VACANT URBAN LAND: TYPOLOGY,

NEIGHBORHOOD EFFECTS, AND GENTRIFICATION

A Dissertation

by

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ABSTRACT

Traditional views on urban vacancies have been concerned primarily with the negative influences on safety, property values, and health issues; more recent views attempt to shed light on the potential for greening and stabilizing vacant properties in an effort to better manage urban decline. The conventional negative views on vacant lots are not always true as they can also be thought of as opportunities for growing cities. Alternatively, certain types of vacant lands (e.g. green space and treated brownfields) can have the potential to encourage neighborhood gentrification.

This research examines these opposing views and attempts to answer if the repurposing of vacant land can be an opportunity for disadvantaged neighborhoods, or if certain types of vacant land tend to encourage gentrification. The research question directed by this inquiry is "What types of vacant land are positively associated with neighborhood gentrification?" To answer this question, this study examines 1) what are the land characteristics contributing to long-term vacancy, 2) how neighborhood socioeconomic characteristics are associated with vacant land types, and 3) what types of vacant land are associated with the gentrifying process of a neighborhood using Minneapolis, MN as a study area.

This research first examines if land characteristics can contribute to long-term vacancies using Kaplan-Meier survival estimates. Three common land characteristics – land use, parcel size, and ownership – were analyzed to identify different life-cycles of vacant land by land characteristics and to suggest a typological classification. The results indicate that small, publicly-owned, industrial and institutional lands tend to have long-term vacancies. Six vacant land types – Remnant, Speculative, Reserved, Dormant, Civic, and Recreational lands – were

developed accordingly. This research also examines if neighborhood-scale socioeconomic characteristics can predict the vacancy types identified above. A logistic regression model was specified for each vacant land type. The results indicate a few points. First, vacant residential and commercial vacancies tend to be located in areas with a high minority population. Second, institutional vacant properties are located in low-income areas with a low minority population indicating potential inequality issues. Third, neighborhood scales predict the vacancy types better than the site-scale socioeconomic status indicating that neighborhood contexts can be more influential than the actual site conditions. This research lastly examines the relationship between vacancy types and neighborhood gentrification at the census block group level using spatial analysis. Speculative and Reserved lands are positively associated with neighborhood gentrification supporting the hypothesis; Civic land showed a negative association; Remnant, Dormant, and Recreational lands showed no significant relationship with gentrification.

This dissertation extends vacant land research into the potential issues of social equality incurred by the existence of prevailing types of vacant properties. When local governments choose to demolish or green an abandoned property, the potential impact on existing and remaining neighborhood populations needs to be taken into deeper consideration. This study also further introduces the tools to measure and categorize citywide vacancies. This diagnostic tool helps predict either neighborhoods' positive gains from redeveloping vacant land into green spaces and spaces for community functions, or the potential risks of nearby gentrification by regenerating vacant land.

DEDICATION

To my parents, with love

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TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION

1.1 BACKGROUND

Urban vacant land in a large American city's territory accounts for almost one-sixth of the territory with a population over a hundred thousand (Newman et al. 2016). This vacant land includes green space or undeveloped land that increased from land annexation of cities as a result of rapid urbanization and urban sprawl. Not only that, after postindustrial cities suffered from economic decline and depopulation, the amount of vacant land increased from abandoned properties. Existing vacant land in urban areas now include more diverse types, such as vacant land that functions as green infrastructure, reserved land for future uses, and land with restrictions. Likewise, the types of vacant land vary by the context of how the land was generated and what the current conditions are. How vacant land research defines urban vacant land differs by study purposes; Bowman and Pagano (2010) stated that "vacant land ranges from never developed parcels to land that once had structures on it. In addition, the definition includes land that supports structures that have been abandoned or become derelict, whether boarded up, partially destroyed, or razed [,]" which encompasses these various types of urban vacancy.

While Bowman's definition well describes the dynamic characteristics of the vacant land in urban areas, how vacant land emerges, functions, and influences nearby areas can differ by type. Vacant land in the outskirt of a city might have never been occupied and could stay vacant until a certain amount of demand appears. Industrial vacant land may stay vacant long due to its high land conversion cost. Vacant land can also catalyze disinvestment in declining neighborhoods. These vacant properties can further bring long-term vacant land and abandonment by promoting the negative perception of neighborhood decline (Perkins, Meeks,

and Taylor 1992, Immergluck and Smith 2006, Németh and Langhorst 2014) and, in some cases, increase crime rates as well (Kondo et al. 2015, Ellen, Lacoe, and Sharygin 2013). Studies also show that unused industrial sites, in other words, brownfields, can both create and spread soil contamination and induce environmental justice issues (Kibel 1997). It is a vicious cycle that brings more vacancy and abandonment facilitating rapid increases of vacancies.

