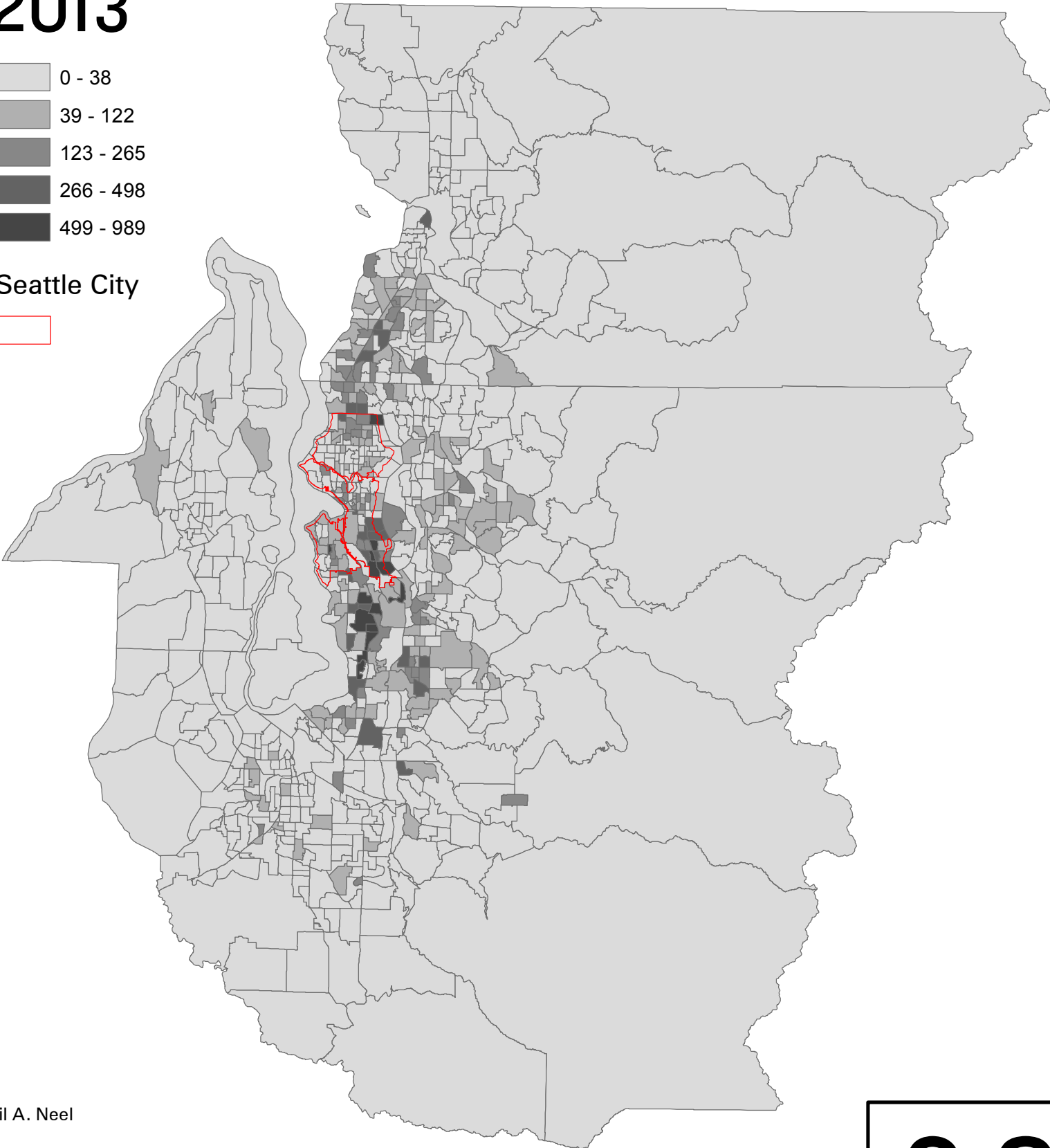
November 28th, 2015

2.7

Total Foreign Born Population African Origin 2013



Seattle City



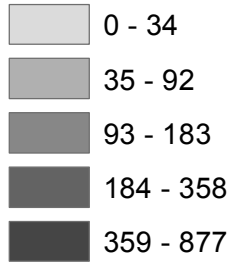
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

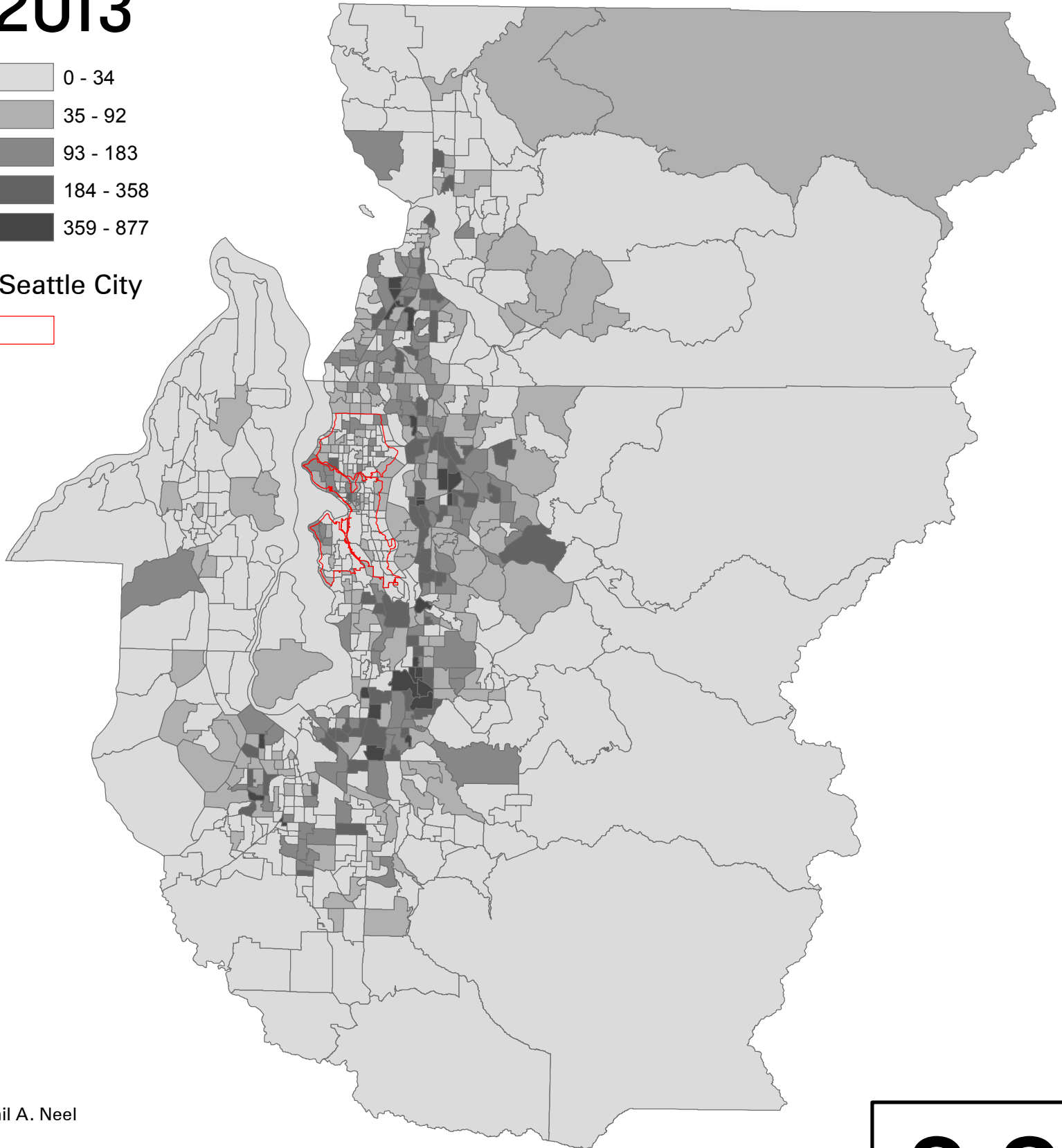
November 28th, 2015

2.8

Total Foreign Born Population Eastern European Origin 2013



Seattle City



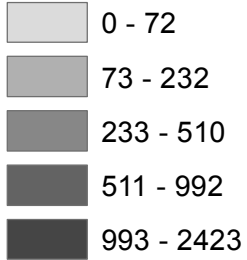
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

