

An Empirical Study of Urban/Suburban Residential Location Choice
in the Seattle Metropolitan Area

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Abstract

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The factors that affect the urban/suburban residential location choice has long been of interest to the field of urban planning as it explains the distribution of both population and income in metropolitan areas. This study provides empirical evidence on whether the urban-centralization trends of population exist and how household income and urban opportunities are associated with urban/suburban locational choice in the Seattle metropolitan area in order to draw policy implications for urban revitalization.

Descriptive statistics show that the net-flow of urban population is negative during the study period. Two sets of binomial logistic models are employed based on origins in order to understand the mechanisms underlying urban/suburban residential location choice. The role of income in explaining urban/suburban residential location choice becomes modest after controlling for other independent variables. Only high-income households are more likely to choose an urban-to-urban move over urban-to-suburban move as compared to middle-income households. In addition, increases in job and retail/services opportunities, as well as the median built-year of neighborhood structure, are positively all related to the log odds of choosing urban over suburban areas regardless of origins. Throughout the study, the classification of urban versus suburban neighborhood is based on the residents' perceptions of their neighborhood type as opposed to census criteria.

Findings suggest that redistribution of population and income back to urban areas does not exist within the Seattle metropolitan area. Policies and programs creating more employment opportunities as well as higher retail/service land use in urban areas will help to increase the proportion of the urban population in the Seattle metropolitan area. Furthermore, solutions for urban revitalization should include strategies to provide newer housing in better condition in urban areas, which will keep both urban and suburban inhabitants from moving to the suburbs for better housing conditions.

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DEDICATION

To my grandparents and parents.

Chapter 1 Introduction

1.1 Background

Since the middle of the 20th century, many metropolitan areas in the United States have experienced a reformation of spatial structure and the redistribution of population. Beginning after World War II with a construction boom in the suburbs and rising vehicle ownerships, many Americans began to relocate to the suburbs with the dream of home ownership. In the 1950s, over 80 percent of population growth in the United States took place in metropolitan areas, and greater than 90 percent of that growth occurred in suburban areas (Taeuber & Taeuber, 1964). This trend of population movement towards the suburbs has continued into the 21st century, as shown in recent studies revealing that population changes in major metropolitan areas between 2000 and 2010 predominantly occurred in the suburbs (Cox, 2011).

As a result of this continuous suburbanization, many central-city neighborhoods have experienced population decreases and job losses. Only 23 percent of Metropolitan Statistical Areas (MSA) residents and 32 percent of MSA jobs were located in central cities in 2000, compared to 50 percent and 60 percent respectively in the 1960's (Baum-Snow, 2010). In addition to a decline in the share of population and economic activity in central cities, suburbanization has had social consequences for the metropolitan areas; the percentage of minority populations in central cities has been higher and the income levels of city residents have been much less than those of their suburban counterparts (Frey & Fielding, 1995). Therefore, these multi-dimensional aspects of inequalities between cities and suburbs have been a leading concern among researchers.

Many researchers have made efforts to understand the mechanisms underlying intra-metropolitan population movement, which may clarify the decentralization of population and socio-economic inequalities between cities and suburbs. Huge population loss for central cities was explained by the suburban preference of main demographic groups, including traditional family households with children. However, only small shares of subgroups, including single-person households, were attracted to cities (Varady, 1990; Kasarda, Appold, Sweeney, & Sieff, 1997). In addition, previous studies discovered the role of household income levels in city/suburban residential location choice, explaining the flight to the suburbs and increasing socio-economic inequality between cities and their suburbs. In other words, whereas residents in upper- and middle- income

households were more likely to migrate towards suburbs, those in low-income households were more likely to choose cities –a phenomenon which maintains if not increases the disparity between cities and suburbs (Clark & Ledwith, 2007; Shiki, 2008).

Whereas the suburbanization of population and income in U.S. metropolitan areas has been acknowledged among the majority of researchers over the second half of 20th century, some researchers began to argue that suburbanization has ended or at least slowed in the early 2000s. They asserted that a trend toward metropolitan recentralization emerged or the income inequality between cities and suburbs reduced (Sohmer & Lang, 2001; Birch, 2002; Sturtevant & Jung, 2011). However, scholars showed inconsistent evidence concerning this argument and results seemed to vary by metropolitan area (Kasarda et al., 1997; Shiki, 2008). For instance, in San Francisco, the poverty rate of residents relocating to the central city from the suburbs is lower than that of suburban residents relocating within or to other suburbs in the late 1990s unlike other metropolitan areas (Shiki, 2008).

Previous studies, to my knowledge, have not separately investigated the residential mobility between cities and suburbs in the Seattle metropolitan area. It is therefore necessary to examine the factors associated with the city/suburban residential location choice in the Seattle metropolitan area. This aims to understand the role that household income and urban opportunities play in city/suburban residential location choice and to find policy implications for urban revitalization in the Seattle metropolitan area. The study area of the present study includes King, Pierce and Snohomish Counties in Washington State, which coincides with the Seattle metropolitan area as defined by the U.S. Census Bureau.

In addition, previous research on residential location choice between cities and suburbs has generally classified cities and suburbs based on the criteria of the U.S. Census Bureau; the largest central city and, in some cases, up to two additional cities, are designated as central cities in each MSA or CMSA (Consolidated Metropolitan Statistical Area) if specified criteria are met concerning population size and commuting patterns (U.S. Census Bureau, 2012). Then, the rest of the MSA or CMSA outside these central cities are assigned as suburbs (Shiki, 2008). In spite of its simplicity, this classification has limitations; city and suburban characteristics are not defined and bound by the edges of central cities. Even though a residential neighborhood is classified as a

'city' neighborhood, it may have more 'suburban' characteristics than other classified suburban areas, and vice versa. Better research design must be implemented to solve this issue and understand why people move within and between what they perceive to be cities or suburbs.

Therefore, the 2006 Puget Sound Regional Council (PSRC) Activity Survey data is employed in the present study, which provides information on the perceptions of the previous and current residential neighborhood types such as urban and suburban areas, as well as current/previous census tracts.¹ Since terminology used in this data set is urban and suburban, this study will use the word 'urban areas' rather than 'cities' when discussing the current research study except for Chapter 2 : Literature Review. Language used by previous studies will be employed in Chapter 2.

¹ Since 2006 PSRC Household Activity Survey data provided x-y coordinates for the previous residence and did not offer a census tract information, this information is obtained by adding tabular data that contains geographic locations in the form of x-y coordinates to census tract boundary map.

1.2 Purpose of Thesis

This study begins with providing insight on what factors determine the residents' perceptions of their neighborhood type (e.g. urban and suburban) to explore the mechanisms behind the differentiation of urban and suburban neighborhoods.

Secondly, the present study aims to confirm whether the recentralization trends of population and income exist and to examine the relationship between income and urban/suburban residential location choice. The results of the study will help predict the changes in socio-economic status of urban and suburban areas due to urban/suburban migration.

Lastly, this study examines the relationship between neighborhood characteristics and urban/suburban residential location choices. Examining the effects of differences in neighborhood characteristics between previous and current neighborhoods on urban/suburban residential location choices will offer policy implications for local and regional housing, economic development and transportation policies. In particular, the effects of variables regarding employment and urban services opportunities will be useful for urban planners in developing effective strategies to retain existing urban residents and to attract suburban residents to urban areas.

1.3 Thesis structure

This thesis consists of 6 chapters in order to improve the understanding of residential location choice between urban and suburban areas in the Seattle metropolitan area. The specific contents of each chapter are as follows.

Chapter 2 provides the theoretical backgrounds of both perception of residential neighborhood and residential location choice through the review of previous literature. This chapter not only covers how urban and suburban areas are different, but also looks at the significant determinants of urban/suburban residential location choice found by existing literature. Based on the literature review, hypotheses are established.

Chapter 3 discusses the data and methodologies in collecting and analyzing the data in order to investigate the hypotheses established in Chapter 2. This chapter explains the raw data of the 2006 Household Activity Survey conducted by the PSRC, as well as other data sources for the analyses. In addition, how to measure the independent variables and dependent variable of each analysis are presented. Lastly, Chapter 3 describes the multi-linear regression model and binomial logistic model used in the present study.

Chapter 4 provides the analysis results of the relationship between neighborhood characteristics and residents' perceived urban index. This chapter interprets the results and examines the hypotheses established in Chapter 2.

Chapter 5 presents the results of logistic analyses of residential location choice between urban and suburban areas. In this chapter, this study discovers the significant factors that are associated with residential location choice between urban and suburban areas. The present study interprets the results and investigates the related hypotheses illustrated in Chapter 2.

Chapter 6 attempts to integrate the analysis results of this thesis into existing literature, and to draw a conclusion from them. In addition to discussing the limitations of the present study, this chapter offers potential policy implications based on these results in the Seattle metropolitan area.

Chapter 2 Literature Review

2.1 Perceived Urban Index

There is a lack of consensus regarding urban-suburban classifications and their methodological validity. Only one study reviewed developed an ‘urban index’ to measure the extent to which neighborhood environments are urbanized while examining the suburban-to-urban migration hypothesis of elderly populations (Kim, 2011); this urban index is determined on the basis of population density, retail and medical services accessibility, and median built-year of residential building, at the 2000 census block group level. Meanwhile, previous studies provided evidence that people’s perceptions of their neighborhoods were based on the physical, social and service environments of said neighborhoods while these factors were not used to develop a framework of perceived urban index (Haney & Knowles, 1978; Wen, Hawkey, & Cacioppo, 2006).

As for the varied physical environments that define perceptions of urban versus suburban areas, cities were perceived to experience lower quality and aging infrastructure when compared to their suburban counterparts (Mattoon, 1995; Haughwout, 1997). The poor physical conditions of cities and the socio-economic inequalities found between cities and suburbs, are closely correlated. While the inadequate physical attributes of cities push middle- and upper- income households to flee, the low-income populations left living in central cities are less able to afford long-run infrastructure investments, thus the inadequate conditions of the physical environments, as a result, are aggravated (Downs, 1994; Bayoh, Irwin, & Haab, 2002).

Housing affordability is also a crucial factor of physical environments that shapes people’s perception of neighborhood type (Wen et al., 2006). The extent to which housing in a neighborhood is affordable can be measured using a median housing price. According to the bid-rent theory, transportation costs rise and housing prices tend to decline with increased distance from central cities (Alonso, 1964). Relatively low land prices in suburban areas also lead to differences in the dominant housing types between urban and suburban areas; while single-family homes are dominant in the suburbs, multi-family housing is more common in urban areas. Population density or crowdedness is one of the most important variables classifying urban and suburban areas. Not only does the US Census Bureau use population density as a basis for

classifying cities versus suburbs, Kim (2011) also shows that the urban index is positively correlated with population density.

Characteristics of the social environments that result in residents' perceptions of their neighborhoods are associated with neighborhood socio-demographic characteristics such as income and racial composition (Chaskin, 1997). In addition, the vast majority of research conducted on inequalities between urban and suburban areas has concentrated on racial and income disparities (Bollens, 1986; Hill & Wolman, 1997). A place stratification theory addresses how households with higher socio-economic status distance themselves, both spatially and socially, from those of lower socio-economic status (South & Crowder, 1997). As a consequence of this stratification, suburban neighborhoods contain residents who are more homogeneous in socio-economic status as well as race and ethnicity (Gans, 1967). Meanwhile, their counterparts in urban areas tend to be ethnically diverse and of various socio-economic statuses, as non-white or lower income households have fewer opportunities for choice.

Finally, service environments are also important variables in people's perception of neighborhood type. Haney and Knowles (1978) discovered that proximity to services and stores is a more positively perceived characteristic of inner city areas over that of the outer city or suburbs. Kim (2011) confirmed this by displaying that the urban index is positively associated with retail and medical service accessibility. Vliet (1981) discovered that children living in city areas tend to positively perceive the characteristics of their neighborhoods based on their greater accessibility to shops, community centers, and libraries.

As noted earlier, not many studies developed a framework that compiles the diverse criteria of urban-suburban classifications; most studies only focused on a single individual element that may classify urban and suburban area. Therefore, this study takes the existing literature on the subject a step further by (a) integrating diverse elements of urban and suburban disparities and by (b) comparing the relative influence of variables on a perceived urban index.

2.2 Residential Location Choice between and within City and Suburban Areas

Previous studies were reviewed in order to identify factors found to be associated with residential location choice between city and suburban areas. A critical review of these factors will serve to structure the analyses conducted in the present study and to determine which variable should be considered in the analyses. Predictors of urban/suburban residential location choices were identified in the previous studies as individual and household factors, as well as areal characteristics.

2.2.1 Socio-economic Characteristics of Household and Individuals

Previous studies have considered socio-economic characteristics of household and individuals such as household income, home and vehicle ownerships, and employment status, in relation to city/suburban residential location choice. In addition to these variables, these models integrated life cycle related factors such as age and the presence of children. While previous literature, in most cases, found the role of households' and individuals' characteristics to be significant in determining residential location choice between cities and suburbs, one study reviewed discovered that these roles became modest after controlling for community-level areal characteristics (Bayoh, Irwin, & Haab, 2006).

In all previous literature on the subject, household income has been one of the key variables in city and suburban residential location choice. All articles reviewed contained household income measures and the majority of them demonstrated that the probability of choosing cities over suburbs decreases with an increase in household income levels (Bayoh et al., 2006; Nelson & Edwards, 1993; Margo, 1992). Some studies deeply illuminated the role that a low level of household income plays in residential location choice between cities and suburbs, as well as the reasons behind this relationship (Shiki, 2008; Glaeser, Kahn, & Rappaport, 2008).

That is, not only have these studies demonstrated the in-migration tendency of low-income households to central cities, but they have also explored why the low-income households choose to live in cities. Shiki (2008) explained that the reasons for low-income households migrating towards cities in the United States are found in the consumption opportunities of city environments, such as transit services, rental housing, and affordable housing. Glaeser et al.

(2008) also concluded that the concentration of the poor in cities can be attributed to the better access to public transportation found in central cities. This demonstrates that there is an interactive effect between income and some neighborhood characteristics, which means that the effects of household income are associated with the effects of some neighborhood characteristics on residential location choice between cities and suburbs.

However, the effects of household income levels on city/suburban residential location choice were not consistent. South and Crowder (1997) showed that income has a positive relation with choosing suburban over city choice only for household originating in suburban areas. In addition, Shiki (2008) indicated that in-migration and out-migration rates of the poor do not very much differ from those of the rich in the San Francisco metropolitan area, even though the author did not prove the statistical effects of the income variable on city/suburban residential location choice in this specific area. Therefore, these findings obtained from previous literature suggested that the effects of the income variable can vary by the location of previous home and region.

Homeownership is another crucial factor in explaining residential location choices between city and suburban areas. According to the U.S. Census Bureau (2011), the home ownership rate gap between central cities and their suburbs has remained unchanged since 1960 despite an increase of home ownership rates in both areas. Sanchez and Dawkins (2001) presented that the most significant housing-related reason for migration among the general population is the desire for home ownership among city-to-suburb movers. Spain (1989) examined the factors explaining the central-city versus suburban residential location choice among high-income households and found that the differences between central-city and suburban moves are mainly explained by demographic differences, as well as the desire for homeownership. In addition, Clark and Davies (1990) demonstrated that the elderly migrating to central cities tend to rent homes while those moving towards the suburbs and away from the cities change their home ownership status from rent to own. However, the research of South and Crowder (1997) delivered different results; home owners were found to be more likely to move from suburbs to cities rather than suburbs to suburbs, while the impact of home ownership is not significant among movers originating in central cities.