While the conventional views on vacant land still prevails, recent studies have begun to shed light on more optimistic views on urban vacancies by functioning as instruments to enhance the quality of life (Popper and Popper 2002, Schilling and Logan 2008, Németh and Langhorst 2014). Other benefits include developable lands for growth, space for temporary and necessary community functions, and a tool for right-sizing depopulating cities (Németh and Langhorst 2014). However, it can be pointed out that these positive aspects also entail the idea that vacant land can be a targeted location of development when the surrounding area has locational benefits or when the demand of economic activities increases. Repurposing the vacant properties can potentially bring more attraction to the area or increase the surrounding property values. Likewise, potentially changing the character of the vacant land areas can be either positive or negative to the neighborhoods. While developing empty properties does not have to push out the current residents than redeveloping already-occupied properties, neighborhood change might inevitably shift the trajectory of the neighborhood and increase potential to experience gentrification and displacement.

Furthermore, even if the vacant properties are not exactly developed, regenerating vacant land as green space or community spaces, or even well-managing vacant properties, have shown the potential to increase land values around the properties. This can be thought of within the context of environmental gentrification that can be observed in low-income areas where the

environment was improved by greening or cleaning up the areas (Curran and Hamilton 2012, Wolch, Byrne, and Newell 2014). It is worth mentioning that recent views on vacant land have shown more optimism on the potential vacant land has, for instance, as an instrument of environmental justice (Németh and Langhorst 2014),

There are few cases that need an attention from vacant land scholarships before we become too optimistic on utilizing urban vacancies. Curran's study on Greenpoint neighborhood in Brooklyn, NY points out the potential threats after cleaning up the contamination around the old industrial site. Due to the locational benefit this low-income neighborhood has, relatively affluent populations came in to the neighborhood along with the cleaning up process, and activists of this neighborhood had to fight to keep the community from being displaced (Curran and Hamilton 2012, Wolch, Byrne, and Newell 2014). Another case shows how managing vacant properties can increase nearby property values. The Philadelphia Land Care (PLC) program was initiated in 1996 to clean up and maintain vacant properties in the New Kensington neighborhood. The well-managed vacant lots, with the help of the PLC program, have increased nearby property values more, compared to the non-greened vacant land (Heckert and Mennis 2012). While these studies are limited to understanding environmental improvement in low-income neighborhoods or the impact of managing vacant land on nearby property values, we can expand these case studies to the potential threat of gentrification led by regenerating vacant urban land in marginalized communities.

It is further questionable whether these vacant lands are beneficial or detrimental to the neighborhoods. For instance, vacant land can be a threat to the neighborhood as an eyesore. It can also be a catalyst of gentrification, carrying debates whether it is an opportunity. Alternatively, existing vacant land can possibly become an opportunity for affordable green

space and proper uses. Seeing the various aspects vacant land can have, there are a lot more implications to examine vacant land in neighborhood context.

1.2 PROBLEM STATEMENT

1.2.1 Vacant land specification

While almost one sixth of a city's territory is known to be vacant in major U.S. cities(Newman et al. 2016), the concept of vacant land can vary by context or municipality. According to Newman et al.'s survey (2016) on vacant land in major American cities, city officials designate vacant lands primarily as greenfields, unused agricultural lands, brownfields or derelict open spaces. While greenfields and brownfields are reported to be the major types of vacant lands, they are ironically the complete opposite in regard to regeneration or development potential. While research on urban vacancies has been conducted on economic, environmental and social effects of abandonment and brownfield, in regard to classifying vacant land, the research has been basically nonexistent and what is loosely related to this topic is quite inconsistent.

Due to the muddiness of defining vacant land, it has been also difficult to understand how urban vacancies can benefit or disadvantage surrounding neighborhoods. Understanding the mechanisms involved with the formation of vacancies better in the context of neighborhood change goes beyond simply developing definitions. Previous studies either encompass the various types of vacant land to gauge citywide trends or nationwide inventories (for example, Northam (1971) and Bowman and Pagano(2000)'s studies) or to specify certain types of vacant land of a city to examine the relationships with surrounding areas (for example, Silverman, Yin, and Patterson (2013).