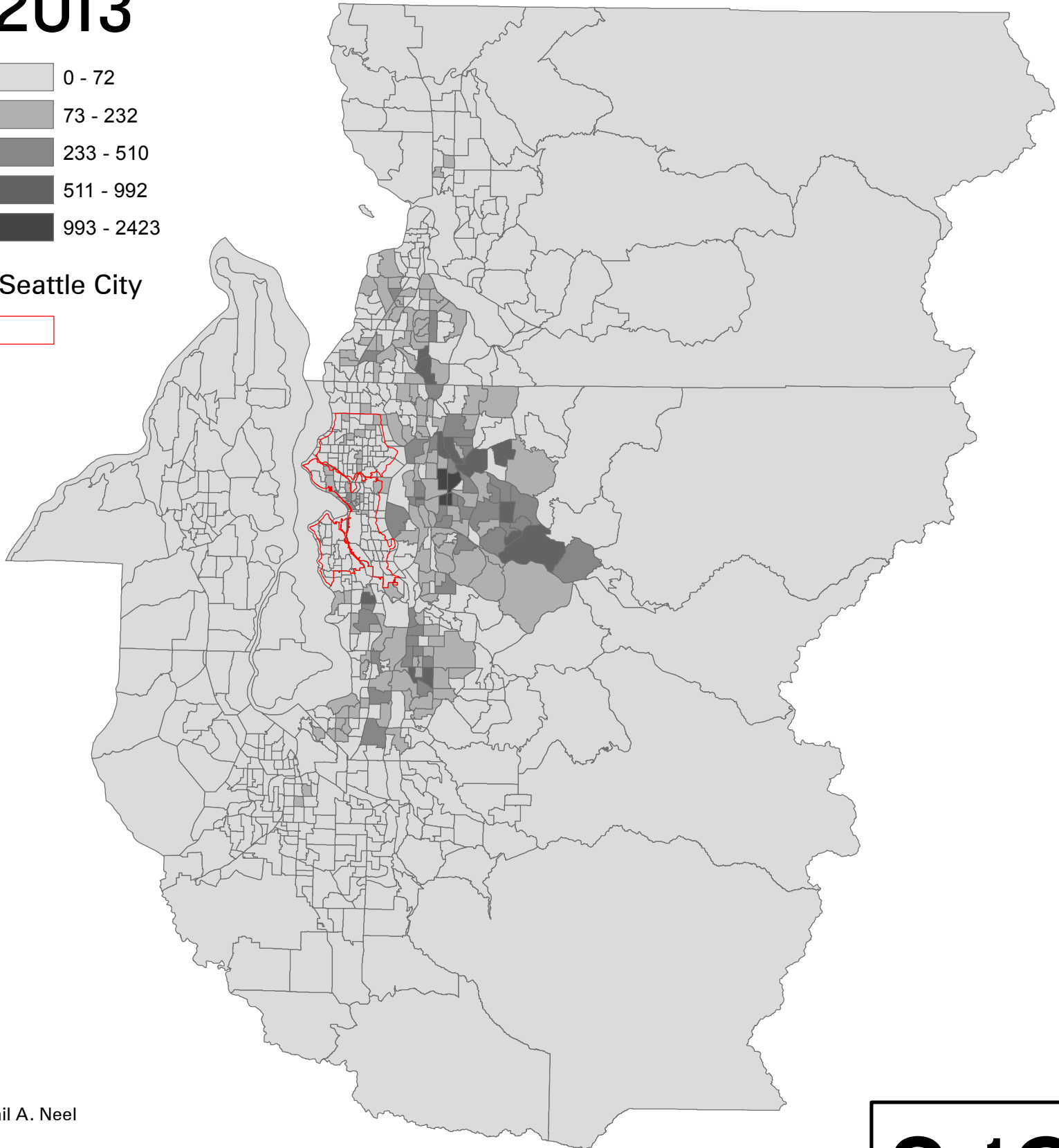
November 28th, 2015

2.9

Total Foreign Born Population South-Central Asian Origin 2013



Seattle City



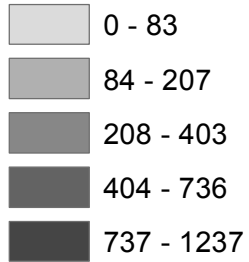
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

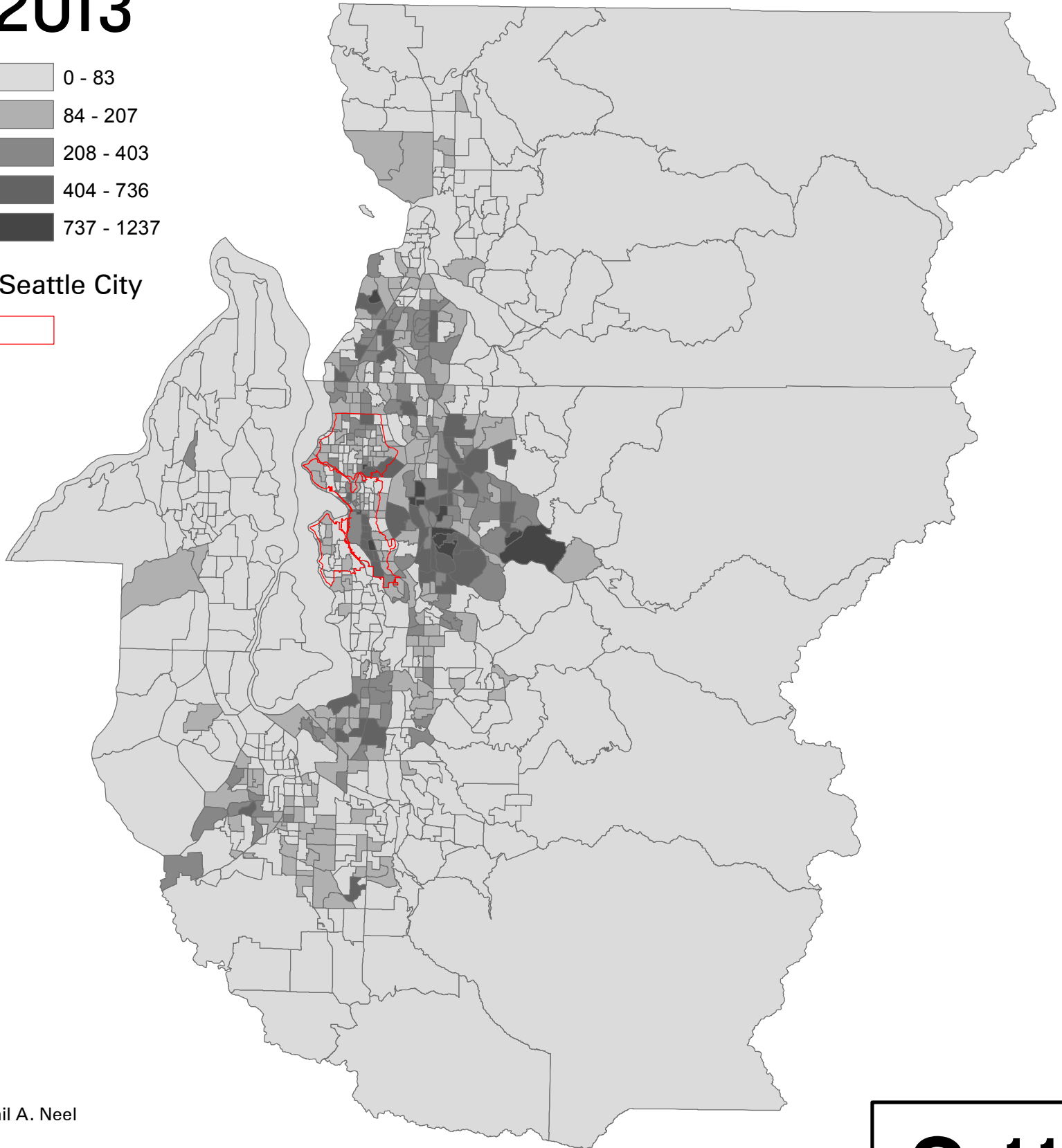
November 28th, 2015

2.10

Total Foreign Born Population East Asian Origin 2013



Seattle City



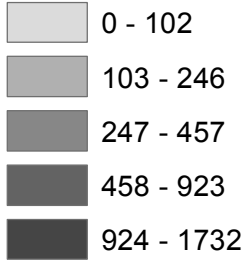
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

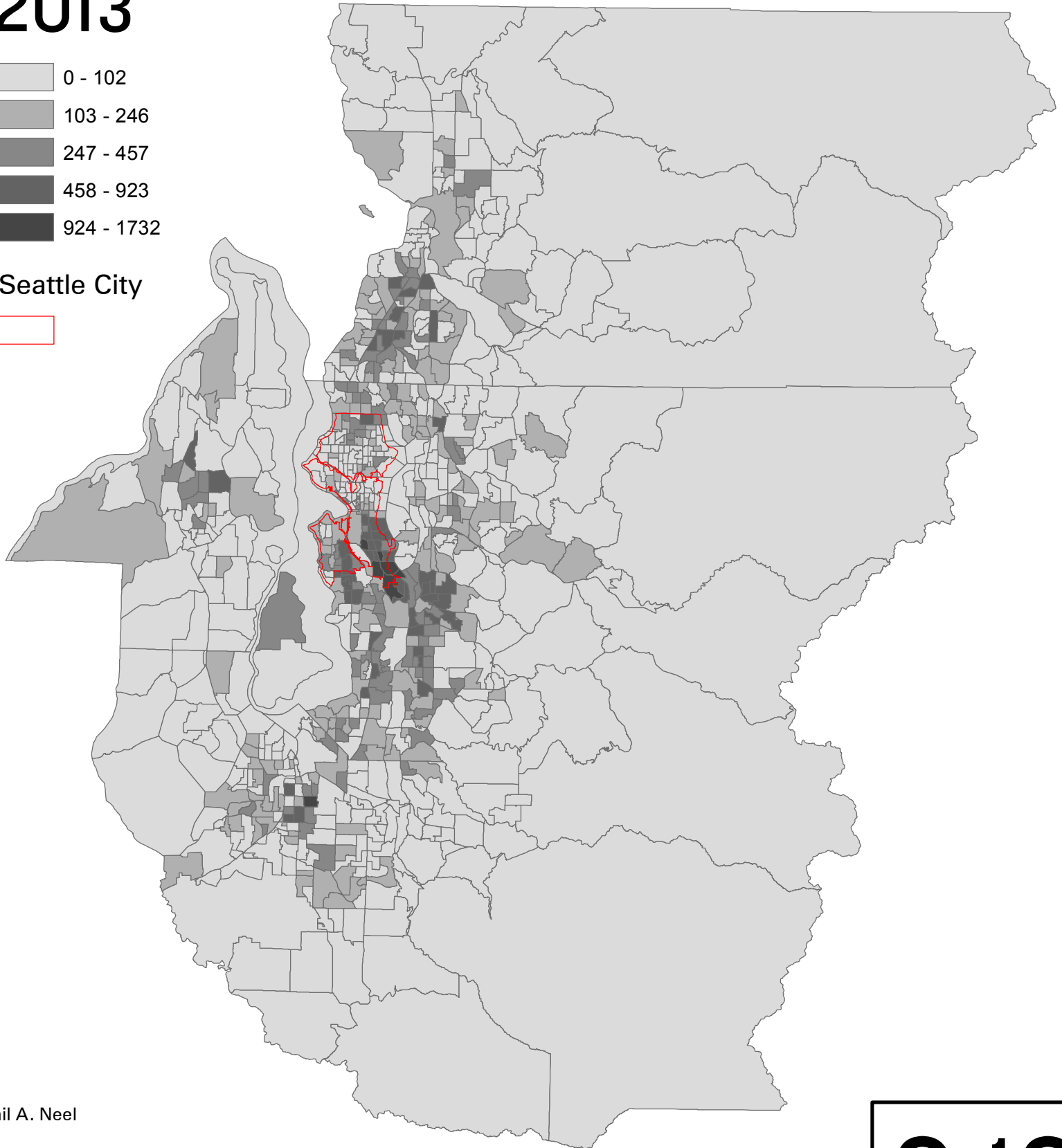
November 28th, 2015

2.11

Total Foreign Born Population Southeast Asian Origin 2013



Seattle City



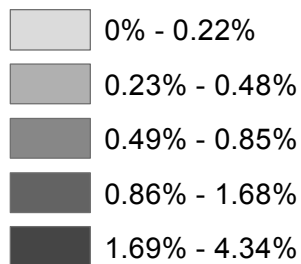
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