Unlike household income and home ownership, variables concerning vehicle ownership and

access to vehicles were not often included in previous literature, even though many scholars incorporated the accessibility of the transportation network in their model. Only one study reviewed incorporated vehicle availability as an explanatory variable and proved that those aged 30 to 59 with greater household vehicle availability are more likely to relocate to less urbanized areas (Kim, 2011). The effect of vehicle ownership on residential location choice has been understudied, while many scholars have investigated the opposite relationship (Handy, Mokhtarian, & Buehler, 2004; Holtzclaw, Clear, Dittmar, Goldstein, & Haas, 2002). In other words, since vehicle ownership choice and residential location choice are mid-term and long-term decisions respectively, studies have mainly focused on the impact of long-term decisions on mid-term decisions. However, a few scholars have recently pointed out the effects of mid-term decision on long-term decision as well (Pinjari, Pendyala, Bhat, & Waddell, 2011).

Regarding the possible effects of employment status on city/suburban residential location choice, studies reviewed exhibited inconsistent findings which may be a reflection of whether the location choice models were integrated or separated based on origins. Shiki's (2008) city/suburban choice model was not divided based on their origin, and discovered that the unemployment status of a householder has a positive effect on choosing cities over suburbs. However, South and Crowder (1997) used separated logistic models based on origin and found employment status to be insignificant in explaining the migration between cities and suburbs.

Earlier studies on residential migration, including research on migration and residential location decisions, placed an emphasis on life cycle factors. Rossi (1955) first demonstrated how crucial family life cycle events and family composition are to residential mobility. After Rossi (1955) introduced this model, many following studies on residential migration also chose to employ life cycle factors (Speare, 1970; Abu-Lughod & Foley, 1960). Specifically, scholars have showed that a household's life cycle stage along with its life style is crucial in explaining whether the household will migrate towards cities or suburbs (Varady, 1990).

One of the life cycle factors found to be significant in explaining city/suburban residential location choice is the presence of children within the household. Empirical research exhibited that households choosing to live in the suburbs are usually households with children, whereas households choosing to live in cities are mainly households without children such as young

singles (Varady, 1990; Shiki, 2008; Kim, 2011). However, South and Crowder (1997) found an inconsistency in this trend. They discovered that families with pre-school aged children, and a previous location within a city, tend to select cities over suburbs; on the other hand, the study also found that the presence of older school-age children does not have an impact on the city versus suburban choice when households previously lived in cities.

Age is another primary variable related to the life cycle theory. Previous studies demonstrated inconsistent results regarding the influence of age on city and suburban residential location choice. Some scholars found that the elderly are more likely to move to urbanized areas (Myers & Gearin, 2001; Kim, 2011) and South and Crowder (1997) demonstrated that age only positively affects the city versus suburban choice when their origins are cities. However, others have shown that age has had a negative impact on the choice of cities over suburbs (Shiki, 2008; Varady, 1990).

2.2.2 Areal Characteristics

Other evidence to explain city/suburban residential location choices has focused not on the socio-economic characteristics of households and individuals, but on the areal characteristics of city and suburban areas that serve as push or pull factors for residential location choice. The focus of previous studies has mainly been on the middle-class out-migration from poorer cities to wealthier suburbs, using the effects of areal characteristics on city/suburban locational choice (Shiki, 2008; Byun & Esparza, 2005). Out of this research, two main theories on the suburbanization of the middle class in relation to the effects of areal characteristics have emerged: a) a natural evolution theory and b) a flight-from-blight theory (Mieszkowski & Mills, 1993).

The former theory is based on the monocentric city model and considers transportation costs to and from central workplaces, as well as the heterogeneity of housing stock, to be important (Wu, 2007). In order to minimize transportation costs to the workplace, central areas are developed first. As metropolitan income rises and the mass production of single-family homes in the suburbs results in a reduction in housing prices, higher income groups migrate to suburban areas where they can enjoy larger and newer houses (Lee & Leigh, 2005; Kunstler, 1993; Byun & Esparza, 2005). Transportation innovations have also been attributed to the suburbanization

process in this theory; along with household economic changes, advances in transportation networks connecting city and suburban areas, and lower transportation costs caused by technological innovations, drive people to move from central cities to suburbs (Bayoh et al., 2006). In this way, natural evolution theory focuses on the “pull” factors of the suburbs that attract city residents.

On the other hand, the flight-from-blight theory proposes that suburbanization in the U.S. is in part led by the “push” factors of central cities. These factors include deteriorating infrastructures, higher crime rates, lower environmental quality, and a greater presence of the lower class relative to suburban and rural areas, all of which cause middle- and higher- income groups to migrate from cities to suburban areas (Wassmer, 2008).

However, Mieszkowski and Mills (1993) also pointed out that these theories are not mutually exclusive, but interactive in complex ways; for instance, income gaps between households is an important factor that contributes to the suburbanization in both the natural evolution and the flight-from-blight theories.

Diverging from the research trends that concentrated on the out-migration of higher-income groups to suburban areas, scholars in the 2000s began noting that the phenomenon of the poor continuously moving into cities rather than the suburbs, because of the differences in areal characteristics between cities and suburbs. Shiki (2008) discovered the role of consumption opportunities such as rental housing units, transit, and retail/services and job availability in explaining the in-migration trend of the poor into cities. She employed an external economy framework, in which the unstable financial conditions of the poor make them dependent on the external economy of central cities. Glaeser et al. (2008) accounted for the concentration of poverty in central cities as the result of better public transportation systems in cities over suburbs. This framework focuses on the positive neighborhood characteristics offered in cities relative to the suburbs unlike the previous two theories.

2.2.3 Summary of Literature Review

Table 1 displays the main explanatory variables and relevant findings found in the previous research on the subject in question. In summary, very few studies have investigated the influence

of urban opportunities on city/suburban residential location choice. Even though Shiki (2008) included variables of consumption and job opportunities, as well as socio-economic characteristics of households and individuals in her model, the author did not classify the model based on origins. This disrupts the study's ability to identify whether people migrate to cities from cities or suburbs; information that is crucial to planners and policy makers in deciding policies and their targets. Although South and Crowder's (1997) study classified movers into two groups based on origin, it fails to be an exhaustive study as the model only considered the areal characteristics related to the flight-from-blight theory.

In addition, the effects of individual and household characteristics on city/suburban residential location choices appear differently when two logistic models based on origins are employed. In other words, the influences of most individual and household characteristics on city/suburban residential location choice are likely to be partially significant, as they are separated on the basis of a previous neighborhood type. This does not coincide with earlier studies that emphasize the significance of individual and household characteristics. It is therefore necessary to confirm the relative impact of individual/household characteristics and areal characteristics when examining a wide array of explanatory variables including urban opportunities. This will offer a more complete picture of the motivations behind city/suburban residential location choice.

Lastly, no studies reviewed explored how the differences in areal characteristics caused by migration affect the city/suburban residential location choice at a neighborhood level. However, this will information help reveal the determining neighborhood characteristics behind city/suburban choice, as people migrate from one location to another for the differences between previous and current neighborhoods. This could not be addressed by previous studies only including the neighborhood characteristics of either previous or current neighborhood.

Table 1 Summary of major studies on city/suburban residential location choice reviewed

Reference	Study Area	Methods	Main variables			Significant /relevant findings
			Individual characteristics	Household characteristics	Areal/regional Characteristics	
Spain, D. (1989)	U.S. large SMSAs	Multiple linear regression	Age, marital status, race(white) education	Children, home ownership, prior residential location	Subjective variable: crowedness, ethnic composition, crime rate, schools	Relatively significant variables: prior residential location,home ownership, race
Varady, D.P. (1990)	Hamilton County (Cincinnati, Ohio)	Discriminant analysis	Age,marital status, education, income, high-status occupation, race(white), work in ohio suburb	Children, two or more workers, school-aged children, previous residential location (moved from suburbs/outside Cincinnati area), previous home ownership, newly formed household	Subjective variable: neighborhood homogeneity, public school, accessibility, efficient government service, good housing price	*Suburban choices [large properties, neighborhood homogeneity, quality of school] *Urban choices [neighborhood diversity, accessibility to employment & stores, desire to preserve neighborhood social relations]
South, S. J., & Crowder, K. D. (1997)	U.S. Metropolitan areas	Binary logistic regression analysis	Age, marital status, race(black),education, current working status	Preschool aged children, school aged children, family income home ownership, persons/room, moved last year, in same house for 3 yrs, receiving public assistance	1. Characteristics of tract of origin: % black, % in poverty, 2. City-to-suburb ratio of: crime rate, population density, unemployment rate, % black, population size 3. Regional type: Northeast, Midwest, South, West	* While higher income has positive effect on suburbs-to-suburbs movement, it does not have significant effect on cities-to-suburbs movement. *The impacts of variables on urban/suburban location choices vary by origins.
Sanchez, T. W., & Dawkins, C. J. (2001)	U.S. 33 Metropolitan areas	Discriminant analysis	Age, marital status, job-related variables, independence from parents	Household income, home ownership	1. City-to-suburb ratio of: population, population density, 2. % MSA resident working in cities, MSA population 3. Regional type: Northeast, Midwest	* Higher incomes seem to have positive effects on suburban over urban choices. * Suburb-to-city movers do not have do not have higher incomes; most upper-income households migrating to cities tend to move within the city.

Table 1 continued

Reference	Study Area	Methods	Main variables			Significant /relevant findings
			Individual characteristics	Household characteristics	Areal/regional Characteristics	
Bayoh, I., Irwin, E. G., & Haab, T. (2006).	17 schhol distircs in Franklin County, Ohio	Hybrid conditional logit model	N/A	Household income, school-aged children	<p>1. Level & quality of local public services & fiscal variable (school quality, tax, crime rate)</p> <p>2. Consumption & job opportunities (per capita business and retail establishments)</p> <p>3. Socio-economic char.s of the population: per captia income, % low income households, % high income households</p> <p>4. Physical features of community:population density, % of old housings</p>	<p>*Relatively significant variables: local public goods, taxes, and socioeconomic features of the population [Flight-from-blight factors]</p> <p>* The impacts of variables related to natural evolution such as household income and life cycle factors become modest when controlling for flight-from-blight factors.</p>
Glaeser, E. L., Kahn, M. E., & Rappaport, J. (2007)	U.S. 16 Metropolitan areas	Multiple linear regression	Independent variables: distance from CBD- 3 miles, 3-10 miles, >10 miles % using public transit distance to rail transit line		Dependent variable: tract median household income	Access to public transportation has a positive effect on the concentration of the poor.
Shiki (2008)	U.S. 78 Metropolitan areas	Two-level logistic regression analysis	Age, race/ethnicity, sex marital status, education, unemployed	Household size, children, household income, previous residential location	Population size, central-city-to-suburb ratio of: population, race, population density, job opportunities, service/retail employee rates, transit commuter rates, renter occupied unit rates, mean rates, mean housing value	<p>* Household income has a negative impact on central city versus suburbs choice.</p> <p>* Relatively strong effects of consumption opportunities variables [transit services, rental housing, & service/retail] on urban/suburban locational choice</p>
Kim (2011)	WA state, U.S.	Multiple regression	Age, employment, commuting distance	One-adult, children, vehicle availability, household size	Pre-move urban index	*Elderly households are likely to migrate from less urbanized areas to more urbanized areas.

2.3 Hypotheses

Based on the literature review, the following hypotheses are established.

- (1) People are more likely to perceive their neighborhood as urban if their neighborhood has
 - higher degrees of urban opportunities including jobs, retail/services, roads, transit, and rental housings
 - lower percentage of single-family homes, higher median housing value, lower median built-year of structures, and higher population density
 - lower levels of socio-economic status (e.g. lower percentage of white population and median household income)

- (2) Moving to urban areas over suburban areas is more likely associated with
 - lower level of household income,
 - higher degrees of urban opportunities including job and retail/services opportunities, availabilities of transit and rental housing unitsof current neighborhood as compared to previous neighborhood

- (3) The influences of household income and other individual, household characteristics on urban/suburban residential location choice become modest when controlling for differences in previous and current neighborhood characteristics and models are separated based on origin.

Chapter 3 Data and Methodology

This chapter explains the research design and data sources used in the present study. In addition, how factors employed in the analysis are measured and how models are constructed to answer my research questions are summarized.

3.1 Research Design

This study is comprised of two main research models: 1) a residents' perceived urban index model and 2) urban/suburban residential choice models.

For the first research model, the study uses a cross-sectional research design and explores influences on residents' urban-suburban perceptions of their current residential neighborhood type in the Seattle metropolitan area. The level of the first model is a census tract. A multiple regression model with an urban index of each census tract is developed to explore how neighborhood characteristics are associated with their perceived urban index. A few census tracts in the study area are excluded, as no residents in them were surveyed.

With regards to the second research model, a cross-sectional research design is used, as this study includes the changes in neighborhood characteristics using the features of previous and current census tracts without including changes to any given neighborhood over time. Two binomial logistic regression models are designed to separate the influences on urban/suburban residential location choice based on the previous residential neighborhood type. Binomial logistic models with the current neighborhood type as an independent variable are developed to examine how individual and household characteristics, as well as changes in neighborhood characteristics, affect urban/suburban residential location choice and how the impacts of these variables vary depending on origin.

The geographical scope of the study is the Seattle metropolitan area, which consists of King, Pierce and Snohomish counties, because of the information available on previous and current census tracts of recent movers, rich data sources on transportation networks, and readily accessible employment estimates. Figure 1 shows the study area of the present study.

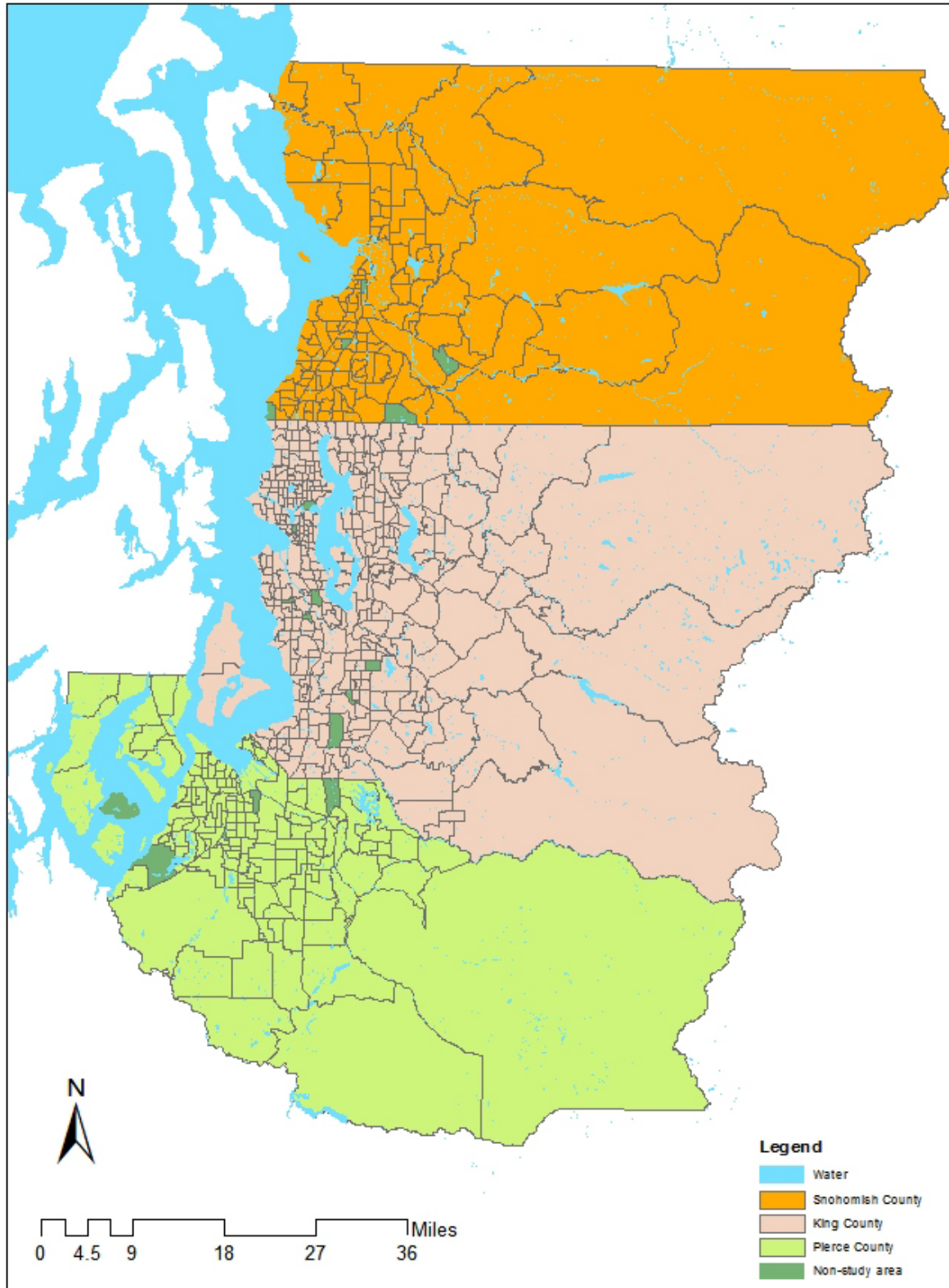


Figure 1 Study area of the present study (Seattle metropolitan area)

3.2 Data

The primary data source for all analyses was the 2006 PSRC Household Activity Survey. The PSRC Activity Survey collected basic demographics, activities, and tour and travel characteristics from every member(s) of 4,746 households (10,510 individuals) residing in King, Kitsap, Pierce and Snohomish Counties using a 48-hour diary. The survey was conducted during the weekdays from early April to mid-June in 2006 (Cambridge Systematics, Inc., 2007). This PSRC Activity Survey is a crucial data source for examining urban-suburban perceptions of their residential neighborhood types, as well as people's urban/suburban residential location choices. For a clear understanding, the Survey includes the questions and choices for respondents in the following manner.