While understanding urban vacancies in multiple contexts requires specification of vacancy types in urban areas, little attention has been given to developing a typology as a tool for planners and policymakers. Understanding what types of vacant land can be a benefit as green space or threat to catalyze decline to low-income neighborhoods can be very useful for policymakers to develop policies according to the current inventory. Proper tools are essential to analyze and diagnose any potential risk a neighborhood can have (Van Zandt et al. 2012) in order to properly respond to the impact of vacant land on changing neighborhood dynamics.

In an effort to more easily study the subject matter across cases, we now confront new challenges of how to identify different types of urban vacancies. This approach entails going beyond creating a singular, all-encompassing definition that includes the different ways in which vacant land varieties can impact urban areas. Some distinctive characteristics of vacant land have been shown to be primary determinants of how vacant land can evolve over time. Size of vacant land is thought to be a chief characteristic that fundamentally blocks development activities on vacant properties (Schenk 1978, Northam 1971). Also, different land use types can have different contexts which range from contamination to tax delinquency (Berkman 1956, Schenk 1978, Greenberg, Popper, and West 1990). This requires understanding of the differences in vacant residential, commercial and industrial properties. Lastly, the type of property ownership – such as public or private – can influence whether or not vacant parcel can bring development opportunities (Berkman 1956, Northam 1971, Schenk 1978, Greenberg, Popper, and West 1990). If there are too many owners or if the owner is passive and does not manage the property, it is likely to stay vacant longer. One feature driven from these characteristics is that the duration of vacancy can be different by such size, land use type, or ownership.

1.2.2 Uneven patterns of vacant land across neighborhoods

Despite emerging citywide policies of attempting to manage vacant urban areas, the influence of urban vacancies and their reuse remains understudied. The aforementioned benefits or disadvantages of vacant areas in neighborhoods may not be equally distributed across different socioeconomic neighborhoods. Several studies point out the spatial heterogeneity of development activities in vacant areas (Németh and Langhorst 2014, Foo et al. 2014, Shlay and Whitman 2006). For example, dense low-income neighborhoods tend to have more unused vacant land (Kremer, Hamstead, and McPhearson 2013). Foo et al. (2014) also indicated that neighborhoods with low socioeconomic status have long-term vacancies while only a few studies have looked at longitudinal vacancy patterns in urban areas and examined relationships within neighborhood characteristics. Considering the potential issues caused by the spatially and longitudinally accumulated vacancies, uneven distribution of vacant land can lead to more intensive vacancy and abandonment issues, especially in neighborhoods with low socioeconomic status. As recent studies have shown the potential positive effects urban vacancies can bring to the city, the necessity has increased to understand the neighborhood change associated with the dynamics of vacant urban land.

1.2.3 Relationship between vacant land and gentrification

While the relationship between vacant land and gentrification has been studied only handfully, regenerated vacant properties and increased investments in declining neighborhoods have theoretically and practically shown to sometimes result in gentrification (Smith 1979, Eckerd 2010, Morckel 2013). For instance, environmental improvement such as increased green space and redeveloped vacant land shows the potential to induce gentrification in the neighborhood (Eckerd 2010, Wolch, Byrne, and Newell 2014). Low-income neighborhoods may

have more risk to be gentrified when the quality of the environment improves, or when environmental gentrification occurs (Wolch, Byrne, and Newell 2014, Curran and Hamilton 2012). Still, the relationship between vacant land and gentrification is undoubtedly complex and unclear.

Meanwhile, some studies actually suggest that vacant land can be either a trigger to neighborhood gentrification or a symptom of a non-gentrified distressed neighborhood. Marcuse (1985) posits that gentrification – physical changes and socioeconomic upgrades – may be the only realistic cure for abandonment. This position dictates that the more a neighborhood is gentrified, the less the areas within the neighborhood are vacant or abandoned. The less a neighborhood attracts market forces, then the more abandonment spreads. Inversely, Morckel (2013) claims that gentrification is the process by which the abandoned space is filled up. A certain amount of abandonment – or emptiness – can be required for newcomers to settle down in the neighborhoods and to fit the budgets for developers; a small ratio can indicate healthy economic growth. Some amount of vacancy can attract market forces due to affordable land value and land availability. The types of vacant lands associated with the gentrification process can vary and their associations seem to be more complex than the prevailing concept of the linear relationships.

CHAPTER II

LITERATURE REVIEW

2.1 VACANT LAND IN URBAN AREAS

2.1.1 Definitions of vacant land

The earlier term used for vacant land was ‘Dead Land’ which was thought to be a land that cannot or does not create any economic or social activities in urban areas (Aschman 1949, Coleman 1982, Berkman 1956). This term was brought to attention when urban decline struck in major cities in America and tax delinquent properties began to accumulate. A solution for dead land was to limit the regulation and restriction on dead properties and let the land come back into the market. The concerns on vacant land were mostly regarding urban decline and the economic condition of the city.