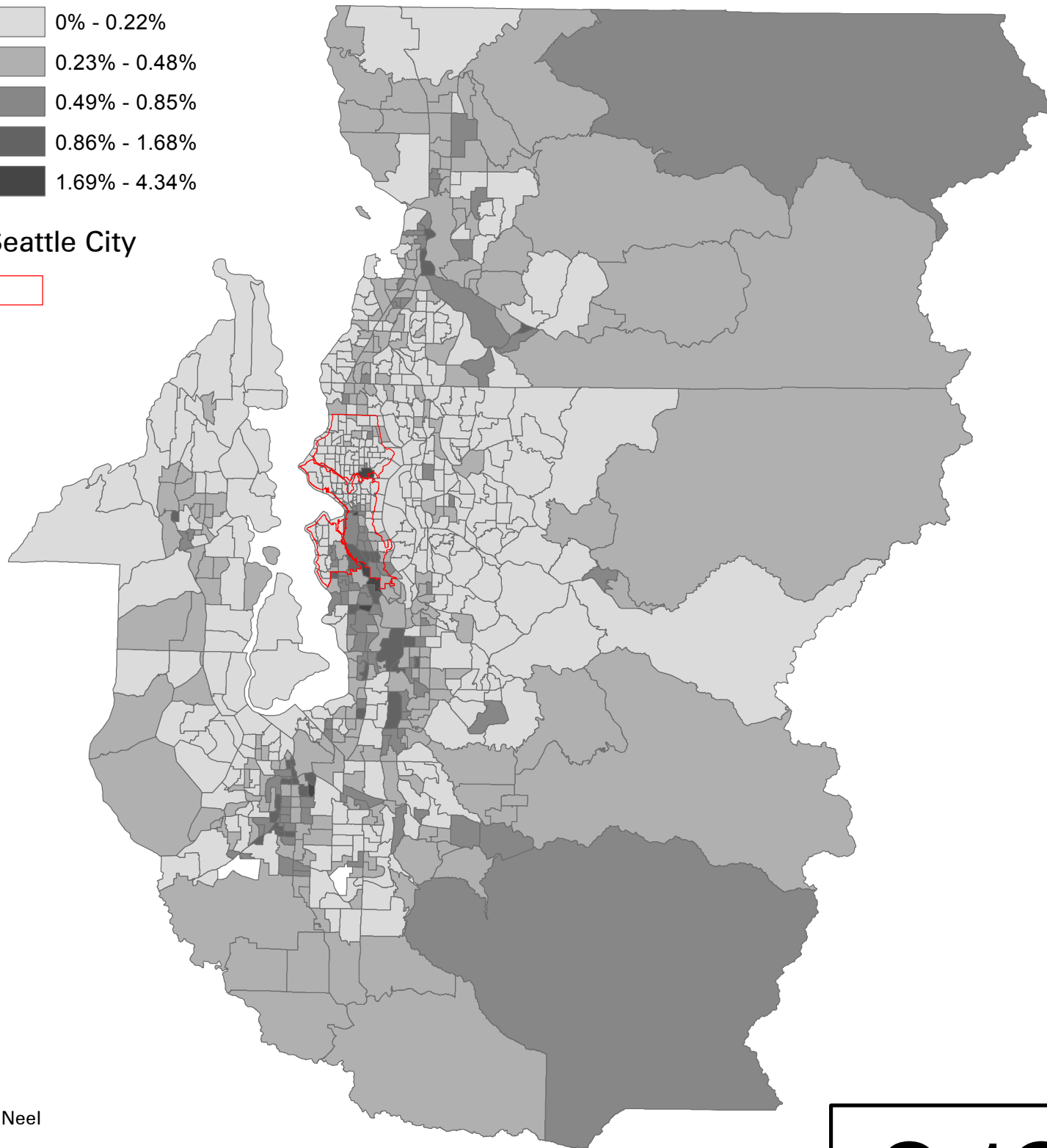
November 28th, 2015

2.12

Population Without High School Diploma Share of Tract Population 25 and Older 2013



Seattle City



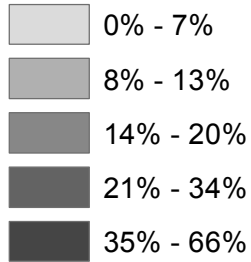
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

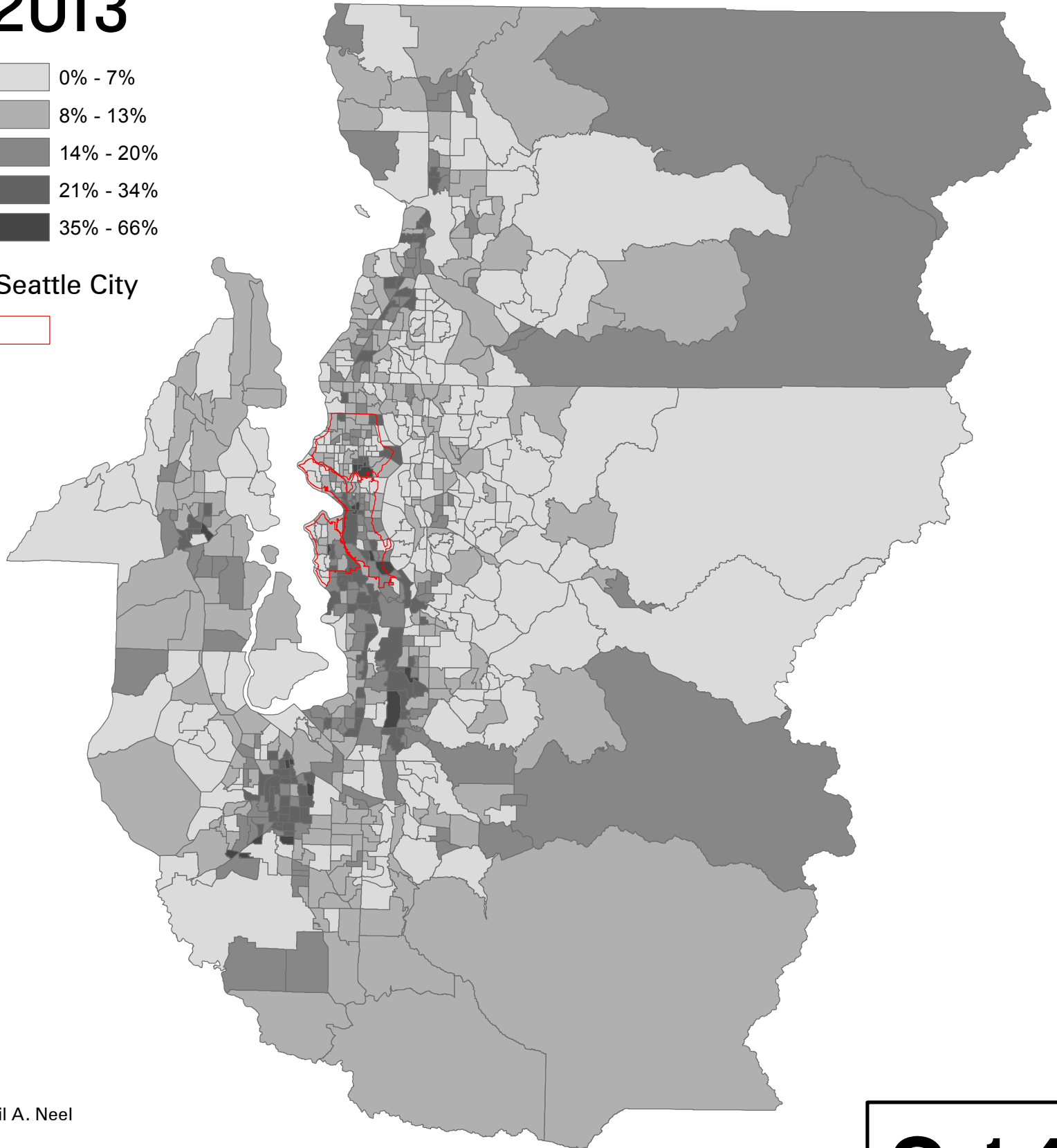
November 28th, 2015

2.13

Population Below 100% Poverty Share of Tract Population 2013



Seattle City



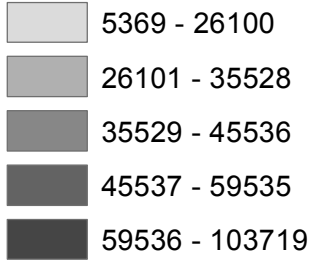
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