Is your current home located in an urban area, suburban area, or rural/exurban area? (IF NEEDED: urban = dense urban environment, suburban=lower-density suburban environment, and rural/exurban area=very low density environment or a mixture of low-density household and open space) (CHECK ONE)

01 Urban /02 Suburban/03 Rural/Exurban/998 Don't Know/999 Refused

The Survey also asks about the residents' previous neighborhood type in the same way. Even though the Survey provides a brief and ambiguous guideline for defining urban, suburban and rural areas, it seems to reflect the people's perception of their neighborhoods.

For the purposes of the first research model, all households who provided their information on their current census tracts and perceptions of their current neighborhoods are included. Due to missing information, only 4,101 households out of the total 4,746 households are included for this model. In addition, for the second research model of urban/suburban residential location choices, only households that migrated to their current residences in the ten years leading up to the survey (1996-2006) and moved within the study area of the Seattle metropolitan area are included, as this time period most closely corresponds to Census 2000 data. Because census surveys are conducted every ten years, it is to be supposed that census tract features did not change between 1996 and 2006, and that these features are reflected in the Census 2000 data.

Because of the missing information, 985 households are included for the second research model: urban/suburban residential location choice model.

Table 2 exhibits the data sources used in this study. Household and individual-level characteristics and migration data is extracted from 2006 PSRC Activity Survey data.

Neighborhood characteristics, including the percentage of renter occupied housing, the percentage of single-family home, median housing value of owner-occupied housing, median built-year of structures, population density, the percentage of white population, and the median household income at a census tract level, are extracted from Census 2000 data.

Employment opportunities and the percentage of retail/services jobs are calculated based on Covered Employment Estimates data (2000), an open source obtained from the PSRC website. Data on transit is obtained from various sources according to County; King County metro transit data is acquired from King County GIS data portal site and Pierce County transit data is obtained from Pierce Transit Agency. In addition, Snohomish County transit data (Community and Everett transit data) are obtained from PSRC. Data on Sound Transit across the study area is also drawn from the Washington State Geospatial Data Archive (WAGDA). Road data was also obtained from WAGDA.

Table 2 Data sources

Model	Variable			Data Sources
	Level	Category	Specific variables	
Perceived urban index	Census tract	Urban index (dependent var.)		2006 PSRC Household Activity Survey
Perceived urban index, Locational choice model	Census tract	Neighborhood Characteristics (independent var.)	Employment opportunities % of retail/services	PSRC Covered Employment Estimates (2000), Census 2000 Data
			Transit density	King : King County GIS Center Pierce: Pierce Transit Agency Snohomish: PSRC, WAGDA Sound Transit: WAGDA
			Road density	WAGDA
			% rental housing units, % single family home, Median housing value, Median built-year of housing, Population density, % white population, Median household income	Census 2000 Data
Locational choice model	Household	Migration type (dependent var.)		2006 PSRC Household Activity Survey
		Individual characteristics (independent var.)	Age	2006 PSRC Household Activity Survey
		Household characteristics (independent var.)	Home ownership, Income, Children, Number of workers, Vehicle availability	2006 PSRC Household Activity Survey

3.3 Measurement

3.3.1 Variables of Urban Index Model based on Residents' Perception

Dependent Variable

Measures of Urban Index based on residents' perception

The Perceived urban index is defined based on the respondents' perceptions of their residential neighborhood types such as urban, suburban, and rural as found through 2006 PSRC Activity Survey. The answers from respondents who provided the information on their current census tracts as well as valid answers for their current residential types are only used to measure the urban index. The urban index of each census tract is calculated by dividing the number of respondents answering their residential type as urban by the total number of respondents at a census tract level. For instance, if 100 people participated in the Survey in one tract and 68 out of 100 people chose the 'urban' as their neighborhood types, $68/100=0.68$ becomes the urban index of that census tract. Figure 2 shows the distribution of urban indexes throughout the study area. This method has the limitation of classifying suburban and rural areas as the same when calculating the index. While the index is effective in measuring the perception of the residents' neighborhood types at a census tract level, this method has a limit in classifying suburban and rural areas. This is because this index considers both of them same.

Independent Variable

Measures of Neighborhood Characteristics

Previous studies, as well as city planning departments of many municipalities have defined neighborhood boundaries along census tract boundaries (Yen & Kaplan, 1998; <http://www.gnocdc.org/NeighborhoodData/NeighborhoodDefinition.html>). Therefore, neighborhood characteristics are measured at a census tract level and neighborhood will refer to census tract in the remainder of this study. As for the variables related to employment, employment opportunities are quantified by dividing the total number of employment estimates by the number of population aged 15 to 64. According to the PSRC, the unit of measurement is jobs, not working persons or proportional full-time employment equivalents and part-time and temporary

positions are included. Retail/service job opportunities are measured by dividing the number of employment estimates in retail and the service field by the total number of employment estimates.

With regard to transportation-related variables, road and transit densities are measured using ArcGIS 10. A road density is equal to the total length of roads divided by tract land area, and a transit density is acquired by dividing the number of transit stops by a tract area.

The remainder of the neighborhood characteristics, including the percentage of rental housing units, the percentage of single-family homes, the percentage of white population, median housing price, median built-year of structures, and median household income are measured using ArcGIS 10 based on Census 2000 data (SF1, SF3). Single-family home is defined as a single-unit detached structure as per the census classification. To measure median values including housing price, year-built of structures, and household income levels, the average of median values at a census block group level is calculated at the census tract level to which the census block group belongs.

Table 3 summarizes the descriptive statistics of variables used for analysis.

Table 3 Descriptive statistics for dependent and independent variables of a multiple regression model

	Variable	Unit	Observation	Mean	SD	MIN	MAX
Dependent	Perceived urban index	-	644	0.38	0.36	0	1
Independent	Employment opportunities	jobs/workers	644	0.86	2.37	0	25.79
	% of retail/services	%	644	38.61	20.24	0	94
	Transit density	numbers (transit stops)/sq.miles	644	22.50	33.92	0	331.56
	Road density	mile/sq.miles	644	13.96	8.12	0.209	50.26
	% of rental housing units	%	644	34.67	21.92	2.89	99.1
	% of single-family home	%	644	62.68	24.51	0	100
	Median housing value	\$	644	214037.3	96232.73	35125	762700
	Median built-year of structure	year	644	1970.23	13.78	1939	1996.5
	Population density	persons/sq.miles	644	3826.00	4172.81	3.12	44130.43
	% of white population	%	644	78.83	14.30	10	97
Median household income	dollars	644	56393.1	17408.9	10556	135540	

Note: The unit of data is a census tract.

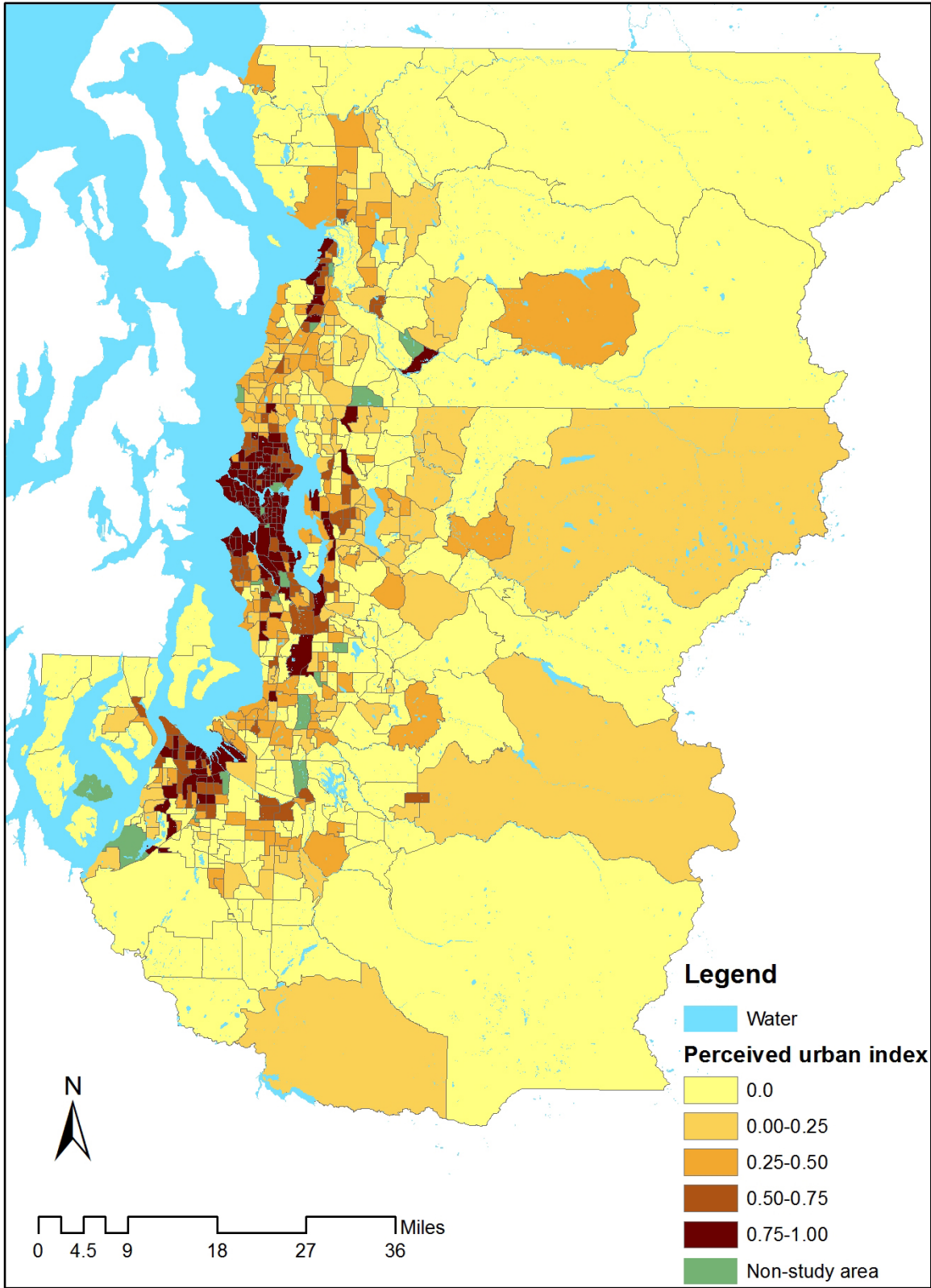


Figure 2 Distribution of perceived urban index in the study area

3.3.2 Variables of Residential Location Choices between Urban and Suburban Areas

Dependent Variable

Measures of Residential Location Choice between Urban and Suburban areas

As for the dependent variables of the analyses of urban/suburban residential location choices, the combinations of previous and current neighborhood types, as perceived by respondents, are employed. Since two analyses are conducted based on the previous neighborhood types, the independent variable of the first model is a dummy variable for whether households move from urban neighborhoods to urban neighborhoods(1) or from urban neighborhoods to suburban neighborhoods(0). In addition, the independent variable of the second urban/suburban residential location choice model is a dummy variable for whether households move from suburban neighborhoods to urban neighborhoods (1) or from suburban neighborhoods to suburban neighborhoods (0).

Independent Variable

Measures of Individual and Household Characteristics

Age and squared age of the first person on the household list or the available household member contacted over 16 years of age are included in the urban/suburban residential location model to examine the linear and nonlinear effects of the age variable on urban and suburban residential location choices. A variable related to home ownership is a dummy variable for whether households own their current home or not. Household income levels are categorized into three groups: (a) below \$ 50,000, (b) \$50,000 to \$100,000, and (c) above \$ 100,000. As some respondents who did not want to offer specific numbers provided information on their household income based on these criteria, this study follows this classification. Using the median group (b) as a base group, two dummy variables for whether the household income is below \$ 50,000 or not, and whether the household income is above \$100,000 or not, are employed. A variable of children is a dummy variable for whether the household has any children. The number of workers in a household is extracted from the PSRC Activity Survey. A vehicle availability variable is a dummy variable for whether less than one vehicle per driver is available or not.

Measures of Differences between Previous and Current Residential Neighborhoods

The way that characteristics of previous and current neighborhoods are measured is the same as the methods used in section 3.3.1 in the first model. However, in the second model, the differences between previous and current residential neighborhoods are additionally measured to obtain independent variables. Since most of the neighborhood characteristic variables are based on data created in 2000 including Census 2000, the basic assumption of measuring differences between previous and current residential neighborhoods is that the neighborhood characteristics between 1996 and 2006 were the same as those in 2000. The numbers of previous neighborhood characteristics are subtracted from those of current neighborhood characteristics to measure the differences between previous and current neighborhood characteristics.

Table 4 summarizes the descriptive statistics of variables used for analysis, by household income group.

Table 4 Descriptive statistics for independent and dependent variables of binomial logistic regression models

Level	Variable	Unit	Obs.	Mean	SD	Min	Max
Independent (1st model)	urban to urban	urban to urban: 1 (else:0)	568	0.785	0.411	0	1
Independent (2nd model)	suburban to urban	suburban to urban: 1 (else:0)	417	0.233	0.423	0	1
Individual	age	year	985	47.072	13.839	25	89
Household	Home ownership	Homeowner:1 (else:0)	985	0.714	0.452	0	1
	Low income	Low income: 1 (else:0)	985	0.175	0.380	0	1
	Middle income(base)	Mid income: 1 (else:0)	985	0.490	0.500	0	1
	High income	High income: 1 (else:0)	985	0.335	0.472	0	1
	Children	Having kids :1 (else:0)	985	0.328	0.470	0	1
	Number of workers	persons/household	985	1.204	0.785	0	5
	Vehicle availability	One or more veh/driver:1 (else:0)	985	0.871	0.335	0	1
Differences in neighborhood Characteristics	Job opportunities	jobs/persons	985	-0.149	3.18	-26	26
	% of retail/services	%	985	-3.417	24.183	-80	62
	Transit density	# of transit stops/sq miles	985	-3.585	48.638	-316	330
	% of rental housing units	%	985	-2.389	26.443	-75	78
	Median housing value	dollars	985	-10624	100890	-540120	428031
	Median built-year of structure	year	985	-1.63	14.168	-51	56
	Population density	persons/sq miles	985	-811.6	6738.1	-41839	35289
	% of white population	%	985	0.324	15.841	-71	79
Median household income	dollars	985	-435.1	18798.7	-79967	71562	

Note: The unit of data is a census tract.