It was not until Northam (1971) introduced the characteristics of vacant land did its definition broaden. Northam’s (1971) concept of vacant land includes remnant parcels, unbuildable parcels, corporate reserves, held for speculations, and institutional reserves. Remnant parcels have physical restrictions including small and odd sizes that are not preferred for inducing development activities. Unbuildable parcels include damaged and contaminated parcels from any types of hazard, or parcels exposed to any potential hazard. The last three types include vacant parcels that are reserved for certain purposes and have been neglected. Northam’s concept, however, is based on the assumption that all buildable vacant lots have certain purposes or reasons to be empty. Therefore, the definition does not include derelict or abandoned land that is not being used without a particular purpose (Bowman and Pagano 2010).

Afterwards, Greenberg, Popper, and West (1990) explored vacant land what they referred to as Temporarily Obsolete Abandoned Derelict Sites (or, TOADS). It includes land that was once used for industrial, business, warehouse, and residential purposes as the last stage of a land-use cycle and even the land that was never used. They suggested three types of TOADS. The concept of TOADS mainly includes derelict or abandoned land that has physical or environmental constraints. Bowman and Pagano (2010) , however, pointed out that this term did not include the concept of neglected or reserved land Northam (1971) characterized.

This study follows the general definition Bowman and Pagano (2010) developed based on these earlier studies (Northam 1971, Greenberg, Popper, and West 1990). Bowman and Pagano (2010) pointed out that earlier studies do not fully explain the characteristics of vacant urban land. The newly suggested definition includes the following: "vacant land ranges from never developed parcels to land that once had structures on it. In addition, the definition includes land that supports structures that have been abandoned or become derelict, whether boarded up, partially destroyed, or razed." Bowman and Pagano (2010)'s study was further expanded in Newman et al.'s study (2016) on vacant land inventory across the United States as well. Newman's study approaches vacant land in the same line but attempts to specify the types of cities based on land and area changes over time. The vacant land defined by these two studies includes any vacant land that was damaged (or contaminated), derelict (or abandoned), or neglected (or unused).

2.1.2 Urban change and vacant land

The accumulated vacant land in urban areas can be both a symptom of urban change and a result of population and industrial shifts. Thus, it is necessary to look at the big picture and understand how a city evolves over time and how vacant land functions in the evolving city.

The formation of urban vacancy is not separate from the way cities evolve and urban areas change over time. Thus, to understand how urban vacancy emerges and disappears in urban areas, theories on urban change need to be explained together (see Figure 1). Among the various urban change theories, Champion (2001) explains well in four stages how a city forms and expands. With that, how a land becomes filled and emptied can be described to an extent in the existing studies on urbanization (for example, Tisdale (1942), Champion (1989), Birch (1971)).

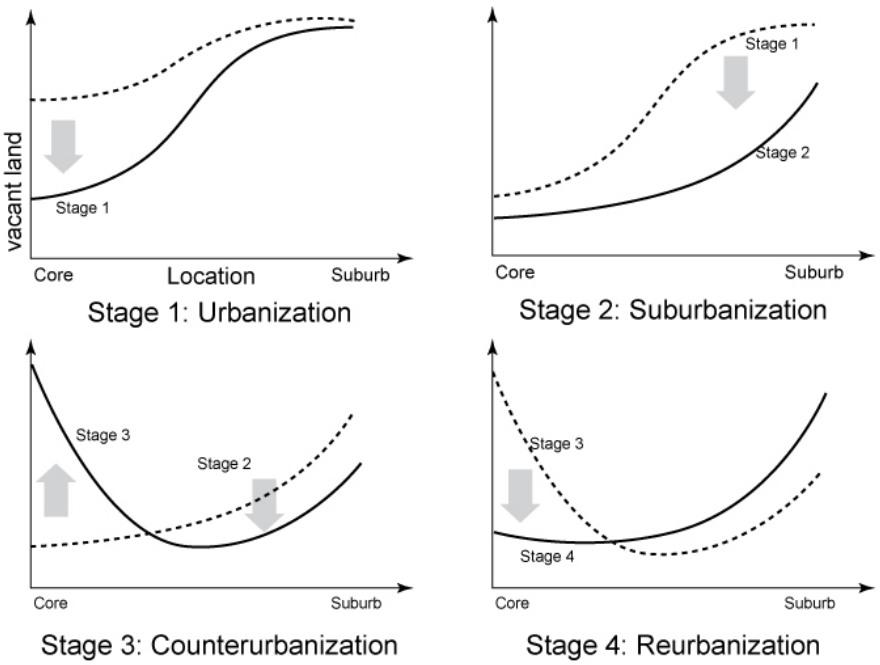

Figure 1 Vacant land and urbanization stages

Urbanization stage

The early stage of urbanization is when a city starts expanding and growing. As a city becomes urbanized, the infrastructures within the city and new job opportunities attract new residents to migrate. Because of the active in-migration and following development activities, the

city core becomes more occupied and dense. In this stage, land in the city gets occupied and undeveloped land decreases.