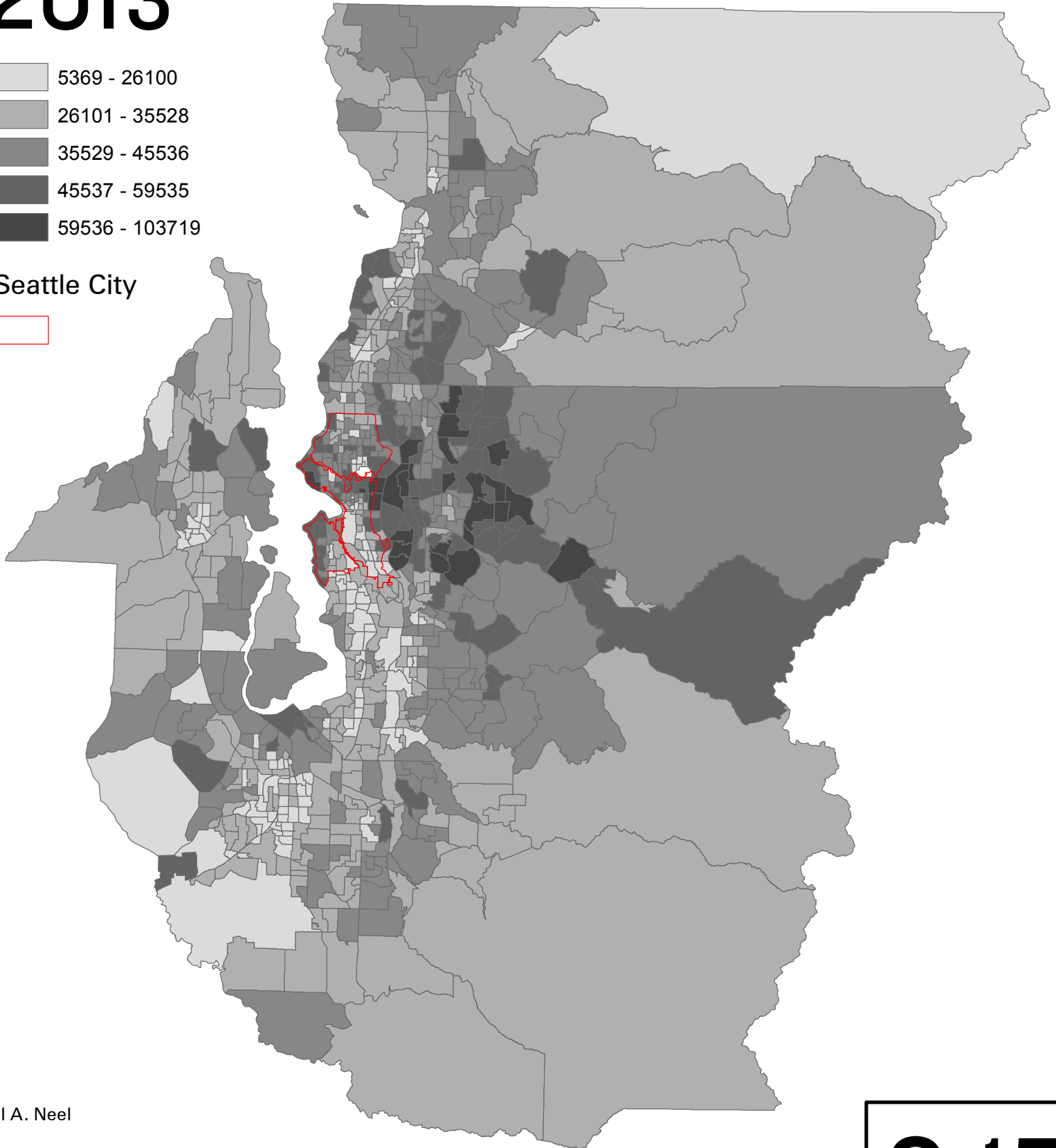
November 28th, 2015

2.14

Median Income by Tract 2013



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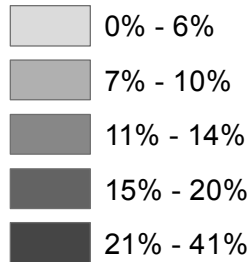
U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

November 28th, 2015

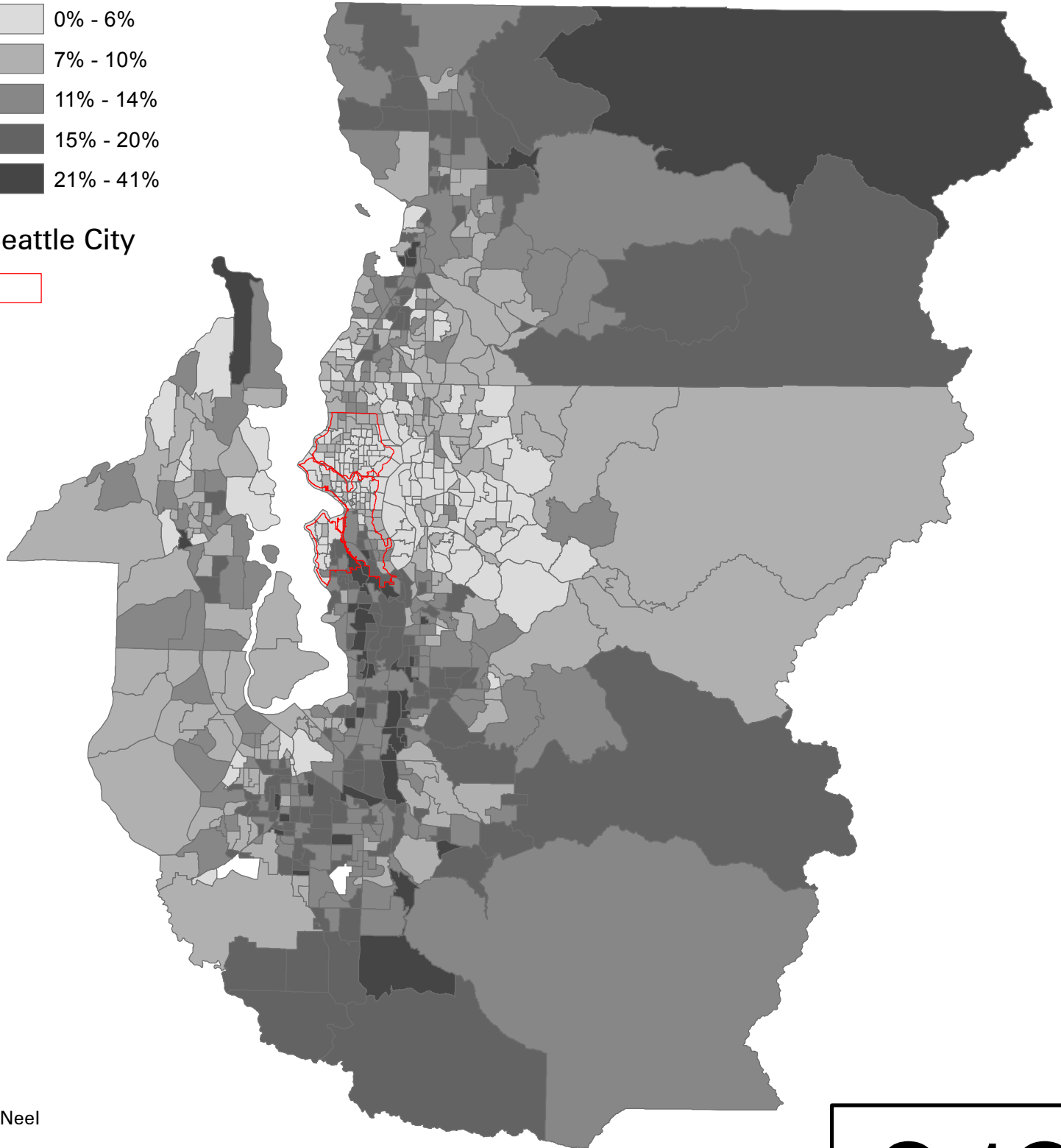
2.15

Share of Tract Population Employed in Manufacturing or WTU *By Place of Residence

2013



Seattle City



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U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