3.4 Methods

3.4.1 Finding Factors that Affect the Urban Index based on Residents' Perception

All statistical analyses for finding neighborhood characteristics that have impacts on the perceived urban index are performed using R. A multiple linear regression analysis entering neighborhood characteristics is conducted to elucidate which variables have significant effects on the perceived urban index and to compare those effects. A multiple regression is often used to develop social ecological framework that considers the perception as an achievement of human-environment systems (Carello & Turvey, 2002). In this study, the response variable is based on residents' perceived neighborhood types and independent variables are neighborhood characteristics. The level of significance for an analysis is set at the 0.1 level or smaller.

3.4.2 Finding Factors that Influence the Urban and Suburban Residential Location Choice

A discrete choice model has long been employed to explain consumption decisions. In the field of urban planning, previous research has used discrete choice and random utility models to account for whether or not a household will relocate to another area and what destination a household will choose among various options (Ben-Akiva & Lerman, 1985). A discrete choice model, introduced by McFadden (1981), is based on the fact that every decision-maker chooses the most desirable alternative among all possible alternatives. It is assumed under this model that every decision-maker selects one out of all alternatives, in order to maximize utility. Among diverse discrete choice models, this study employs the binomial logistic model.

This study considers each mobility as a unique observation and there are four types of mobility: a) urban to urban, b) urban to suburban, c) suburban to urban, and d) suburban to suburban. The resulting file includes a total of 985 observations without missing variables; 568 (57.7%) and 417 (42.3%) observations originated from urban and suburban areas respectively. As a probabilistic choice model analyzes data by including a random error, residential neighborhood choices of households can be estimated more precisely using this model. Of the various probabilistic discrete-choice models, two binomial logistic models based on origins of urban and suburban are employed in this study, following the previous related literature (South & Crowder, 1997).

Chapter 4 How Do Residents Perceive their Residential Neighborhood Type?

4.1 What Are the Differences between Perceived Urban Areas and the Central Cities of Census Classification?

As noted in Chapter 1, previous literature has employed the urban and suburban classification defined by the U.S. Census Bureau in order to explain the city/suburban residential location choices. Despite its simplicity, this method does not reflect the actual reasons of moving to city or suburban neighborhoods. That is, even if people migrate to city neighborhoods classified by US Census Bureau, it is possible that people choose to live in those neighborhoods as they perceive it as suburban neighborhoods. This might often occur around the boundaries of cities, an ambiguous area between city and suburban areas.

While most previous literature classifies the central city and the remaining metropolitan areas outside the central city as a city and its suburbs respectively, this study uses a word ‘urban’ rather than a city. Therefore, this study investigates the difference between cities and perceived urban areas.

In order to confirm how often and where this discordance between residents’ perceptions and Census’ classification occurs, urban index is classified into 3 categories: a) 0-0.4: suburban areas (non-urban areas), b) 0.4-0.6: unclear areas which show a high percentage of conflicting choices, and c) 0.6-1.0: urban areas.

As shown in Table 5, 82 out of the 644 census tracts surveyed displays urban index between 0.4 and 0.6, which means that approximately 13 percent of tracts surveyed does not reach a consensus on their neighborhood types.

Table 5 Descriptive statistics of perceived neighborhood types

Perceived Neighborhood Type	Urban index value	Frequency	Percent
Suburban	below 0.4	373	57.92
Ambiguous type	0.4-0.6	82	12.73
Urban	0.6 or above	189	29.35
Total		644	100

Figure 3 displays both of city boundaries defined by U.S. Census Bureau and the distribution of urban index reflecting people's perception of their neighborhoods. While the majority of perceived urban areas fall inside the boundaries of central cities based on the census criteria, several ambiguous areas with urban index between 0.4-0.6 are located outside around the boundaries of central cities. In addition to ambiguous areas adjacent to central cities, there are also ambiguous areas situated away from central cities.

The map showing the distribution of perceived urban indexes will be helpful for planners in making plans at a city level; some census tracts in a central city, for instance, are perceived as suburban or ambiguous areas despite their administrative positions. These neighborhoods can be utilized to bring suburbanites with middle- and high- income status to urban areas, thus broadening the tax bases of cities.

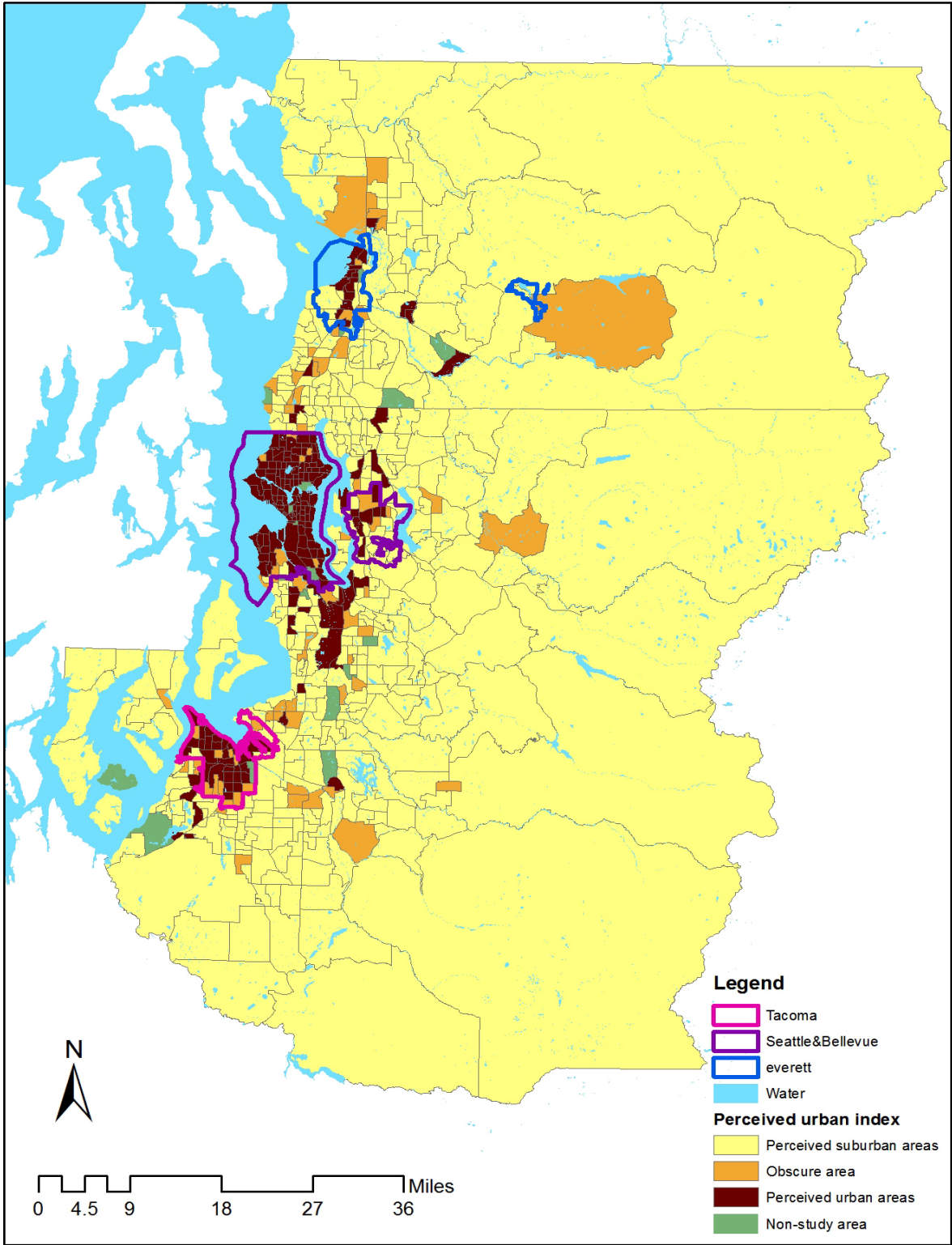


Figure 3 Comparison between central cities based on Census classification and perceived urban index

4.2 What Factors Contribute to Residents' Perceived Urban Index?

4.2.1 Correlation Analysis and Results

Before conducting multiple linear regression analysis, correlation analysis is conducted in order to examine the correlation among the independent variables. It has been accepted in the previous studies that correlation coefficients whose magnitude are greater than 0.7 indicates high correlation between pairs of explanatory variables, which generates multicollinearity (Myers, 1986). Multicollinearity can have significant effects on the stability of the fitted regression model, and a simple approach to multicollinearity issue is to use only one of highly correlated pairs of explanatory variables or combine correlated variables into a single variable (Blalock, 1963; Dohoo, Ducrot, Fourichon, Donald, & Hurnik, 1997). The former approach is based on the assumption that one variable left contains principally all the information in the other variable removed.

Looking at the bivariate correlation matrix for independent variables in Table 6, it is found that road density has strong positive associations with population density (0.806) as well as transit density (0.727). In addition, the Table 6 shows high correlations (-0.891) between the percentage of single-family homes and the percentage of rental housing units. In order to solve the multicollinearity in the regression model and enhance the stability of the model, a method of removing independent variables is used; variables of road density and the percentage of single-family homes are omitted. As for the directions of associations among other variables, a correlation matrix displays the expected associations among variables.

4.2.2 Multiple Linear Regression Analysis Results

Table 7 summarizes the multiple linear regression analysis results of the perceived urban index model. The adjusted R-squared value of the model is 0.541, which means that about 54.1 percent of the variation in the urban index can be explained by the regression on variables employed. Variables related to employment opportunities and urban opportunities, including the percentage of retail/services jobs, the availability of rental housing units, are found to have significant positive impacts on perceived urban index. In addition, all variables regarding physical attributes seem to affect the perceived urban index. While median housing value and population density

Table 6 Correlation matrix

		Correlations										
		Employment opportunities	% of retail/services	Transit density	Road density	% of rental housing units	% of single-family home	Median housing value	Median year housing built	Population density	% of white population	Median household income
Employment opportunities	Pearson Correlation	1										
	Sig. (2-tailed)											
% of retail/services	Pearson Correlation	.026	1									
	Sig. (2-tailed)	.511										
Transit density	Pearson Correlation	0.428***	0.334***	1								
	Sig. (2-tailed)	.000	.000									
Road density	Pearson Correlation	0.172***	0.366***	0.727***	1							
	Sig. (2-tailed)	.000	.000	.000								
% of rental housing units	Pearson Correlation	0.317***	0.308***	0.579***	0.543***	1						
	Sig. (2-tailed)	.000	.000	.000	.000							
% of single-family home	Pearson Correlation	-0.356***	-0.229***	-0.482***	-0.366***	-0.891***	1					
	Sig. (2-tailed)	.000	.000	.000	.000	.000						
Median housing value	Pearson Correlation	.004	0.237***	0.080**	.009	-0.163***	.156	1				
	Sig. (2-tailed)	.920	.000	.041	.821	.000	.000					
Median year housing built	Pearson Correlation	-0.094**	-0.377***	-0.441***	-0.543***	-0.332369759	.054	-0.121740843	1			
	Sig. (2-tailed)	.016	.000	.000	.000	.000	.170	.002				
Population density	Pearson Correlation	.026	0.352***	0.690***	0.806***	.566	-0.453754306	.087	-0.394	1		
	Sig. (2-tailed)	.508	.000	.000	.000	.000	.000	.027	.000			
% of white population	Pearson Correlation	-0.143***	-0.119***	-0.301***	-0.390***	-0.466711936	.311	.249	.258	-0.33446025	1	
	Sig. (2-tailed)	.000	.002	.000	.000	.000	.000	.000	.000	.000		
Median household income	Pearson Correlation	-0.224***	-.047	-0.410***	-0.379***	-.686	.609	.679	.282	-.354	.443	1
	Sig. (2-tailed)	.000	.235	.000	.000	.000	.000	.000	.000	.000	.000	

Note: *: significant at p<0.1 **: significant at p<0.05, ***: significant at p<0.01

Yellow area: Pearson correlation value >0.7

have positive associations with the perceived urban index, median built-year of structures seems negatively associated with the index. That is, as neighborhood have older structures, residents are more likely to classify their neighborhoods as urban areas.

As for the variables regarding the social environments, the percentage of white population is negatively related to a perceived urban index, whereas median household income is found to be insignificant in explaining the perceived urban index. This is not consistent with previous literature's results and hypothesis that median household income is an important criterion determining the residents' perceptions of their neighborhood types. These findings suggest that people in Seattle metropolitan area do not connect urban neighborhoods with lower median income households. This implies that income disparity between urban and suburban areas cannot be used as an urban index in all metropolitan areas.

In regards to the relative influences among explanatory variables, median built-year of structures, followed by the percentage of rental housing units, population density, and employment opportunities seems more significant than other variables in explaining the perceived urban index. This suggests that people are more affected by variables of physical and service environments than variables of social environments, when they classify their neighborhood types.

Table 7 Regression model results of perceived urban index

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	22.869***	1.708		13.393	.000		
Employment opportunities	0.022***	.005	0.147***	4.332	.000	.622	1.608
% of retail/services	0.002***	.001	0.104***	3.332	.001	.732	1.366
Transit density	-.001	.001	-.052	-1.103	.270	.316	3.166
% of rental housing units	0.003***	.001	0.175***	3.498	.001	.286	3.495
Median housing value	4.870**	.000	0.130**	2.525	.012	.270	3.708
Median year housing built	-0.011***	.001	-0.438***	-13.114	.000	.639	1.566
Population density	0.000013***	.000	0.147***	3.323	.001	.366	2.733
% of white population	-0.002**	.001	-0.062**	-1.970	.049	.719	1.391
Median household income	-1.38E-06	.000	-.066	-.990	.323	.158	6.314

Note: Dependent Variable: Urban Index

*: significant at p<0.1 **: significant at p<0.05, ***: significant at p<0.01

R Square: 0.547, Adjusted R Square: 0.541

Yellow area: relatively strong variables

Chapter 5 How Are Household Income and Changes in Employment/Urban Services Opportunities Associated with Urban/Suburban Residential Location Choice?

5.1 Descriptive Statistics

Table 8 and Table 9 summarize the descriptive statistics of two models based on differing origins. A total of 985 households in the Seattle metropolitan area are included in the two logistic models. Of these households, 568 households and 417 households originated in perceived urban and suburban areas, respectively. Both groups show a tendency to remain in the same perceived neighborhood type as their previous one; 80 % of households originating in urban areas choose to live in urban neighborhoods again, while 77 % of households originating in suburban areas choose to continue living in suburban neighborhoods. The urban-centralization movement of the population was not found in the Seattle metropolitan area based on the net-migration flow of the samples studied; whereas 122 samples of households migrated from urban to suburban areas, 97 samples of suburbanites migrated from suburban to urban areas, thus resulting in a net-decline in urban population.