Suburbanization stage

As the city grows dense, the light starts to shed on the greenfield adjacent to the city (Northam 1971) to convert to new land uses – mostly residential and commercial uses (Kibel 1997). The demand for the space in the periphery gets higher and makes the rural areas urbanized and developed (Northam 1971), which explains the historical trends on metropolitan decentralization.

Throughout the urban sprawl and suburbanization process, the patterns and functions of vacant land change accordingly. Undeveloped vacant land in the urban periphery, which is generally considered greenfield or open space, absorbs the development demand from urban areas for residential constructions (Kibel 1997) once it is annexed into the city limits.

Counter-urbanization stage

The expansions of urban infrastructure such as highways and easy access to the vehicular transportation system make it feasible to shift populations from central cities to suburban areas, avoiding high-rising land values within the city center. Rapid population and economic growth in the U.S. metropolitan areas peaked in the nineteenth century (Kibel 1997, Northam 1971) and was controversially geared toward lowering the quality of urban life. Urban infrastructure was not adequate to support developmental demand, and the monotonic urban life stressed the people living in the city. Overwhelming traffic and air pollution got worse, and land prices raised sharply due to the limited land supply compared to the increased demand. These phenomena led to decaying inner cities which caused people to leave and market forces to weaken. This is also explained by Coleman (1980) as a natural cause of the death of the inner city.

The way vacant land is generated is simultaneously related to the dying economic condition of the city and city policies that can affect economic activities (Coleman 1980). Such issues lead city officials and developers to seek for alternative available land in the urban periphery. The massive undeveloped land in urban periphery is affordable for construction and relocation. As a result of urban decline, meanwhile, the increased blighted and obsolete areas in the inner city can push the population to suburban areas and help facilitate urban sprawl (Kibel 1997, Berkman 1956).

The intensive urban change can lead to the social and environmental issues caused, primarily, by urban vacancy. Due to urban sprawl and population shifts, existing residential and commercial land in urban areas become vacant and abandoned. (Kibel 1997). The imbalance of both supply and demand between the suburb and the city get worse. Inner city neighborhoods are poorer, and the quality of life regarding safety and crime level becomes worse than before. The marginalized populations living in declining inner city are suffering from isolation and segregation (Kibel 1997) caused by depopulation and deterioration.

Re-urbanization stage

As inner cities decline, cities start to put efforts toward urban renewal program as a solution toward urban decline in central city areas and bring people and investment back to the city. These efforts were feasible due to the prevailing abandoned land and affordable land in city core where majority populations have already left. It may be still debatable if the actual urban renewal programs throughout the US history have been successful. However, efforts to revitalize central cities have let many cities gain populations. During the re-urbanization era, urban sprawl slows down – but not stops – and many massive vacant periphery parcels have become not fully occupied and remained, vacant (Northam 1971, Berkman 1956, Metzger 2000). This

controversially increase the actual amount of vacant land within the city limits, which have earlier expanded by land annexation (Newman et al. 2016).

Meanwhile, many cities in the Rustbelt were not so successful in re-urbanizing, although some of the cities such as Buffalo, Pittsburgh, and Cleveland are slowly reviving after decades of efforts (Milligan 2014). Vacant land in the inner city keeps increasing and expected to continue. Many of these cities now seek for an alternative toward 'smart decline' rather than pushing for an unrealistic growth.

2.1.3 Characteristics of vacancies

Existing literature has discussed the causes of urban vacancy in various ways. Although the terminologies seem different, a majority share similar patterns on the list of factors that encourage vacancy. The table below shows how the existing literature refers to the major causes.

Existing studies indicate that three common characteristics of land that cause (or at least are related to) urban vacancy are: parcel size, land use and ownership. First, size of vacant land is thought to be a chief characteristic that fundamentally blocks development activities on vacant properties. If a parcel is too small, it is difficult or restricted to develop the parcel. Also, different land use types have different contexts of the causes such as contamination or tax delinquency, which will be discussed more below. This requires understanding the difference of residential, commercial, and industrial properties. Last, the type of property ownership – such as public and private –can influence whether or not vacant land can bring development activities. If there are too many owners or if the owner is passive and does not manage the property, it is also likely to stay vacant longer.