November 28th, 2015

2.16

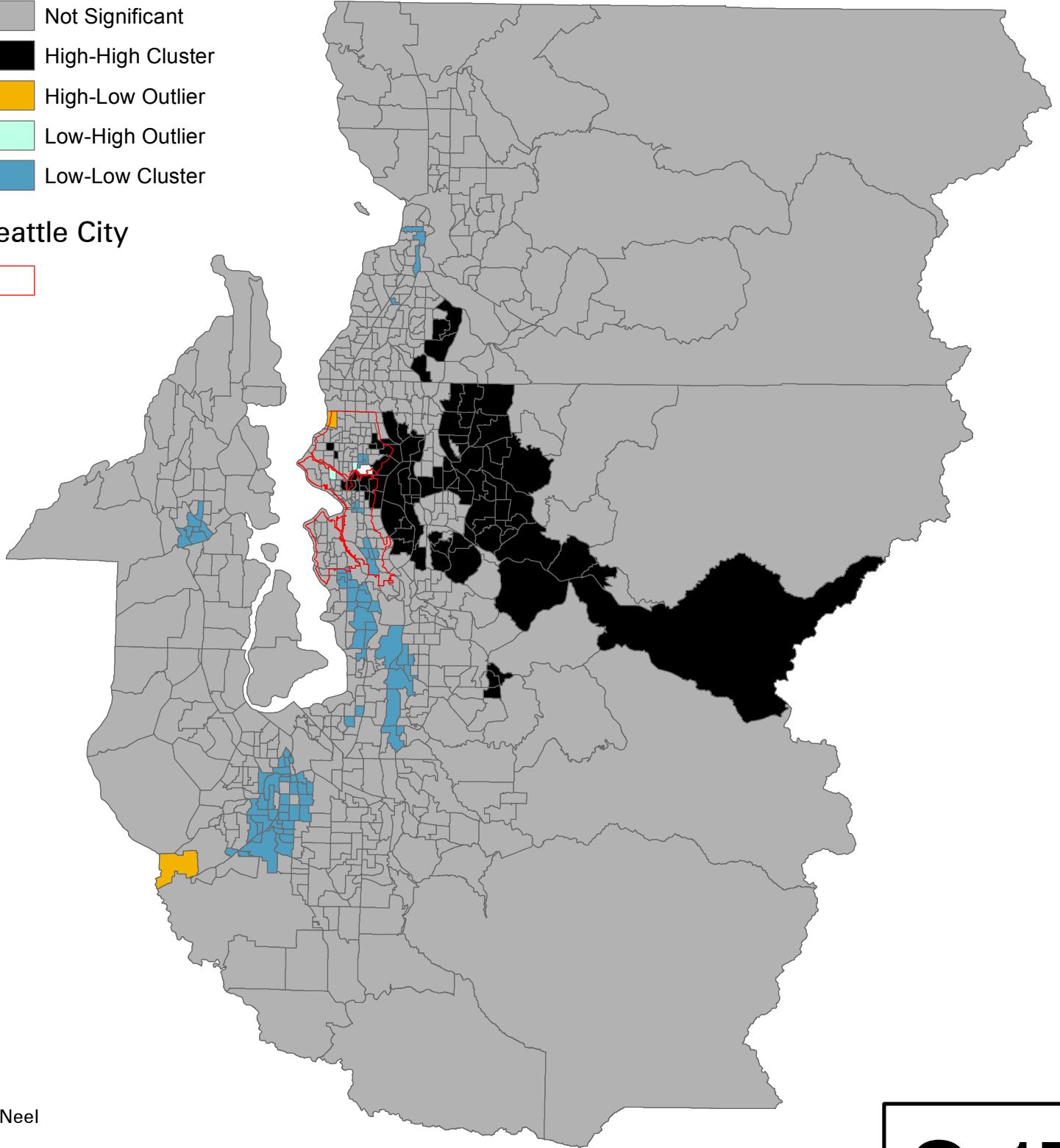
Median Income Clusters

2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized

- Not Significant
- High-High Cluster
- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster

Seattle City



Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

November 28th, 2015

2.17

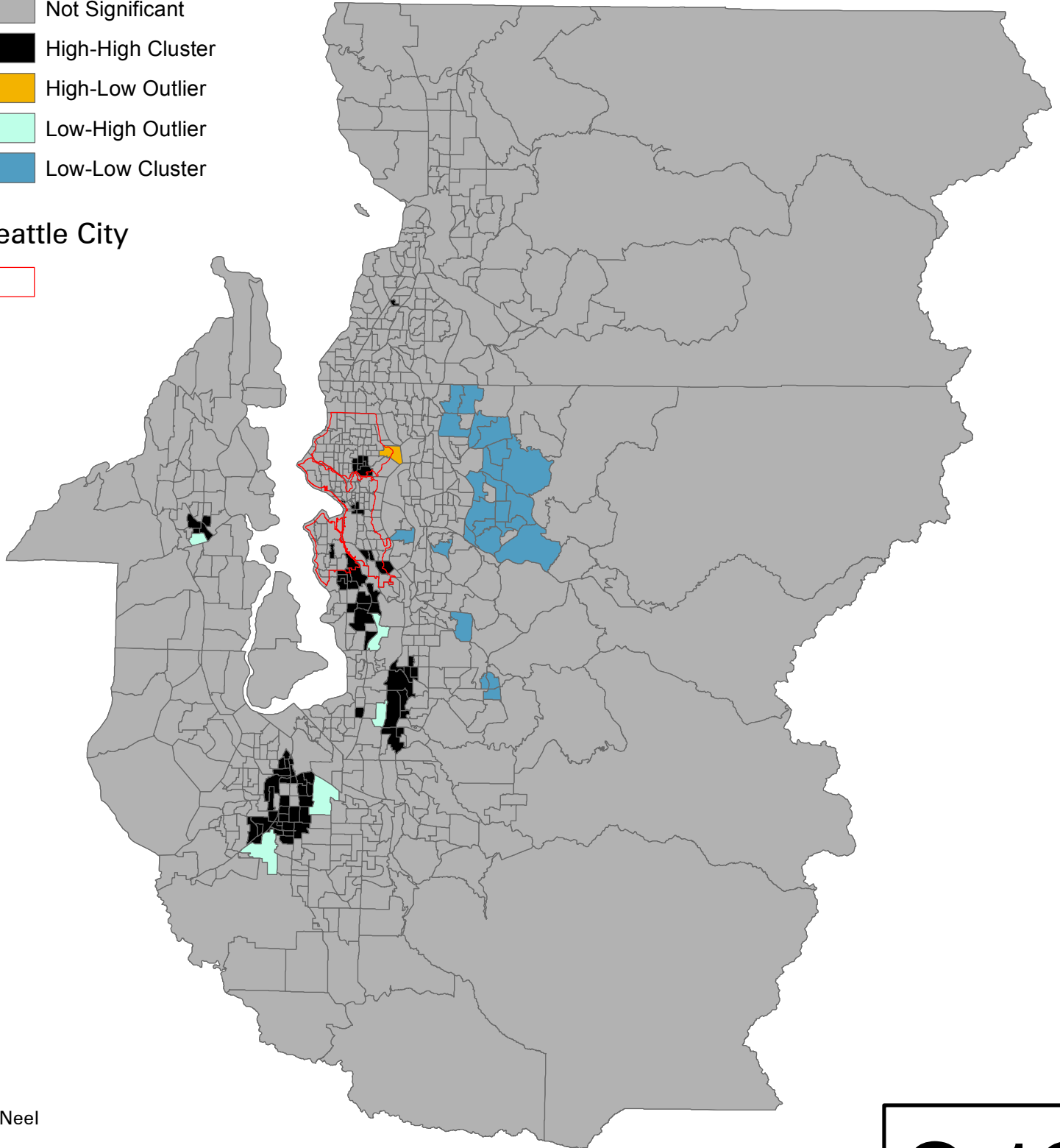
Poverty Clusters

2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized

- Not Significant
- High-High Cluster
- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster

Seattle City



Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

November 28th, 2015

2.18

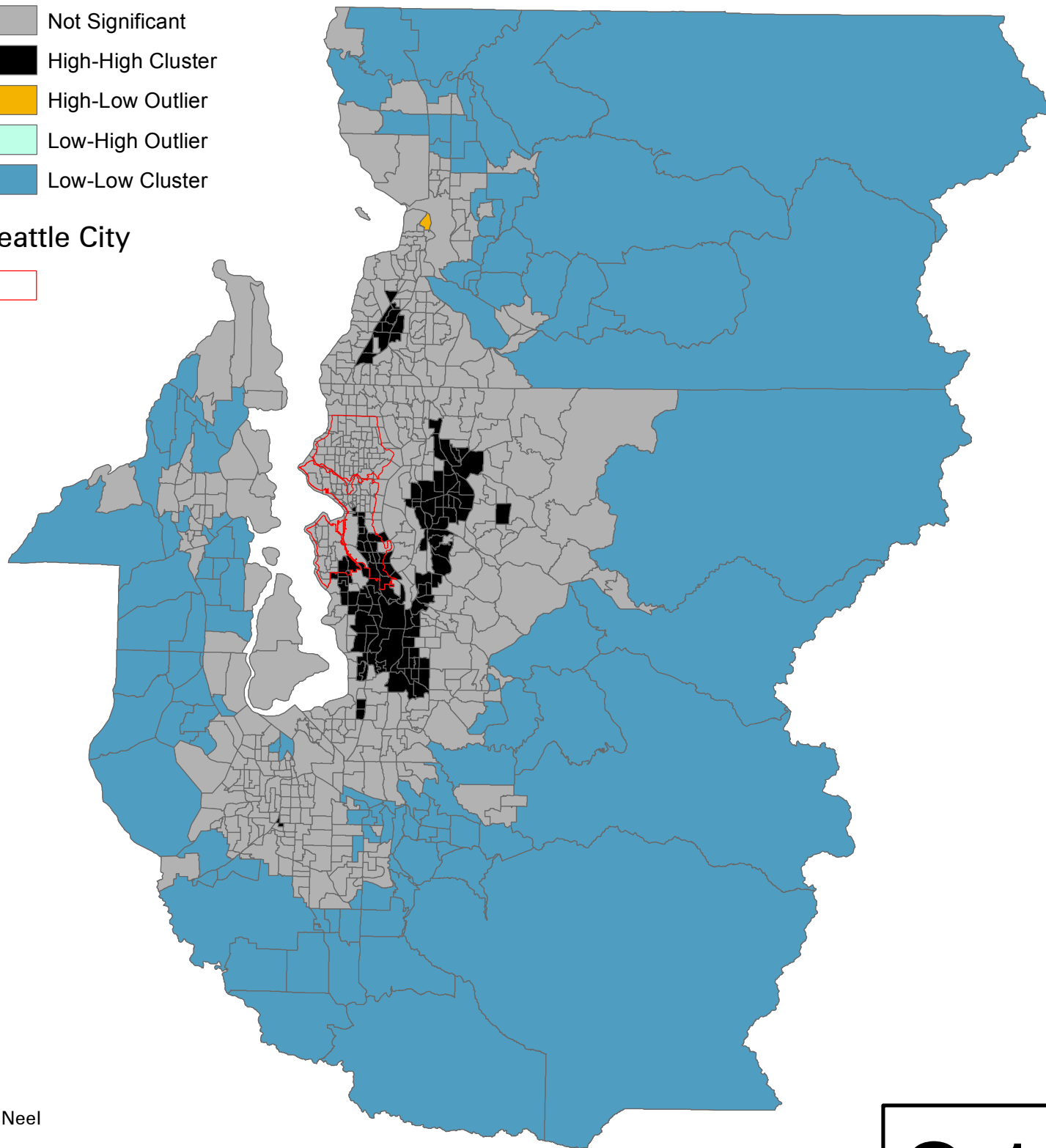
Foreign Born Clusters

2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized

- Not Significant
- High-High Cluster
- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster

Seattle City



Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

November 28th, 2015

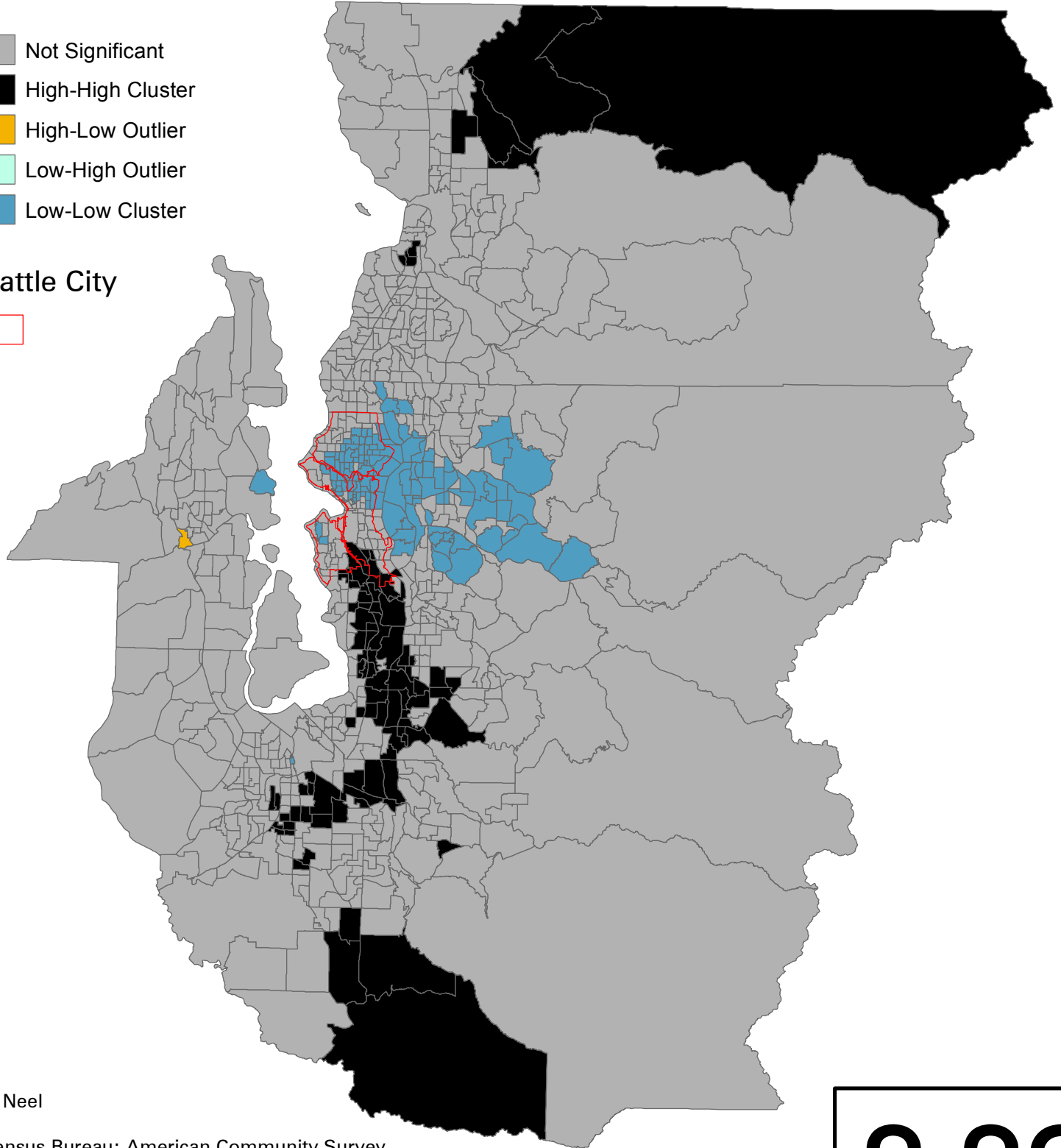
2.19

Manufacturing and WTU Industry* Clusters 2013

Anselin Local Moran's I
Conceptualization of Spatial Relationships
Set to Contiguity (Edges, Corners)
Row Standardized
*Industry by Place of Residence

- Not Significant
- High-High Cluster
- High-Low Outlier
- Low-High Outlier
- Low-Low Cluster

Seattle City



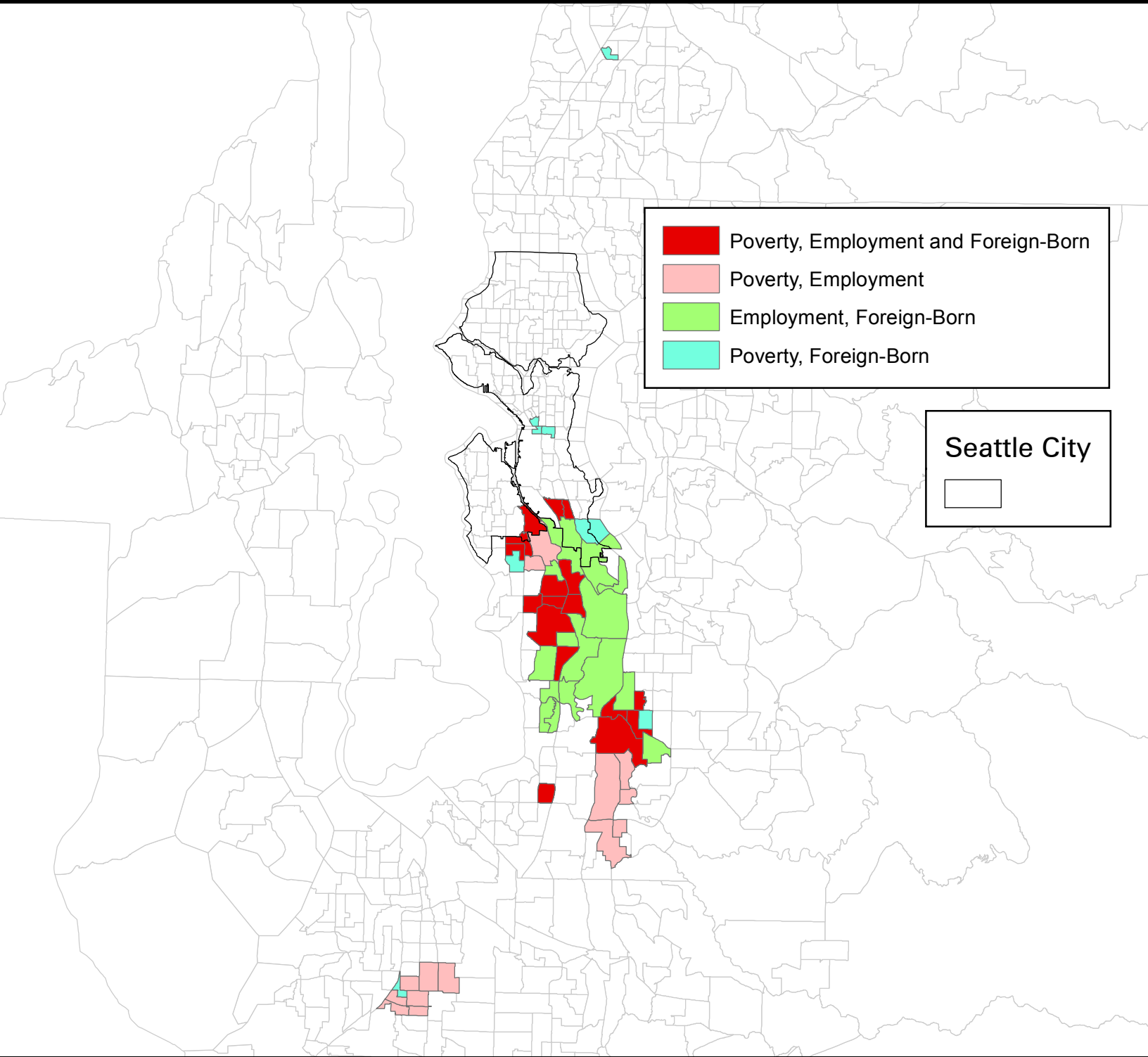
Phil A. Neel

U.S. Census Bureau; American Community Survey,
2013 American Community Survey 5-Year Estimates