Urban-to-urban movers have slightly higher proportions of low- and high- income households than urban-to-suburban households. However, urban-to-urban movers have a smaller proportion of middle-income households than urban-to-suburban households. As for original suburbanites, those moving to urban areas have greater and smaller proportions of low- and high- income households respectively than those moving to the suburbs. The proportion of middle-income households among suburban-to-urban movers is almost the same as that of suburban-to-suburban movers. These findings suggest that a recentralization of income does not occur in the Seattle metropolitan area and the migration tendency of the poor migrating to urban areas still exist without regard to their origins.

People who migrate to urban areas are older than those who migrate to suburban areas, regardless of their origins. A greater proportion of people migrating to suburban neighborhoods have children than those migrating to urban neighborhoods, regardless of origins. There is no

difference in the average number of workers in a household between those originated from urban areas and those originated from the suburbs. However, people migrating to suburban over urban areas have a higher average number of workers in their households, regardless of their origins. This suggests a recent migration trend of workers to suburban areas. As for vehicle availability, 93 % of households originating from suburbs have more than one vehicle per driver compared to 83% of those originated from urban areas. In addition, a higher proportion of households moving to the suburbs have more vehicle availability than those moving to urban neighborhoods despite previous neighborhood type.

Table 8 shows that people originating in urban areas have a tendency to move to neighborhoods with more suburban characteristics; shown differences in population density and transit density between previous and current neighborhoods support this conclusion. Even people who move from urban to urban neighborhood tend to move to areas with more suburban characteristics. That is, people originating in urban areas tend to move to less urbanized areas within urban neighborhoods.

As shown in Table 9, households originating from suburban areas are likely to move to more urbanized areas, as can be seen in the fourth column of table. However, this does not mean that there are more suburban-to-urban movers than suburban-to-suburban movers. Despite the smaller portions of original suburbanites moving to urban areas, differences between current urban and previous suburban neighborhoods characteristics are much larger than the differences between current and previous suburban neighborhoods.

Table 8 Independent samples t-test results of urban-to-urban group and urban-to-suburban group

Variable		Mean/S.D.	Total (N=558)	Urban to Urban (N=446)	Urban to Suburban (N=122)	Test statistics	
Individual	age	mean	46.75	47.41	44.34	t=2.132**	
		S.D.	14.13	14.33	13.15	Sig.=0.033	
Household	Home ownership	Own home	Freq. (%)	389(68.5)	294(65.9)	95(77.9)	$\chi^2=6.338^{**}$
		Do not own home	Freq. (%)	179(31.5)	152(34.1)	27(22.1)	Sig.=0.012
	Household income	Low income	Freq. (%)	225(39.6)	179(40.1)	46(37.7)	$\chi^2=1.611$ Sig.=0.447
		Middle income(base) High income	Freq. (%)	234(41.2) 109(19.2)	178(39.9) 89(20.0)	56(45.9) 20(16.4)	
	Presence of Children	Have children	Freq. (%)	172(30.3)	121(27.1)	51(41.8)	$\chi^2=0.131^{**}$
		Do not have children	Freq. (%)	396(69.7)	325(72.9)	71(58.2)	Sig.=0.044
	Number of workers	mean		1.20	1.18	1.30	t=-1.410
		S.D.		0.80	0.80	0.80	Sig.=0.159
	Vehicle availability	One or more per driver	Freq. (%)	470(82.7)	358(80.3)	112(91.8)	$\chi^2=8.927^{***}$
		Less than one per drier	Freq. (%)	98(17.3)	88(19.7)	10(8.2)	Sig.=0.003
Differences in neighborhood Characteristics	Job opportunities	Mean	-0.47	-0.30	-1.09	t=2.298***	
		S.D.	3.38	3.19	3.93	Sig.=0.022	
	% of retail/services	Mean	-5.67	-3.27	-14.45	t=4.392***	
		S.D.	25.33	24.48	26.52	Sig.=0.000	
	Transit density	Mean	-9.83	-5.46	-25.83	t=4.625***	
		S.D.	55.30	58.47	37.82	Sig.=0.000	
	% of rental housing units	Mean	-5.65	-2.57	-16.92	t=5.340***	
		S.D.	26.93	26.17	26.80	Sig.=0.000	
	Median housing value	Mean	-13065.11	-12986.17	-13353.70	t=0.034	
		S.D.	105794.40	108309.77	96458.32	Sig.=0.973	
	Median built-year of structure	Mean	2.97	0.62	11.55	t=7.619***	
		S.D.	14.72	13.64	15.37	Sig.=0.000	
	Population density	Mean	-1571.40	-1092.30	-3322.87	t=2.722***	
		S.D.	8064.34	8300.81	6884.72	Sig.=0.007	
	% of white population	Mean	0.08	-0.37	1.70	t=-1.106	
		S.D.	17.52	17.19	18.65	Sig.=0.247	
Household income	Mean	1463.15	-232.88	7.66	t=-4.237***		
	S.D.	18511.66	1.84	1.78	Sig.=0.000		

Note: *: significant at p<0.1 **: significant at p<0.05, ***: significant at p<0.01

χ^2 or t-test statistic values that indicate statistical significance at the 0.1 level are highlighted.

Table 9 Independent samples t-test results of suburban-to-urban group and suburban-to-suburban group

Variable		Mean/S.D.	Total (N=417)	Suburban to urban (N=97)	Suburban to suburban (N=320)	Test statistics	
Individual	age	mean	47.51	52.02	46.14	t=3.839***	
		S.D.	13.44	14.25	12.90	Sig.=0.000	
Household	Home ownership	Own home	Freq. (%)	314(75.3)	58(59.8)	256(80.0)	$\chi^2=16.340^{***}$
		Do not own home	Freq. (%)	103(24.7)	39(40.2)	64(20.0)	Sig.=0.000
	Household income	Low income	Freq. (%)	138(33.1)	45(46.4)	93(29.1)	$\chi^2=10.120^{***}$ Sig.=0.006
		Middle income(base) High income	Freq. (%)	185(44.4) 94(22.5)	35(36.1) 17(17.5)	150(46.9) 77(24.1)	
	Presence of Children	Have children	Freq. (%)	151(36.2)	16(16.5)	135(42.2)	$\chi^2=21.272^{***}$ Sig.=0.000
		Do not have children	Freq. (%)	266(63.8)	81(83.5)	185(57.8)	
	Number of workers		mean	1.20	0.94	1.28	t=-4.166***
			S.D.	0.76	0.70	0.76	Sig.=0.000
	Vehicle availability	One or more per driver	Freq. (%)	388(93.0)	89(91.8)	299(93.4)	$\chi^2=0.327$ Sig.=0.568
		Less than one per drier	Freq. (%)	29(7.0)	8(8.2)	21(6.6)	
Differences in neighborhood Characteristics	Job opportunities		Mean	0.29	1.61	-0.11	t=3.580***
			S.D.	2.84	4.64	1.82	Sig.=0.001
	% of retail/services		Mean	-0.35	8.14	-2.93	t=4.397***
			S.D.	22.20	21.32	21.84	Sig.=0.000
	Transit density		Mean	4.93	29.31	-2.46	t=5.278***
			S.D.	36.08	58.13	21.09	Sig.=0.000
	% of rental housing units		Mean	2.06	16.67	-2.38	t=6.899***
			S.D.	25.12	25.54	23.28	Sig.=0.000
	Median housing value		Mean	-7298.82	-2648.94	-8708.32	t=0.458
			S.D.	93821.24	121730.04	83732.07	Sig.=0.647
	Median built-year of structure		Mean	-0.19	-7.58	2.05	t=5.755***
			S.D.	13.18	15.16	11.65	Sig.=0.000
	Population density		Mean	223.28	2714.51	-531.84	t=4.858***
			S.D.	4109.92	6413.69	2681.27	Sig.=0.000
	% of white population		Mean	0.66	-5.14	2.42	t=-4.016***
			S.D.	13.24	17.51	11.08	Sig.=0.000
Median Household income		Mean	-3020.67	-11640.00	-407.92	t=-5.291***	
		S.D.	18900.19	20250.00	1.77	Sig.=0.000	

Note: *: significant at p<0.1 **: significant at p<0.05, ***: significant at p<0.01
 χ^2 or t-test statistic values that indicate statistical significance at the 0.1 level are highlighted.

5.2 Final models and Results

This study tests two sets of binary logistic regression models to examine the effects of both household income and differences in previous and current neighborhood characteristics on the log odds of choosing urban areas over suburban areas when controlling for other socio-economic characteristics. While the first logistic model is based on households originating from perceived urban areas, the second one is for households originating from perceived suburban areas. The outcomes of the binary logistic analyses are reported in Table 10. The results of the models are displayed as logit coefficients and standardized logit coefficients. For instance, the standardized coefficient on vehicle availability in the first model is -0.202 and statistically significant. This can be interpreted as the log odds of moving from urban to urban areas over urban to suburban areas decrease by 0.202 in standard deviation, per one standard deviation increase in vehicle availability.

Overall, the relationships between individual/household characteristics and the log odds of moving within/between urban and suburban areas become modest, after controlling for other independent variables.

Age and squared age are found to be insignificant regardless of origins, which shows that age does not have a linear or non-linear association with urban/suburban residential location choice. Home ownership and the number of workers per household also do not show any significant associations with urban/suburban residential location choice, which is not consistent with previous studies. The presence of children in households has significant negative relations with the log odds of moving to suburban areas when households originated from urban areas. In other words, households who originate in urban areas and have children are more likely to move to suburban rather than urban neighborhoods. Households with more than one vehicle per driver are also more likely to move from urban to suburban areas rather than urban to urban areas. However, variables of children and vehicle availability are not related to urban/suburban residential location choice among households originating in suburban areas.

When the middle income group is a reference group, high income level is positively associated with the log odds of choosing urban over suburban areas. This shows the tendency of high-income households originating in urban areas to move within urban areas when compared to

middle-income households. Meanwhile, a dummy variable of low income is found to be insignificant in explaining the urban/suburban location choice regardless of origins.

Turning to differences in neighborhood characteristics between previous and current neighborhoods, coefficients on jobs and retail/services opportunities are statistically significant and positive, regardless of origins, among urban services variables. These findings suggest that increases in job and retail/services opportunities of a current neighborhood relative to a previous neighborhood are positively related to the in-migration tendency to urban areas regardless of origins. The coefficients on the availability of rental housing units are significant and positive only among households originating in urban areas. In other words, the reason why people migrate within urban areas is related to rental housing opportunities. However, transit density does not play any role in urban/suburban residential location choice.

Among physical attribute variables, median built-year of structures in the neighborhood is the strongest explanatory variable in both sets of models; as the median built-year of structures in current neighborhoods relative to previous neighborhood increases, the log odds of moving to suburban over urban areas increase, regardless of origins. This implies that people's migratory tendency towards the suburbs is highly and negatively associated with increases in the median built-year of structures, in other words, newer structures. Meanwhile, median housing value and population density variables are positively correlated to the log odds of moving to urban areas only among those originating in the suburbs.

As for the variables regarding social environments, racial composition is the only variable found to be significant. The higher the percentage of the white population in the current neighborhood over the previous neighborhood the lower log odds of moving from suburban to urban areas than suburban to suburban areas. Median household income does not show any significant association with urban/suburban residential location choice. This indicates that the flight-from-blight theory recently lost much their explanatory power of urban/suburban residential location choice in the Seattle metropolitan area.

In regards to the relative influences among explanatory variables, median built-year of structures is the strongest variable in both of the two logistic models as noted earlier. The percentage of

rental housing units and job opportunities each have the second strongest explanatory power for the first and second sets of urban/suburban residential location models respectively.

Table 10 Estimated coefficients of binomial logistic regression models for urban/suburban residential location choice

Variable	Origin: urban				Origin: suburban			
	Coeff.	Std.Coeff.	S.E.	Exp(B)	Coeff.	Std.Coeff.	S.E.	Exp(B)
age	0.053	0.331	0.058	1.055	0.096	0.472	0.070	1.101
age square	-3.40E-04	-0.228	0.001	1.000	-0.001	-0.377	0.001	0.999
Home ownership	-0.289	-0.059	0.310	0.749	-0.435	-0.069	0.377	0.648
Low income	0.026	0.005	0.368	1.026	-0.381	-0.050	0.442	0.683
High income	0.517*	0.106*	0.286	1.677	-0.216	-0.038	0.368	0.806
Children	-0.523*	-0.106*	0.280	0.592	-0.602	-0.106	0.381	0.548
Number of workers	0.116	0.041	0.190	1.123	-0.397	-0.110	0.253	0.672
Vehicle availability	-1.218***	-0.202***	0.401	0.296	-0.249	-0.023	0.554	0.780
Job opportunities	0.075**	0.112**	0.045	1.078	0.287***	0.298***	0.090	1.333
% of retail/services	0.013**	0.140**	0.005	1.013	0.015**	0.122**	0.007	1.015
Transit density	-0.005	-0.110	0.003	0.995	0.003	0.037	0.009	1.003
% of rental housing units	0.025***	0.298***	0.009	1.025	0.004	0.040	0.013	1.004
Median housing value	-0.0000003	-0.013	0.000	0.999	5.649E-06*	0.194*	0.000	1.000
Median built-year of structures	-0.066***	-0.429***	0.010	0.936	-0.055***	-0.265***	0.014	0.947
Population density	-0.00001	-0.042	0.000	1.000	0.00014**	0.209**	0.000	1.000
% of white population	-0.008	-0.063	0.008	0.992	-0.047***	-0.228***	0.015	0.954
Median household income	-5.9863E-06	-0.049	0.000	1.000	-3.664E-06	-0.025	0.000	1.000
Constant	1.483		1.477	4.405	-3.147*		1.892	0.043

Note: *: significant at $p < 0.1$ **: significant at $p < 0.05$, ***: significant at $p < 0.01$

Number of obs= 568 (1st), 417 (2nd)

Pseudo R²: 0.220 (1st), 0.333 (2nd)

Dependent variable : Urban :1 , Suburban :0 (1st, 2nd)

Yellow area: relatively strong variables

5.3 Discussion

This study of the Seattle metropolitan area does not support the hypothesis that household income level has a negative impact on urban versus suburban choice, even though descriptive statistics accord with this hypothesis. Descriptive statistics show that the suburban-to-urban group has a higher proportion of low-income households as compared to the suburban-to-suburban group. Moreover, a higher proportion of high-income households is found among suburban-to-suburban mover compared to suburban-to-urban movers. However, the results of binomial logistic analyses indicate that these impacts of income variables on urban/suburban residential location choice become insignificant when controlling for other independent variables.

Meanwhile, while lower income status is not related to urban/suburban residential location choice regardless of origin, higher income households are more likely to choose urban-to-urban moves over urban-to-suburban, when compared to middle-income households. That is, high-income households who prefer an urban-lifestyle tend to maintain their residential neighborhood type as urban compared to middle-income households, when controlling for other variables. This finding implies that most high-income households living in urban areas are not moving from suburbs, but moving from urban areas, which does not support the urban centralization trend of income.

As for the hypothesis that predicted the associations of employment and urban services opportunities with urban/suburban residential location choice, this study shows similar results to those expected (Shiki, 2008). Better employment and retail/services opportunities are positively associated with log odds of moving to urban versus suburban areas regardless of origins. However, the positive relationship of rental housing opportunities with the log odds of moving to urban areas is only significant among those originating in urban areas and transit density is not significantly related to urban/suburban residential location choice. Whereas Shiki (2008) found that all variables related to employment opportunities and urban services were found to be significant, my results are little different, as logistic models are divided into two sets based on the origins of the households. These results provide the rationale that policies encouraging employment and retail/services opportunities should be targeted at urban areas in order to promote urban revitalization.