These studies also identify multiple patterns of vacant land – location, clustering and duration – based on the characteristics above. For example, vacant land located far from urban

core in the urban periphery tends to be greenfield whereas land in the urban core are more abandoned properties. Vacant parcels located in low income neighborhoods tend to be more clustered. How long a property stays vacant also differs by the characteristics of vacant land such as ownership and the socioeconomic condition of surrounding neighborhoods. Each pattern will be discussed more in detail in the next section.

Author	Terminology	Characteristics
Berkman (1956)	Dead land	• Diverse owners, too many or no titles • Tax delinquency • Too small and scattered • Limited access to utility
Northam (1971)	Vacant Land	• Unbuildable, remnant parcels • Held for certain purposes
Schenk (1978)	Unemployed land	• Steep slopes, hazard risks, • Ownership • Limited utilities • Back taxes • Small or odd-shaped • Neighborhood conditions
Greenberg, Popper, and West (1990)	TOADS	• Owners stopped managing • Unwanted land use • Periphery land
Kivell (1993)	Wasteland	• Once used but required some treatment (contaminated land)
Kivell (1993)	Derelict land	• Once used but local economies are not enough to reuse the land
Bowman and Pagano (2010)	Vacant Land	• -
Silverman, Yin, and Patterson (2013)	Zombie properties	• Shrinking cities) not a particular land use within the land is necessary. • Needs to be removed

Common causes
• Size, shape • Contamination (LULU) • Held for certain purposes • Abandoned by owners • Land in periphery • Tax delinquent. Back taxes • Supply and demand mismatch (need to be removed or waited) •

Figure 2 Causes of urban vacancies

Land characteristics

To understand how these characteristics of vacant land generate different types of vacant land, each characteristic will be specifically discussed in this section.

- *Size of vacant parcels*

The size of a parcel is one of the main characteristics that blocks or promotes the reuse of vacant land. Too small of a parcel may not be eligible to be developed or restrict the activities allowed on it. These parcels may have never been developed due to the size limitations. Northam (1971) stated that remnant vacant parcels are not acceptable to be developed as they are only a "few hundred square feet or, at best, a few thousand square feet". Schenk (1978) supported Northam's point on small parcels that are structurally hard to be developed. Officials in major US cities also reported that vacant parcels tend to be irregular and small-shaped, which makes it hard to be developed (Newman et al. 2016).

When a vacant parcel is too large, on the other hand, it could be vacant due to physical restrictions or hazardous location (Northam 1971). This suggests that large vacant parcels are not always better to be developed. Alternatively, a corporation may have kept vacant land in case they need the land in the future. These properties are reserved for certain purposes such as relocation of firms (Northam 1971) and, therefore, will not be developed or on the market unless necessary. Northam again states that there have been "tens or hundreds of vacant lands" that have been reserved.

In general, parcel sizes vary and are subdivided by land use types and related guidelines. However, it does not mean that parcels under these guidelines are best to be developed. There are more of a historical context under the way parcels were subdivided, and therefore, size and shape tend to vary. Although parcel sizes are different across time and space, Northam's (1971)

examples indicate that when the size of parcel is extremely large or small, development of these parcels is restricted.

Further, when the parcels are being developed, large parcels may be more influential to nearby areas. Larger development activities can ensue by large size of parcels. For instance, constructing a community center or sports facilities may have more impact on neighborhoods than constructing a house for single family.

- *Land uses*

Urban parcels function differently by land use and therefore have distinctive characteristics depending on the land use. Lands generated during the expansion of a city are likely to be residential or undeveloped parcels. Vacant land is thought to be the last stage of a land-use cycle and can include industrial, business, warehouse, residential uses, which were introduced as a type of TOADS from Greenberg's study (1990). Among the land uses, for example, industrial sites are typically the ones abandoned for unwanted land uses (LULU).

Land use robustly determines the characteristics of parcels and does not likely change when being redeveloped. According to Park and von Rabenau's study (2014), when a land has a high potential conversion cost, it is more likely to be abandoned. For example, industrial sites typically need to be cleaned up before being developed. In the case of residential properties, they do not usually convert to another land use. Instead, conversion costs such as upgrading, renovating, and occupancy conversion can be a burden to reuse the vacant land (Park and von Rabenau 2014).