November 28th, 2015

2.20

Demographic Super-Clusters 2013



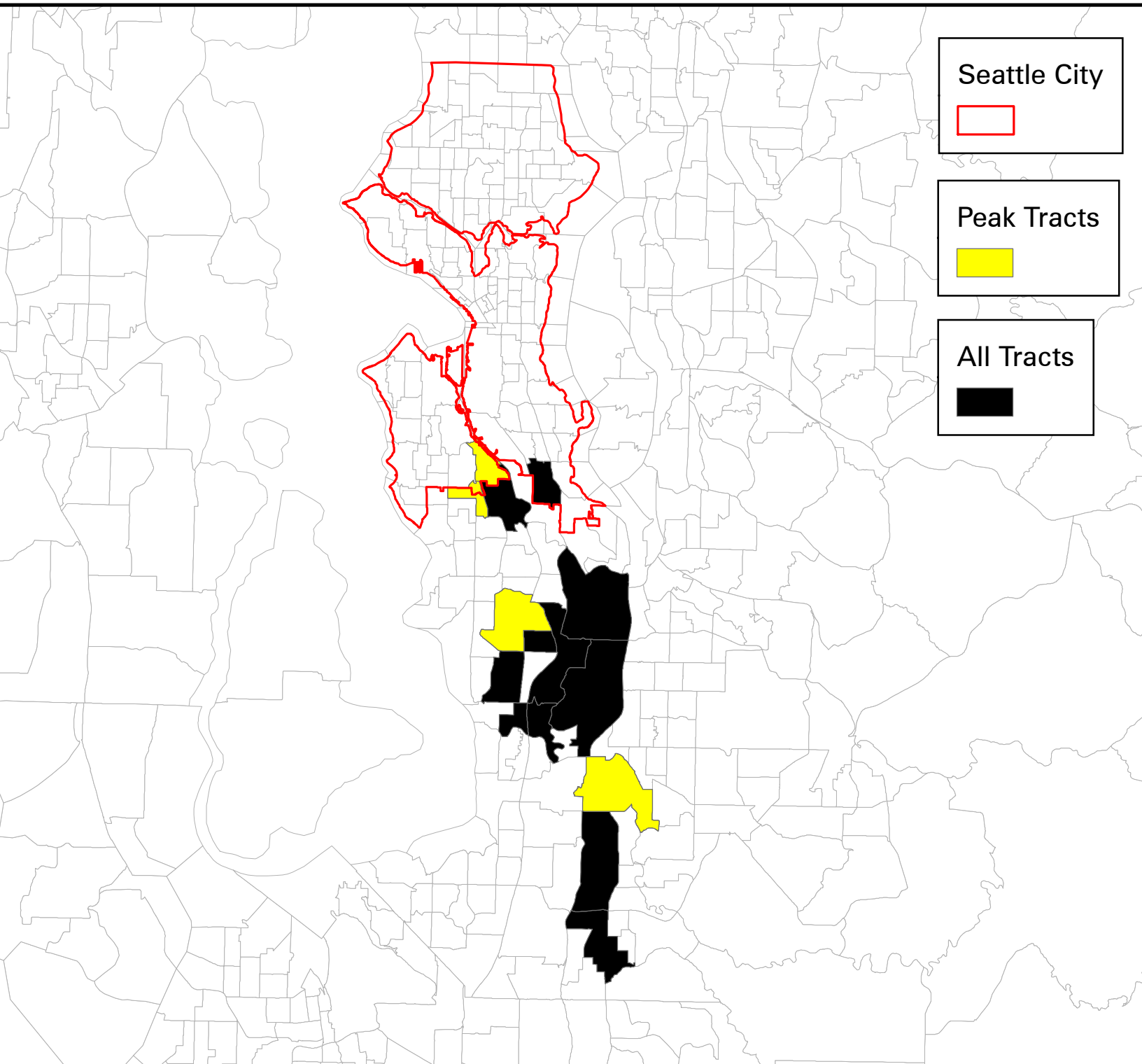
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2013 American Community Survey 5-Year Estimates

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2.21

Super-Cluster Overlap 2013



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2013 American Community Survey 5-Year Estimates

November 28th, 2015

3.1

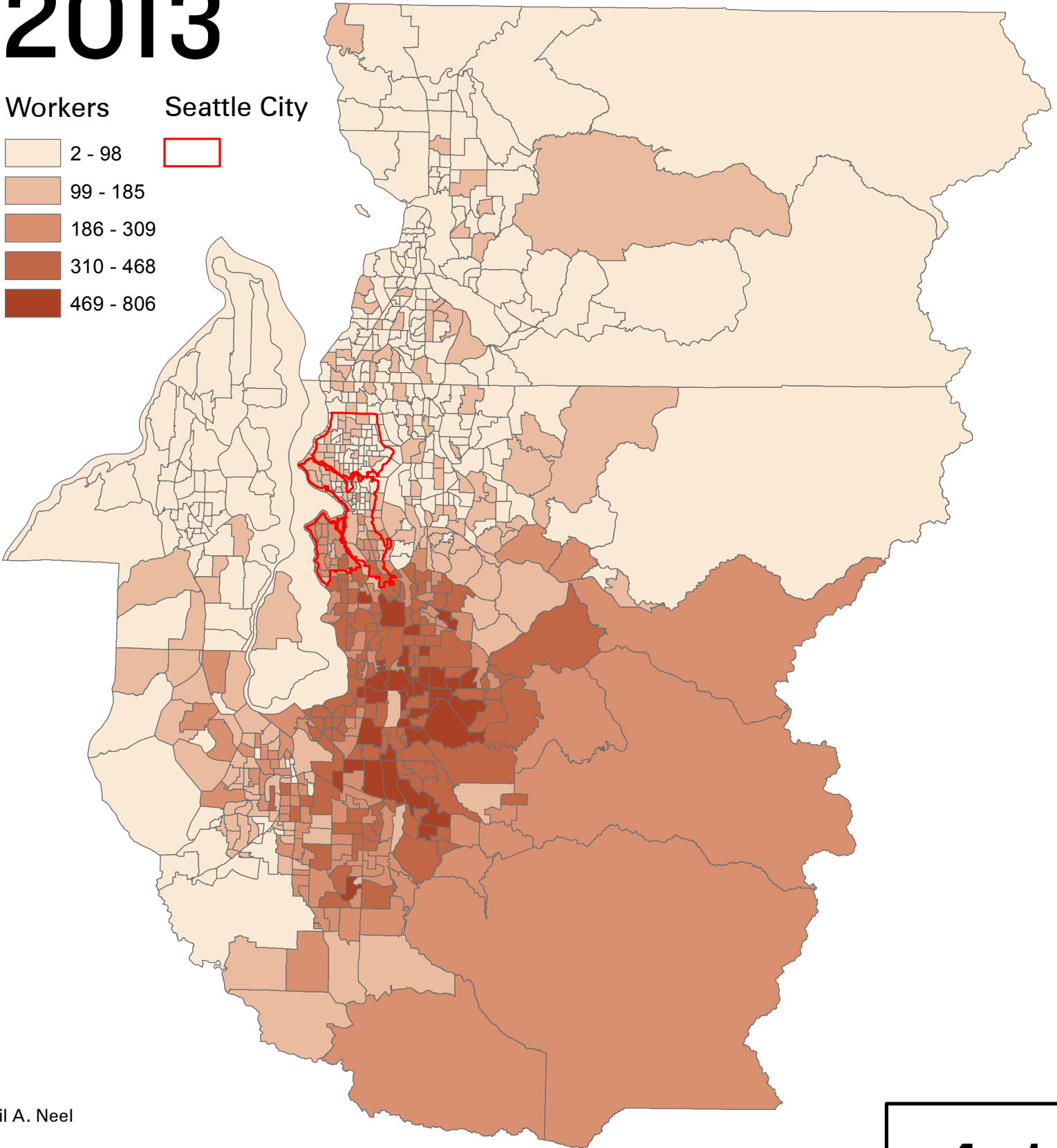
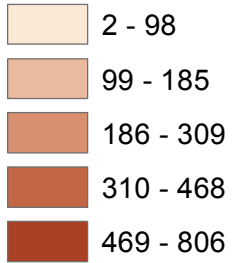
Feeder Tracts

Tracts Sending Workers
To Jobs in Manufacturing and WTU
Within Industrial Super-Clusters

2013

Workers

Seattle City



Phil A. Neel

U.S. Census Bureau; LEHD Origin-Destination
Employment Statistics (LODES), Washington State, Main, 2013

November 28th, 2015

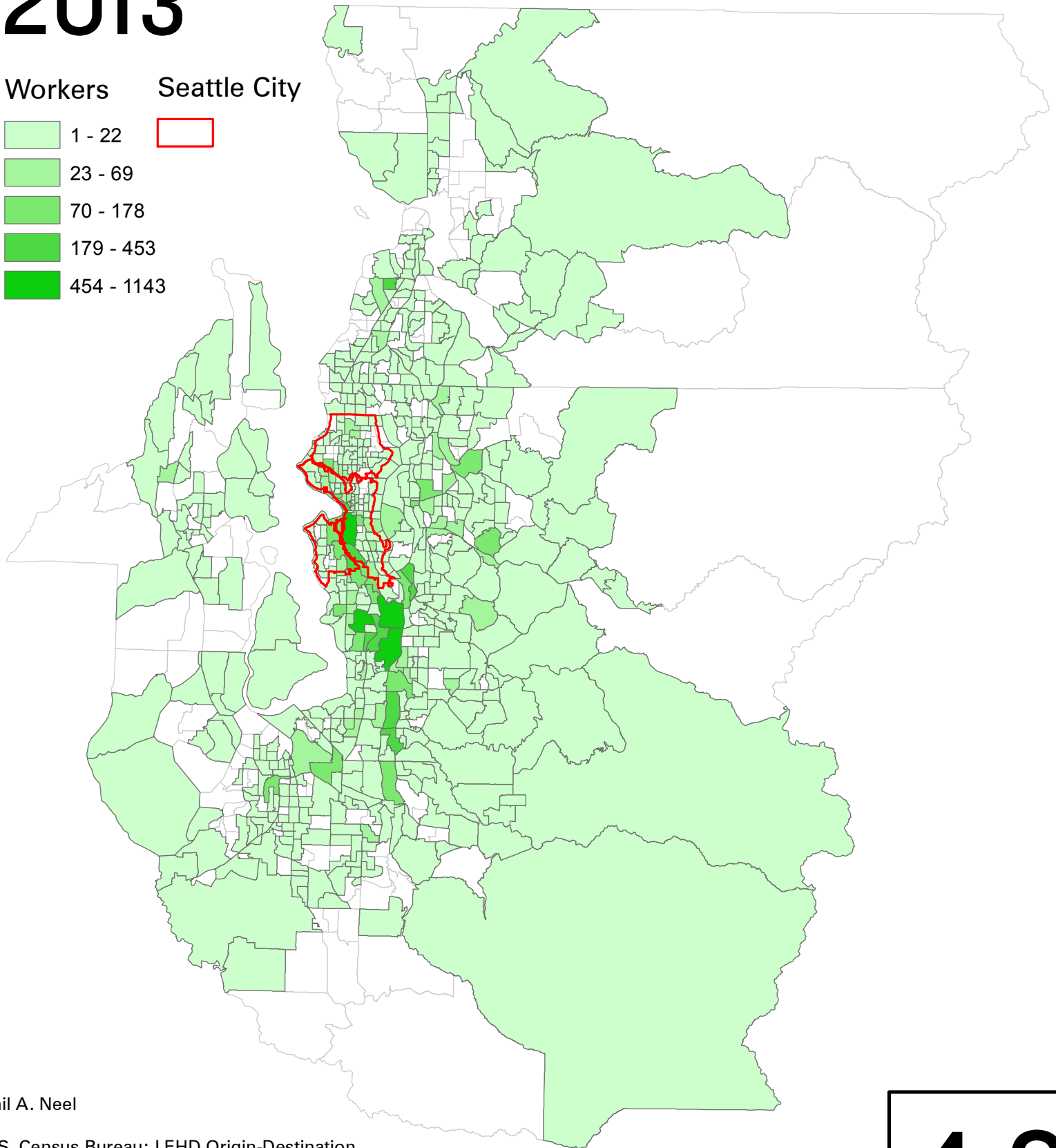
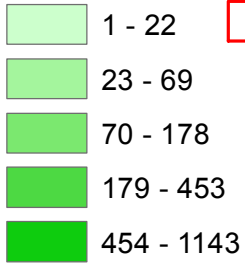
4.1