Consistent with the results of previous research (Bayoh et al., 2006), this study does support one of the hypotheses; that the effects of individual and household characteristics on urban/suburban residential location choices become modest when controlling for neighborhood characteristics and dividing the urban/suburban residential location choice models based on previous neighborhood type. Except for the high income variable as discussed above, only two variables, children and vehicle availability, have significant associations with choosing suburban over urban areas among those moving from urban areas. The weaker influence of household and individual characteristics relative to neighborhood characteristics suggests that people, regardless of their socio-economic status, might have similar reasons for choosing urban or suburban areas in associations with neighborhood characteristics.

In addition, the reason why associations of variables with urban/suburban residential location choice differ depending on origins is because origins may reflect households' previous considerations when choosing their original option and desired environmental characteristics. For instance, vehicle availability is only statistically significant among original urban households, as those who previously lived in urban areas most likely considered vehicle availability important in their original locational choice as compared to those who originally chose suburban areas.

Chapter 6 Conclusion

The present study consists of two research models. The first research model explores the neighborhood characteristics that affect the perceived urban index in order to understand the mechanism underlying urban/suburban residential location choices. The second research model investigates the effects of not only household income, but also the differences in employment and urban service opportunities between previous and current neighborhoods on urban/suburban residential location choices.

The first research model finds that people perceive their neighborhood types based on physical attribute factors, variables regarding employment and urban service opportunities, as well as one variable of social environment –the percentage of white population. The analysis results show that people's perception of urban and suburban neighborhoods is more heavily affected by variables of physical attributes and job/urban service opportunities rather than social environment variables, as neighborhood median household income appears to be insignificant in a perceived urban index model in the Seattle metropolitan area.

As for the second research model, descriptive statistics by migration type show that there are still more people who choose an urban-to-suburban move than a suburban-to-urban move. In addition, suburban-to-urban movers have a higher proportion of low-income households than suburban-to-suburban movers, whereas the former group has a lower proportion of high-income households.

To find an effect of household income on urban/suburban residential location choice after controlling for other explanatory variables, two sets of logistic models are designed. As a result of binomial logistic analyses, it is found that high-income households originating in urban areas are more likely to move within urban areas compared to middle- income households, which is different from what is expected based on descriptive statistics. However, unlike the findings in descriptive statistics, low-income status does not appear to play a role when controlling for other variables.

With regard to variables regarding differences between previous and current neighborhoods, this study provides evidence that higher levels of employment and retail/services opportunities are positively associated with urban over suburban choices, regardless of origin. There is a

significant positive association between the availability of rental housings and urban over suburban choices, among households originating in urban areas. Moreover, the median built-year of structures is found to be positively and strongly related to suburban over urban choices.

This study has several limitations.

Firstly, it is possible that samples used in the analyses are biased, as many households did not provide information on their previous neighborhood type. Those respondents, who account for approximately 40 % of households who migrated within recent 10 years, are omitted from the urban/suburban residential location choice model because of missing information on previous residence.

Secondly, 2006 PSRC Activity Survey data does not contain information on race/ethnicity at a household level, which may play a crucial role in urban/suburban residential location choice. In addition, the present study does not include some neighborhood characteristics including crime rate, quality of schools, and taxes in the urban/suburban residential location model. Despite their significance found in previous studies, these variables are omitted in the present study because of a lack of data. Future research should thus integrate these variables into their research models in order to investigate a more accurate association of each variable with urban/suburban residential location choice.

Despite these limitations, the present study provides several implications for future research and policy development in the field of urban planning.

The first research model of the present study develops a framework that integrates diverse criteria of urban-suburban classifications and compares the relative impacts of these criteria on a perceived urban index, which will be useful for future studies on the subject. That is, this practical classification model of urban and suburban areas, which shows urbanized areas based on diverse criteria, can be utilized in developing policies and research questions to control urban sprawl and promote urban revitalization.

In addition, the results of this study demonstrate that over the study period (1996-2006) and in the Seattle metropolitan area, the recentralized trends of population and income, as well as the negative effect of household income on urban versus suburban choice do not exist. While the

migration trend of high- and middle- income households to suburbs or recentralization trend of those households occurs in other metropolitan areas, there is little evidence that any of these trends are occurring in Seattle metropolitan area. Therefore, urban planners and policy makers should not assume that all metropolitan areas are created equally and that each urban area must be given its own context when making policies related to urban revitalization.

Furthermore, the outcomes regarding the statistical significance of neighborhood characteristic variables in the urban/suburban residential location choice model suggest several policies and programs that aim to revitalize urban areas by bringing people back to urban areas. The positive associations of the job and retail/services opportunities with migration-toward-urban areas regardless of origin, suggest that policies or programs that create jobs and increase diversity in retail/service land uses in urban areas will help not only retain existing urban residents, but also bring more people into urban areas. Furthermore, based on the findings related to the relationship between the median built-year of structures and urban/suburban residential location choice, governments should provide new housing or allow more renovation of existing structures in urban areas. This will keep both urban and suburban inhabitants from migrating to suburban areas for better housing conditions.

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Appendix: GIS Maps of Neighborhood Characteristics