Amongst the land use types, residential and commercial lands tend to be the major uses in land market and respond to the market quicker than other land use. These two land uses are also the most common land uses in urban areas excluding agricultural or undeveloped land. They are

also the main actors of neighborhood change either encouraging or discouraging development activities when vacant parcels are being developed – yet they function differently. For example, among residential uses, vacant single-family units are more obviously perceived as abandoned structures than, for example, vacant apartment units. Sometimes city officials encourage to demolish abandoned structures in order to keep the environment managed. Although demolition may intuitively seem to increase vacancy, Morckel (2013) states that there are studies indicating that demolition actually does not increase nearby abandonment.

- *Land ownership*

Lastly, ownership is highly related to the potential of a land to be redeveloped (Németh and Langhorst 2014, Adams 1994, Kivell 1993). For example, owners of vacant land tend to be more active than owners of occupied land in order to bring development activities within the land (Adams 1994). Controversially, properties abandoned by owners can be said to have passive owners than occupied and managed properties. Also, large-size organizations and companies tend to manage the land less than smaller ones. These examples suggest that there are mechanisms that somehow explain the relationship between ownership and management of vacant land.

One noticeable mechanism is that complex ownership can restrict further development activities. (Schenk 1978, Kivell 1993, Berkman 1956). If the ownership is too complicated, the land is less likely to be developed due to the document issues that may block the legal procedure. This issues include such disputes over property ownership and multiple ownerships as well (Schenk 1978).

Another mechanism is that land changes differently depending on whether the owner is an active or a passive owner (Adams 1994). Active land owners will try to be involved in the

market actively and make the land available for development activities. The willingness of owners to develop the land encourages the owners to overcome any restriction the land might have. Passive land owners tend to keep the restrictions and show less effort to develop or sell the land (Adams 1994). In this vein, passive ownership can be a criterion to define an 'abandoned' property. Dewar and Thomas (2012a) defined abandonment based on ownership; abandonment occurs when the owners stop managing the land. Thus, we can conclude that depending on the ownership, a land can be developed quickly or stay vacant longer.

Although intuitively, private sectors are more active than public sectors, it is not clear which is passive or active owners (Adams et al. 2002). Traditionally, public owned properties are not on the market, whereas private sectors actively seek for development opportunity. After the city grows, private-owned land increases. However, economic decline makes these private owners become passive actors. Now during the redevelopment phase, it is more challenging to say which sector can be more active (Adams et al. 2002).

Dynamics of Urban Vacancies

The life-cycle of urban vacant land seem to have some association with neighborhood characteristics, which includes socioeconomic status and distance from CBD. Broadly, vacant land is thought to be related to high poverty, high percentage of renter units, minorities (Silverman, Yin, and Patterson 2013), any marginalized groups (Németh and Langhorst 2014), unwanted land use and low property values (Foo et al. 2014). While vacant land shows uneven distribution throughout the space and seems to have some association with the patterns of certain neighborhood socioeconomic status, it is not clear if vacancy is a symptom or rather a cause of the spatial unevenness. Perhaps both are plausible. Regardless of how the causal relationship is defined, there seems to be an association between vacancy and neighborhood characteristics.

Because socioeconomic characteristics of a neighborhood can be more influential than the actual physical condition (Sampson and Raudenbush 2004), existing vacant land in low income neighborhoods can be perceived more negatively and influence further development activities. Otherwise, the presence of vacant land can also be explained by the marginalized property values or any inactive land uses (Foo et al. 2014).

Existing studies have identified the relationship between the dynamics of urban vacancy and neighborhood characteristics. The dynamics include location, amount, clustering, and duration of vacancy as in the table below (Table 1).

Table 1 Characteristics of vacancy

Characteristics of vacancy	Relationship	Sources
Location	Vacant lots tend to be located where low-income populations lives	Kremer, Hamstead, and McPhearson (2013); Sternlieb et al. (1974)
	Greenfields are located in urban periphery.	(Bowman and Pagano 2000)
Amount / Clustering	Vacant lots tend to be increasing where the income level is dropping	Silverman, Yin, and Patterson (2013).
	Vacant land tends to be clustered	Morckel (2014), Accordino and Johnson (2000)
Duration	Lots tend to stay vacant longer when they are located in the low-income areas	Kremer, Hamstead, and McPhearson (2013); Foo et al. (2014)

First, vacant land seems to show locational characteristics based on the characteristics of the surrounding neighborhoods. One aspect is that vacant land appears more in low income neighborhoods. Existing studies found that increasing low income minority populations in a neighborhood tend to be associated with the possibility of having abandonment (Sternlieb et al. 1974, Kremer, Hamstead, and McPhearson 2013). Likewise, which neighborhood the vacant land belongs to can explain the appearance of the vacant land. Another aspect is that neighborhoods further from the CBD tend to have more vacant land that are greenfields. In other

words, the type of vacant land can be different depending on the location or distance from the CBD. Vacant land in the periphery tends to be undeveloped after being annexed due to civic expansion (Bowman and Pagano 2000). Vacant land in the city core, on the other hand, tends to be the types of abandoned or deteriorated properties that were once developed at an earlier time (Kivell 1993, Coleman 1982).