Receiver Tracts

2013

Tracts Receiving Workers
In Manufacturing and WTU
From Demographic Super-Cluster Peaks
(Poverty, Employment, Foreign-Born)

Workers Seattle City



Phil A. Neel

U.S. Census Bureau; LEHD Origin-Destination
Employment Statistics (LODES), Washington State, Main 2013

November 28th, 2015

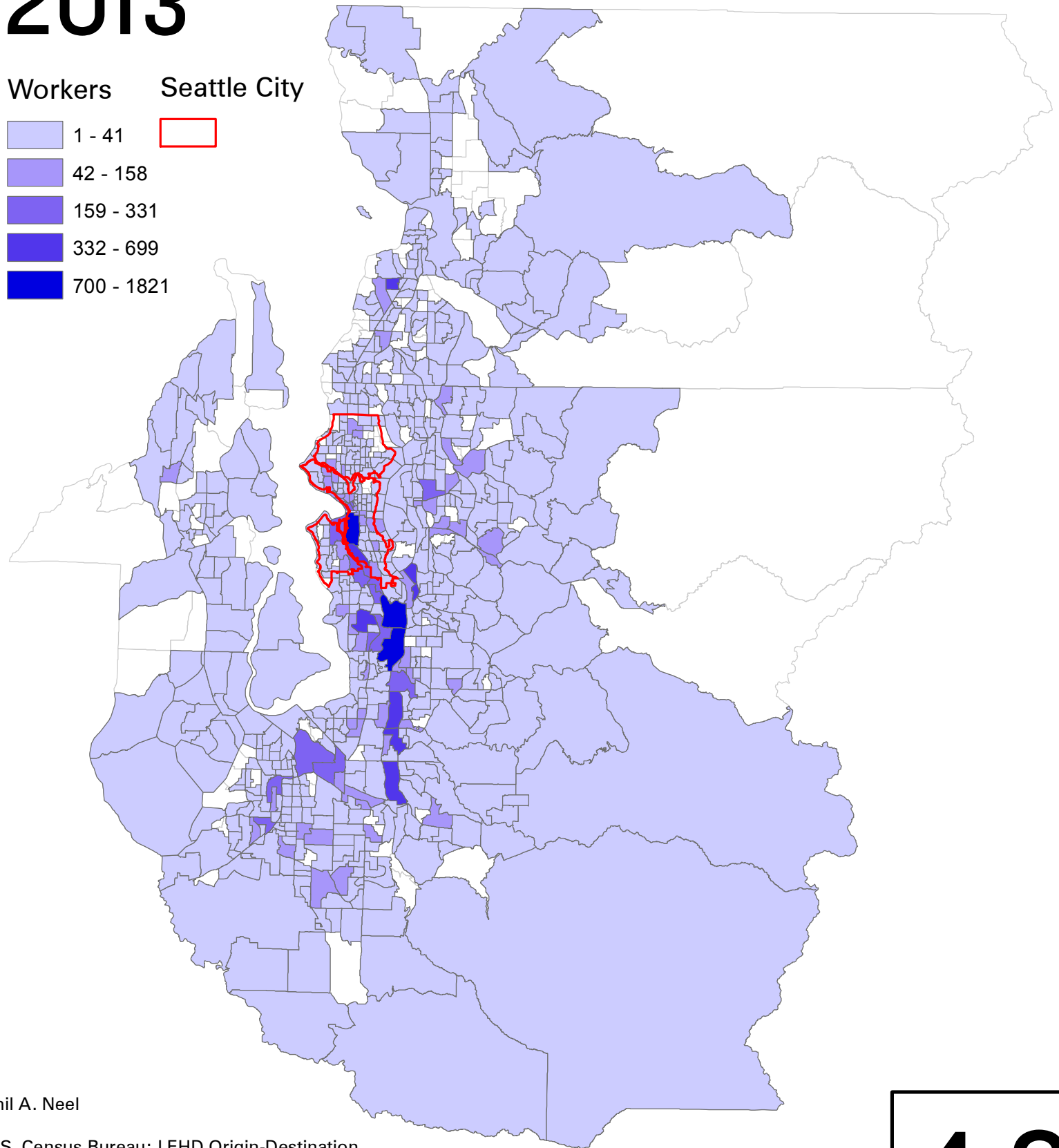
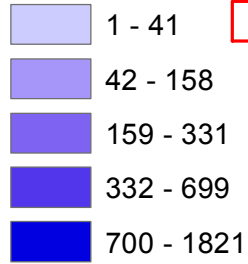
4.2

Receiver Tracts

2013

Tracts Receiving Workers
In Manufacturing and WTU
From Demographic Super-Clusters
(Poverty, Employment Overlap)

Workers Seattle City



Phil A. Neel

U.S. Census Bureau; LEHD Origin-Destination
Employment Statistics (LODES), Washington State, Main 2013

November 28th, 2015

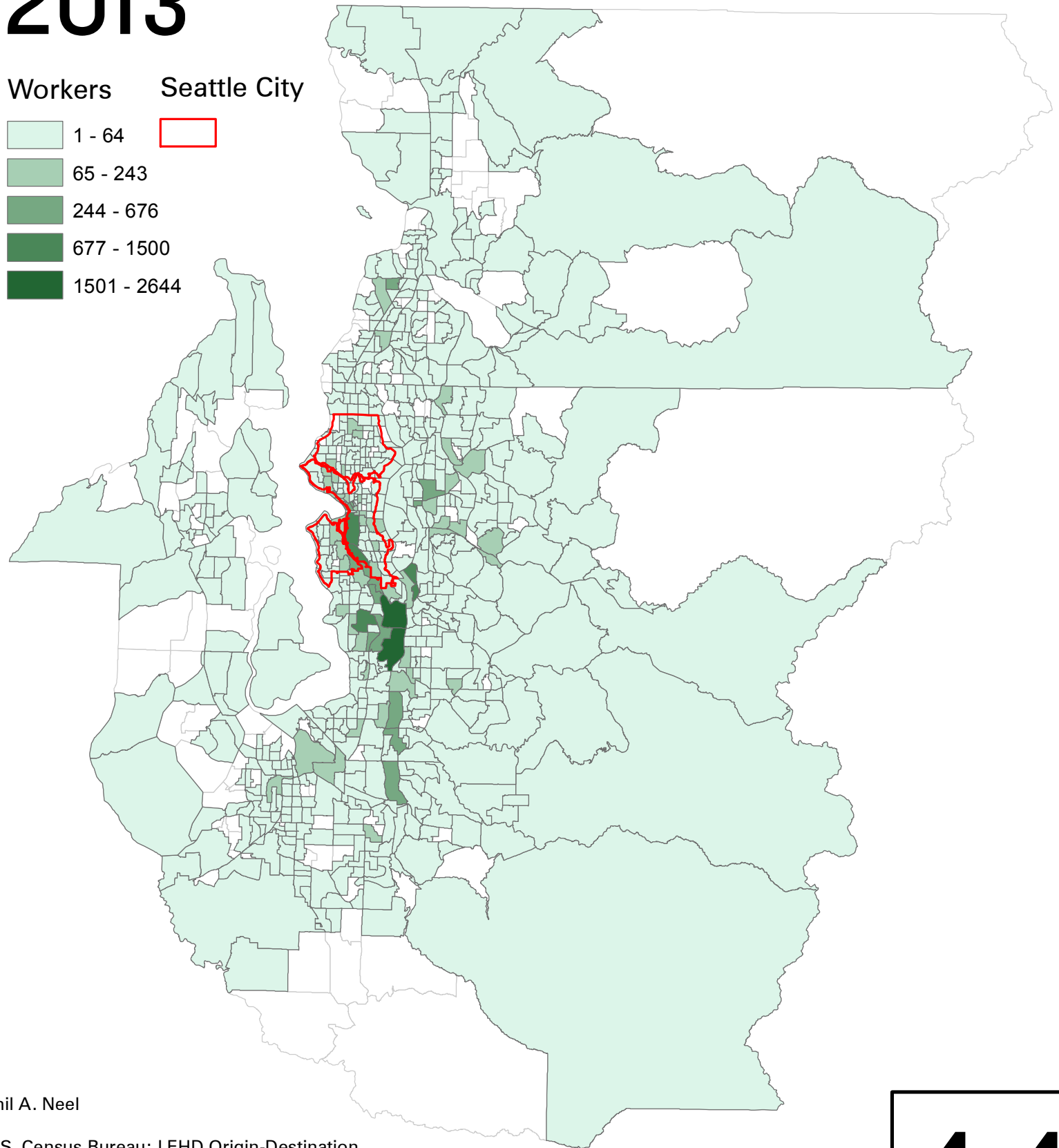
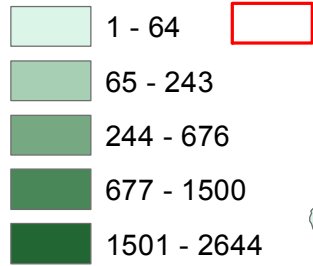
4.3

Receiver Tracts

2013

Tracts Receiving Workers
In Manufacturing and WTU
From Demographic Super-Clusters
(Employment, Foreign-Born Overlap)

Workers Seattle City



Phil A. Neel

U.S. Census Bureau; LEHD Origin-Destination
Employment Statistics (LODES), Washington State, Main 2013

November 28th, 2015

4.4