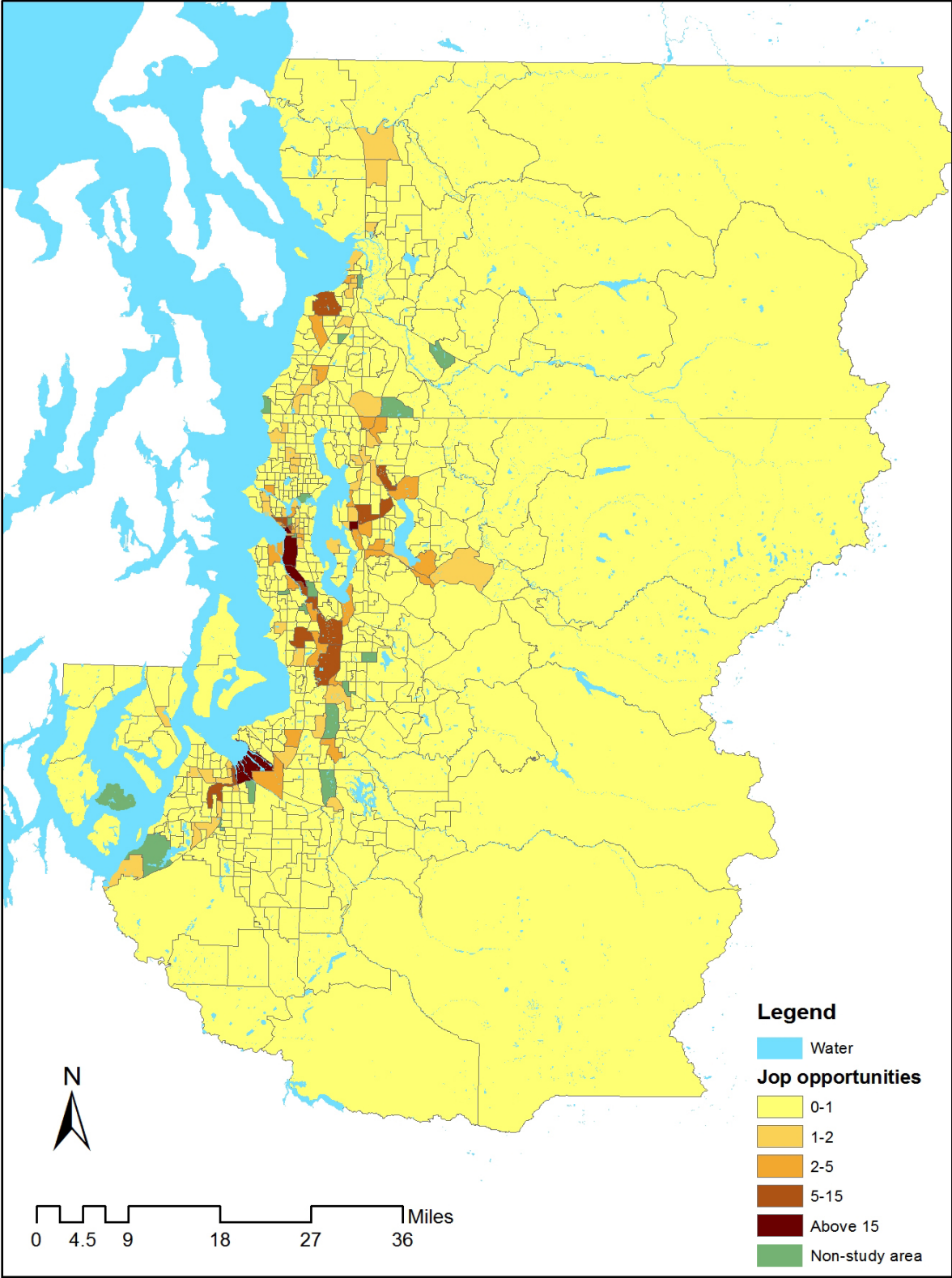


Figure A Distribution of employment opportunities

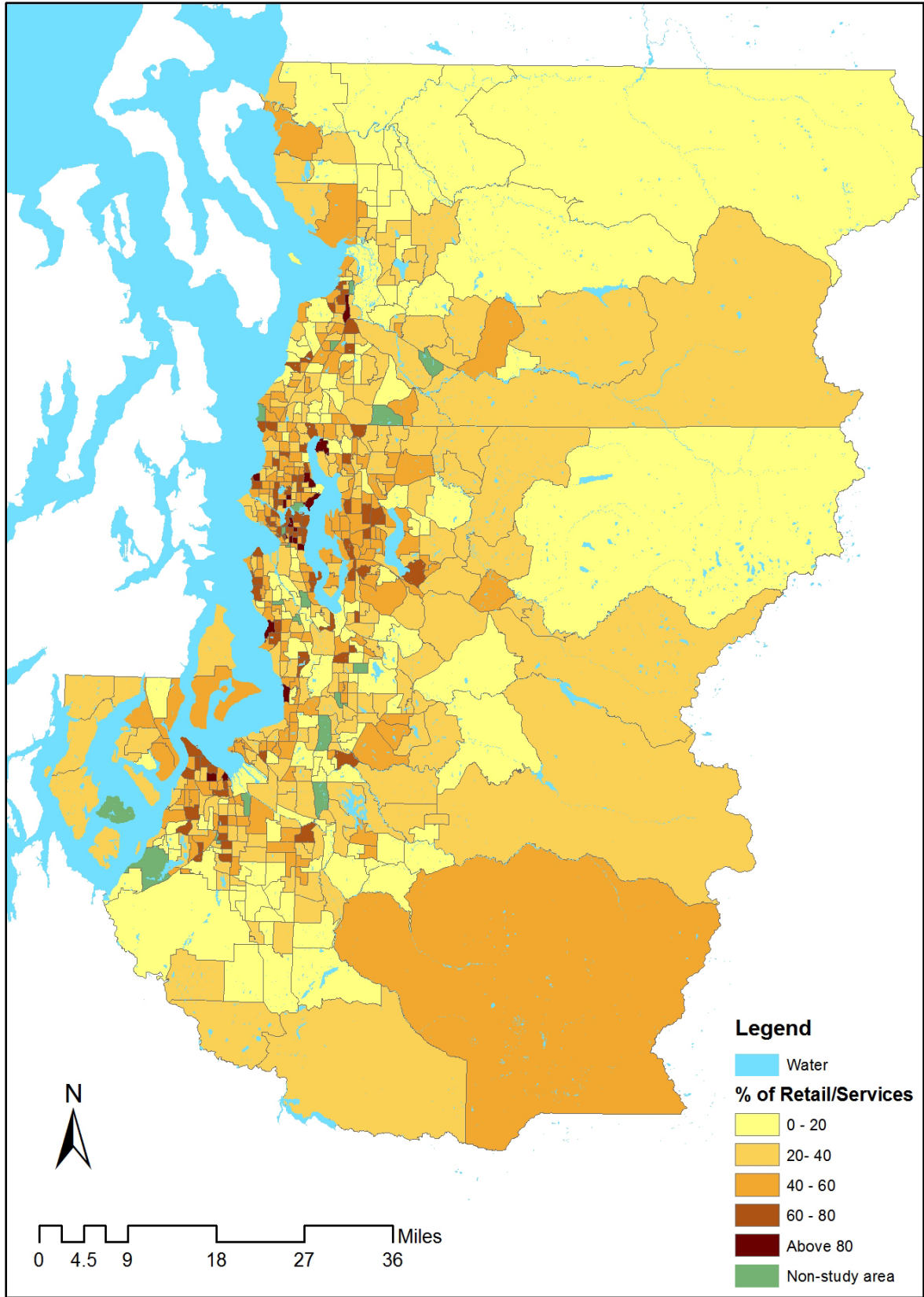


Figure B Distribution of % of retail/services jobs

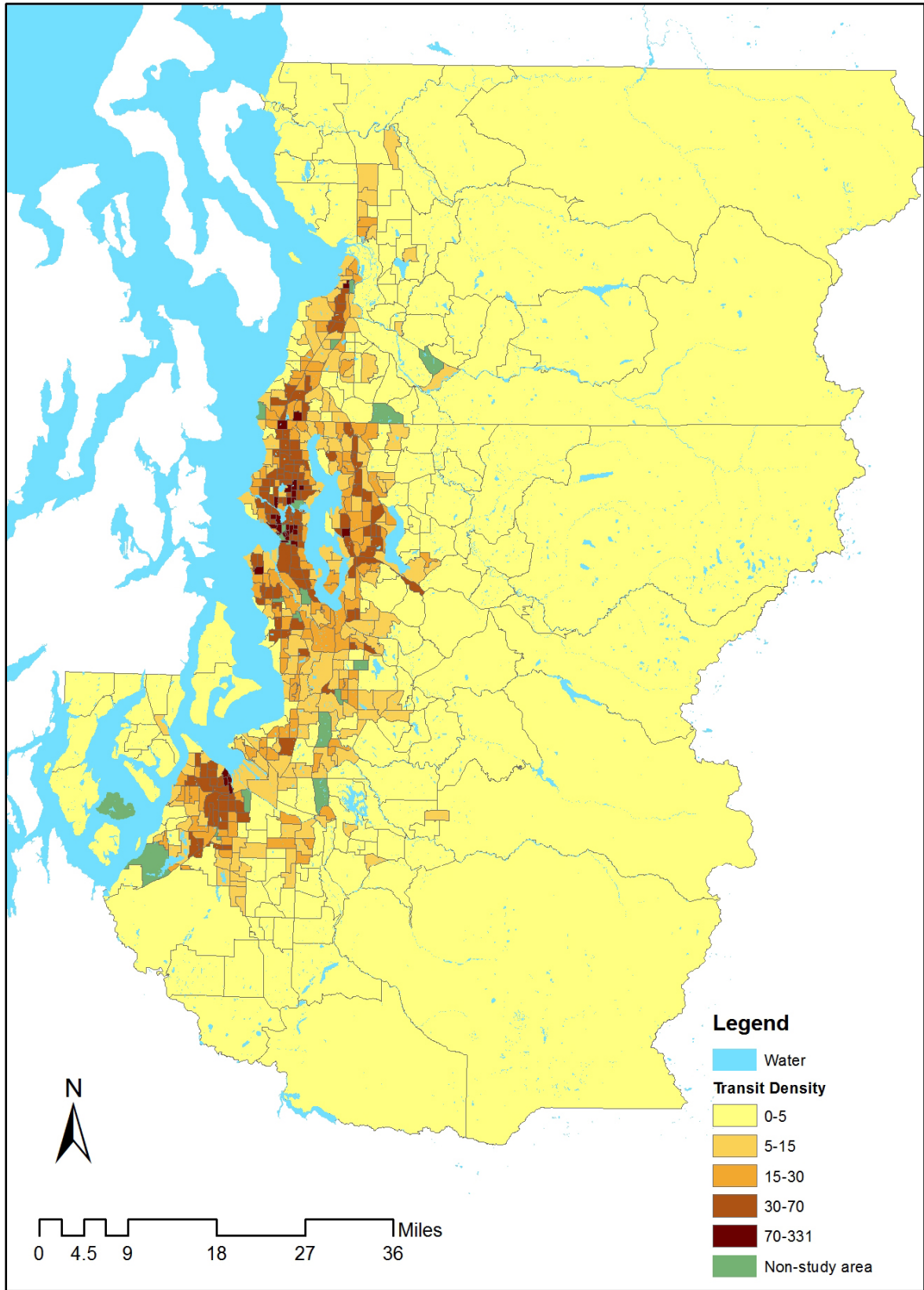


Figure C Distribution of transit density

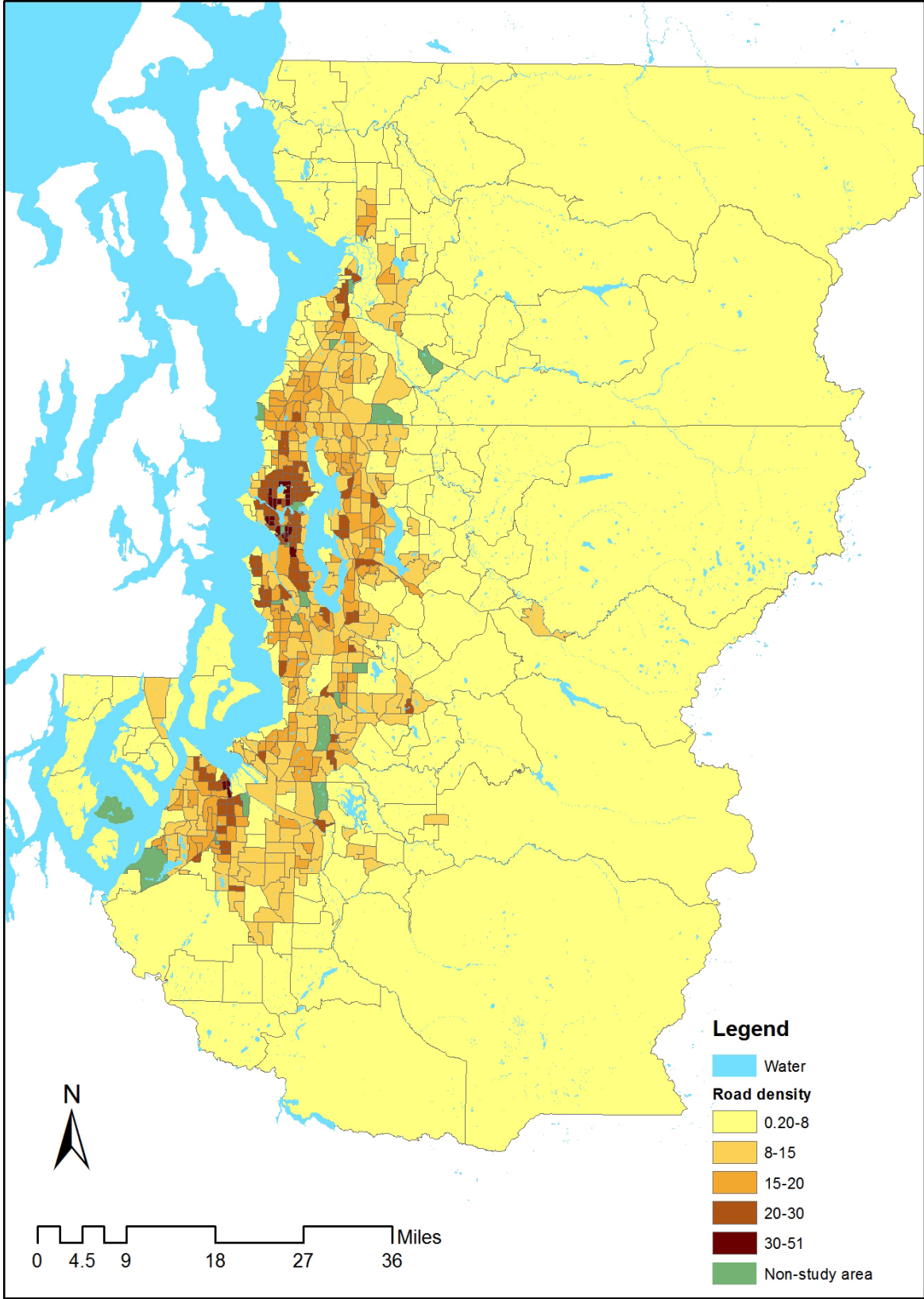


Figure D Distribution of road density

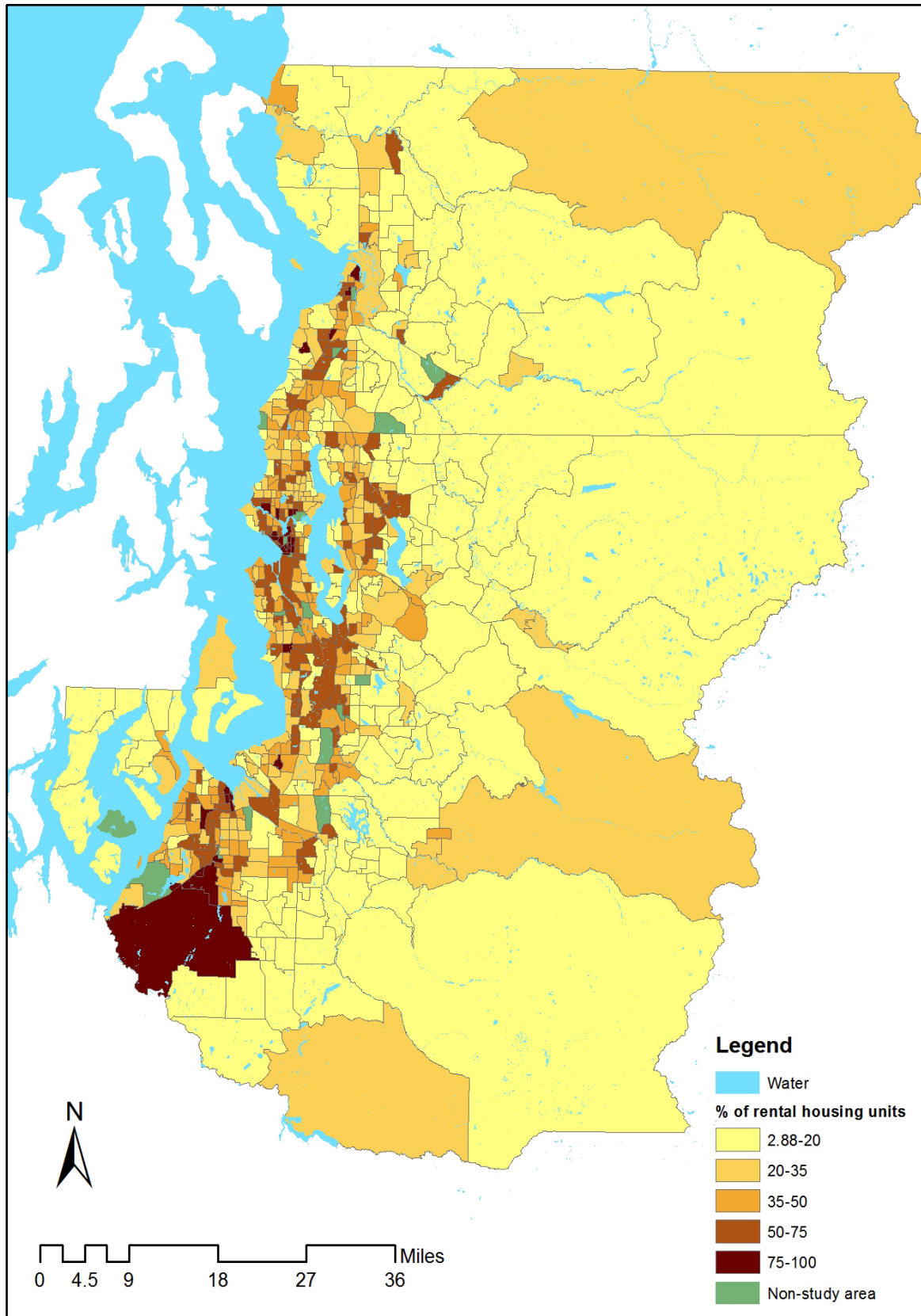


Figure E Distribution of % rental housing units

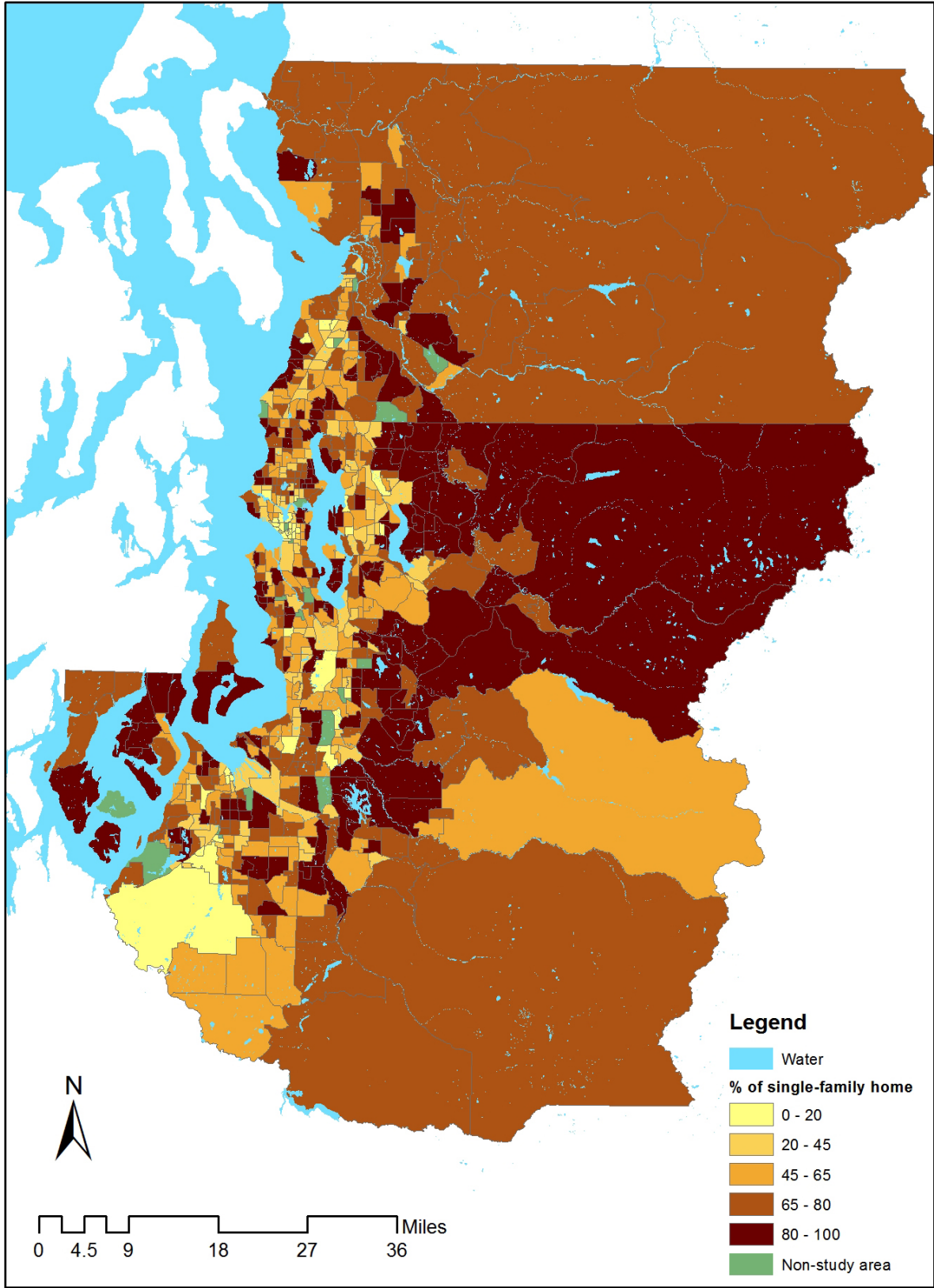


Figure F Distribution of % of single-family homes

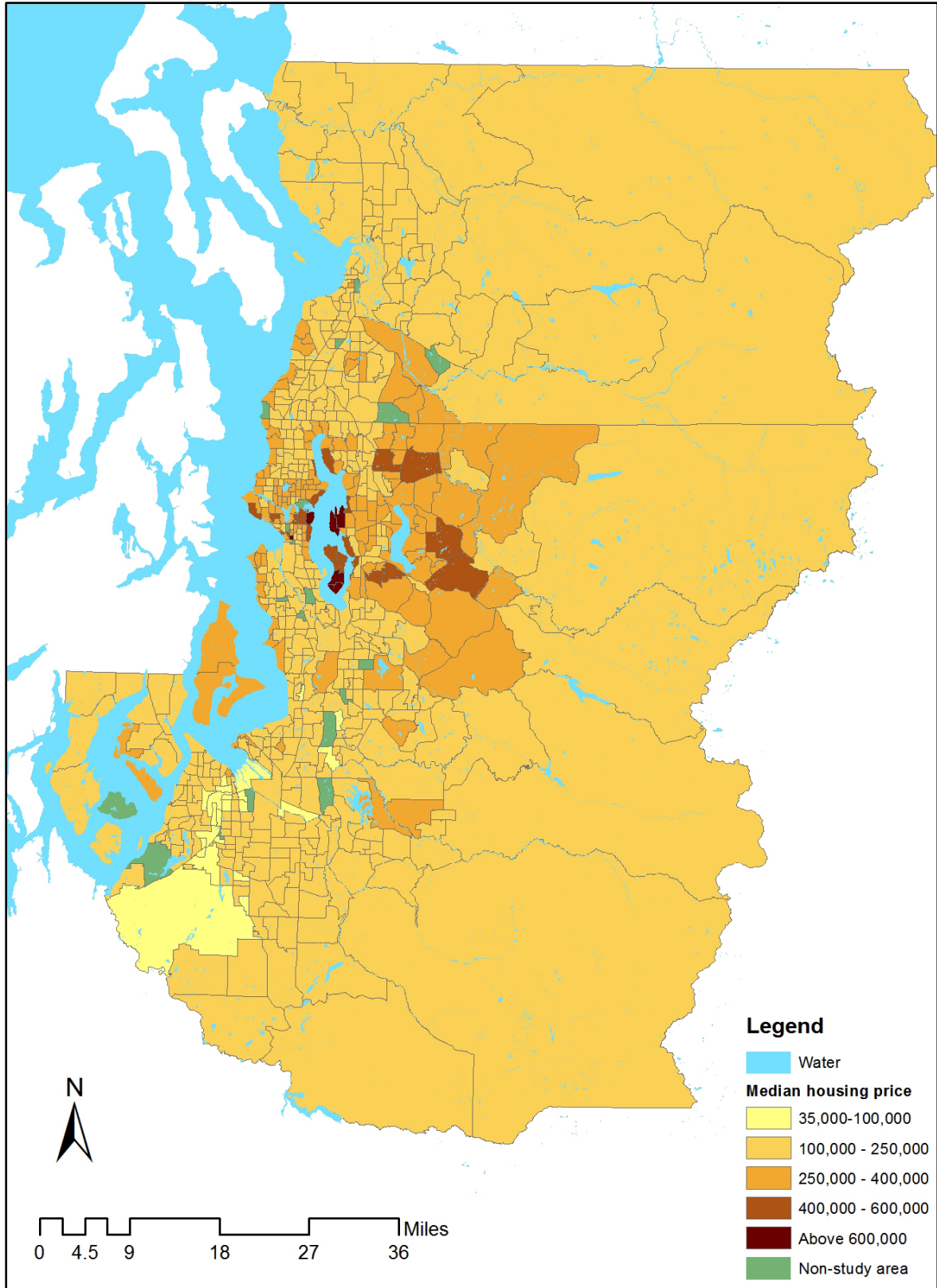


Figure G Distribution of median housing value

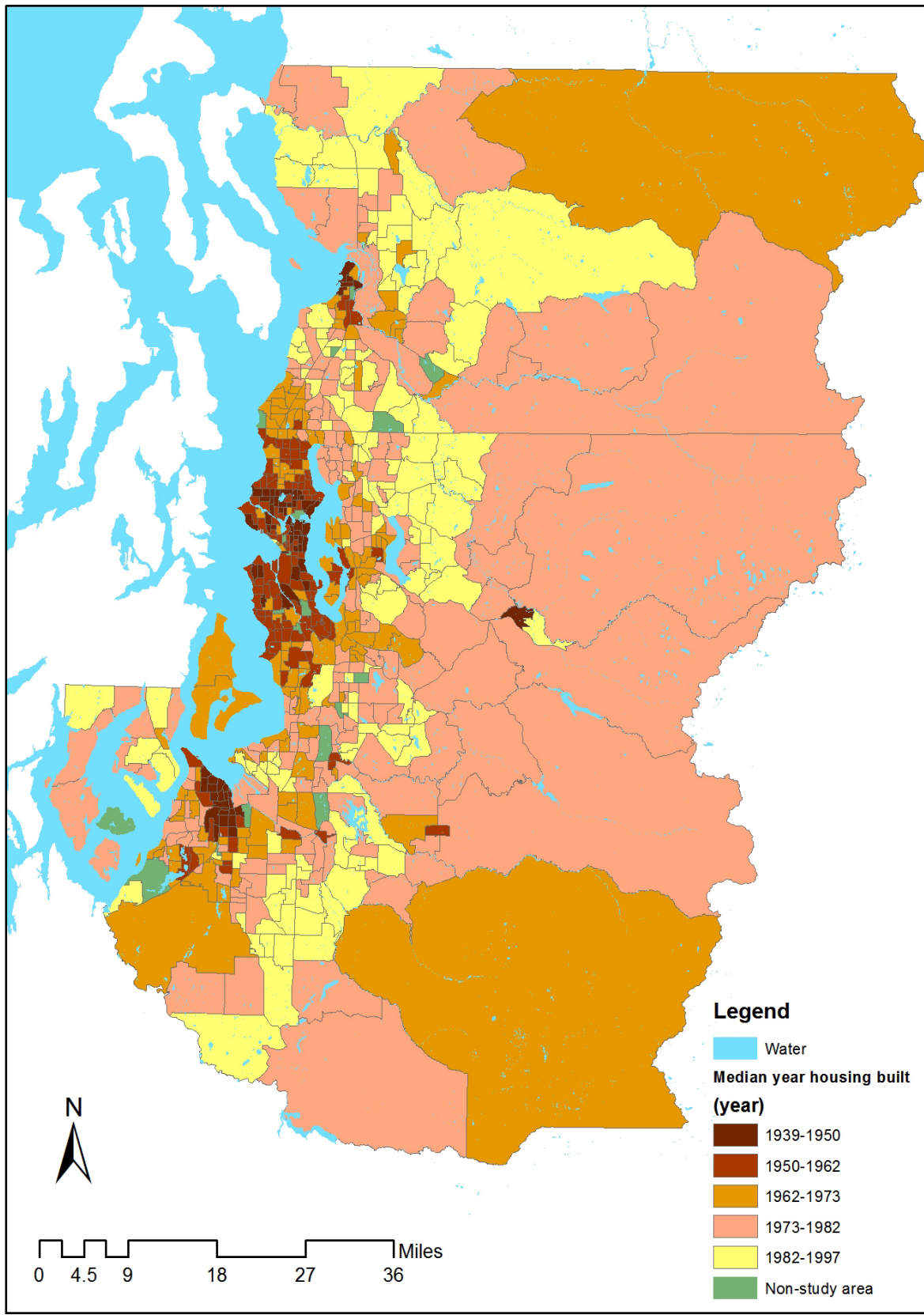


Figure H Distribution of median built-year of structure

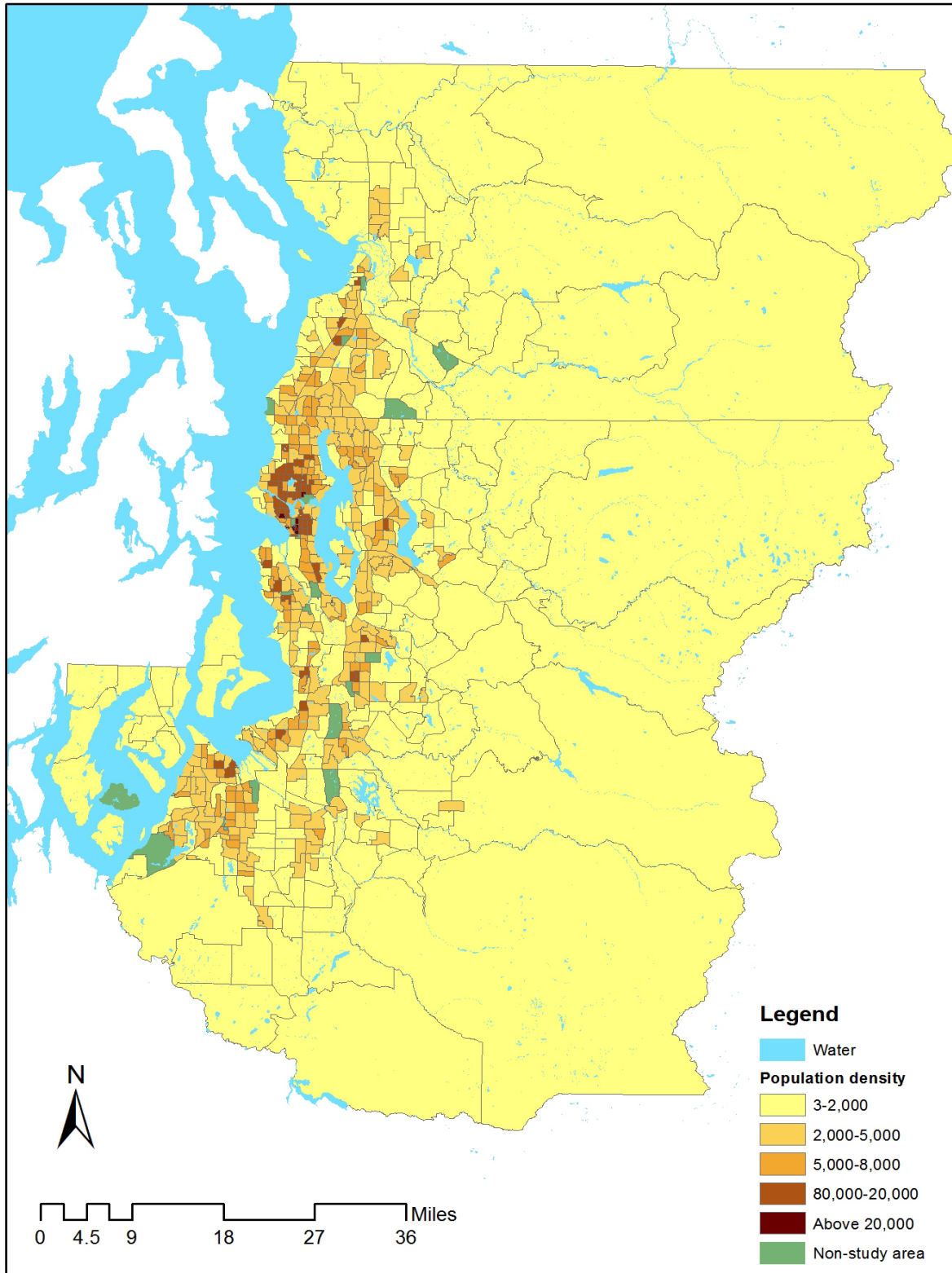


Figure I Distribution of population density

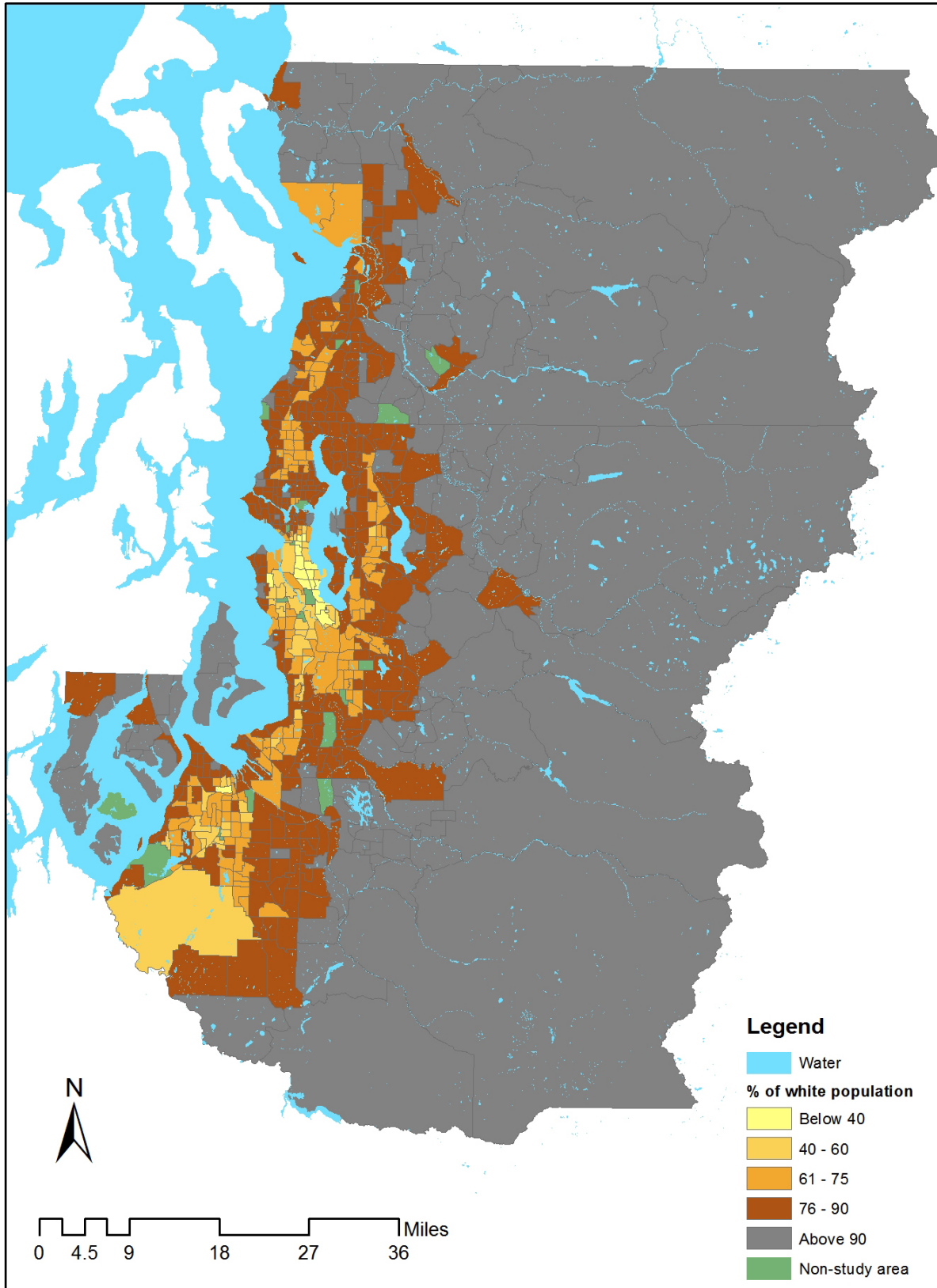


Figure J Distribution of % of white population

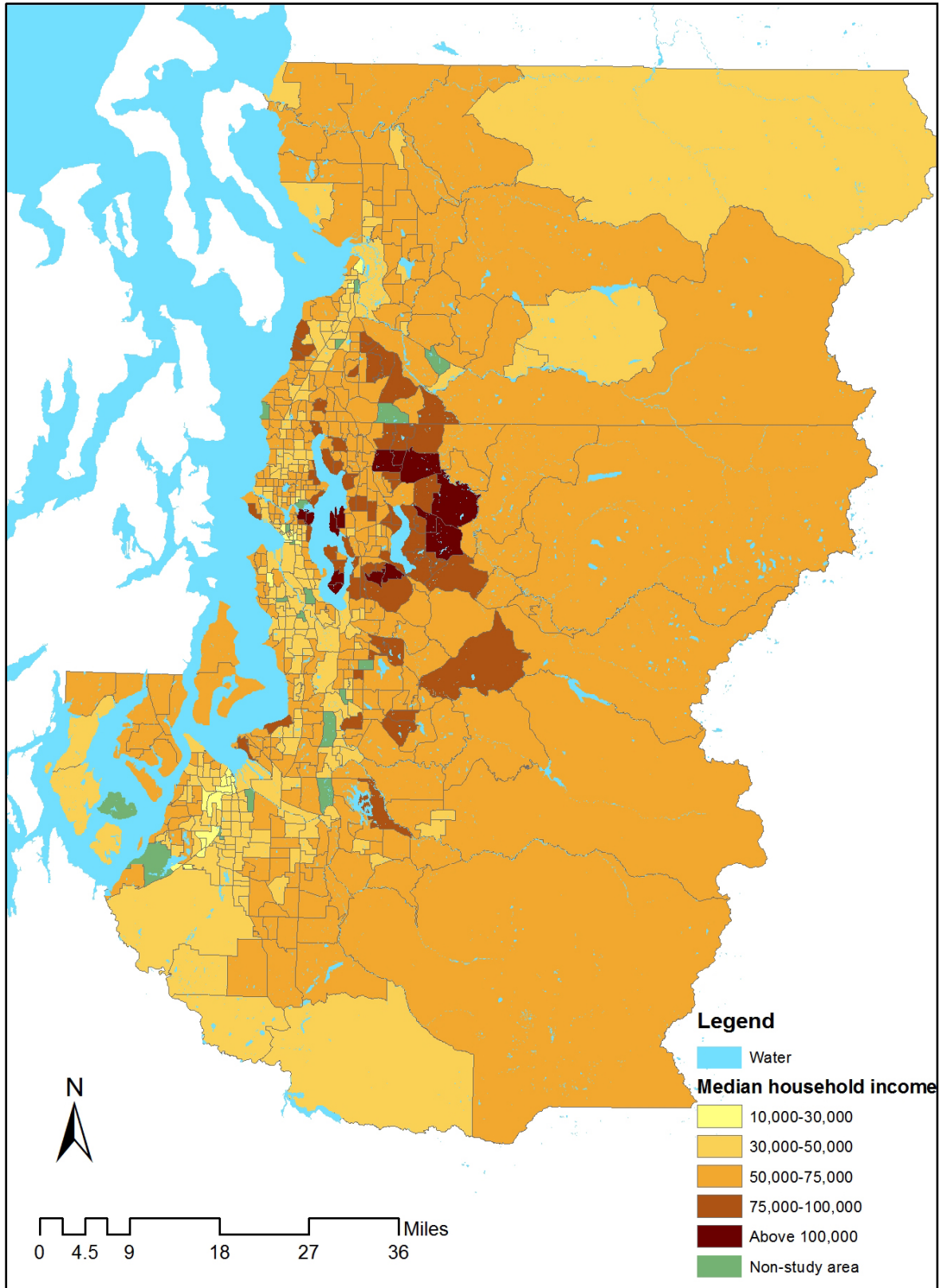


Figure K Distribution of median household income