Second, vacant land seems to increase and cluster in low socioeconomic status neighborhoods. From Silverman et al.'s study (2013), abandoned properties were increasing in the neighborhoods that have high proportions of minority populations, increasing poverty rates, and long term vacancies. Morckel (2014) also pointed out the possibility for abandonment to influence nearby areas and induce more abandonment, showing the 'spillover effect.' Her research indicates that abandonment in nearby neighborhoods can increase the possibility for a house to be abandoned. Clustered vacant land can induce more vacancy as a pattern of a 'vicious cycle' (Accordino and Johnson 2000) within a neighborhood, and low income neighborhoods may suffer more from these patterns. Meanwhile, some argue that the sporadic distribution of vacant land actually restricts development activities and therefore keeps the parcels vacant longer (Newman et al. 2016). From this perspective, clustered vacant land can be thought to have more development opportunity. Although this perspective seems to conflict with the spillover effect of abandonment, these two characteristics may exist together. Even if vacant parcels tend to cluster, it may be difficult to induce large development unless, for example, the parcels share the border; even if vacant parcels tend to be sporadic, these vacant parcels can still have patterns of appearing in a neighborhood with more abandonment.

Third, vacant land tends to stay vacant longer when the land is located in low socioeconomic neighborhoods, possibly as a result of uneven development activities. Kremer's

study (2013) supports this relationship showing that, among vacant lots, the ones in dense low income neighborhoods are the ones not being reused – including temporary reuses. This argument can be extended to Foo's study (2014) suggesting that vacant lots in low income neighborhoods and relatively farther from the city core tend to stay vacant longer. Although Foo's result on low density outskirt vacancy seems opposite from Kremer's study on dense neighborhoods, one consensus from these studies is that low income neighborhoods are likely to have longer vacancy. In other words, there is the possibility that low-income neighborhoods are less resilient to neighborhood change. Also, longer durations of vacancy in low-income neighborhoods accumulate the socioeconomic issues, which makes the neighborhoods less likely to recover from the 'vicious cycle' of neighborhood decline. Similar evidence can be found as well on contaminated sites that show slower cleaning-up pace in minority neighborhoods (Eckerd and Keeler 2012).

2.1.4 Strategies for vacant land

Conventional views on urban vacancies

Although urban areas can change either toward growth or decline depending on the way socioeconomic conditions shift, it has been commonly believed that cities will continue to grow in the future. In fact, the role of planners has been always to control and manage the growth of urban areas (Popper and Popper 2002). The majority of planning regulations have aimed to promote sustainable growth. From this perspective, views on urban vacancy have been strongly negative. Vacant land in a neighborhood is considered a threat that facilitates potential neighborhood decline. Vacant land can lead to negative perceptions about a neighborhood, increasing costs to maintain properties. Non-functional vacant land can be a problem for the city,

reducing tax bases and increasing potential environmental justice issues regarding hazards and condemnations (Németh and Langhorst 2014).

The conventional views have continued until recently, even with the existence of cities suffering from depopulation and economic decline – especially in the Northeast and Midwest regions of the U.S. City officials have believed the "myth" that cities have to and will grow (Popper and Popper 2002). Even the comprehensive plan, which is a long-term plan for a city, tends to be blind toward urban shrinkage and rather focuses on the dreamlike growth (Ryan 2012). Pointing out these issues, Popper and Popper (2002) have argued against the growth-oriented approaches and suggested the concept of 'Smart Decline' as a solution for shrinking cities. Strategies on smart decline may need to be creative and different from the ones for smart growth.

Vacant land as an instrument of smart shrinkage

Popper and Popper (2002) suggest the concept of 'Smart Decline' as "leaving behind assumptions of growth and finding alternatives to it". It is important to think about who and what can be left, specifically, if any functions need to be changed to an alternative, or even to eliminate one. Since the planners' job has been always to promote activity and viability, downsizing may not be so comfortable (Popper and Popper 2002).

In this vein, depopulating cities recently adopted the concept of rightsizing due to the overflowing structures and population loss. Here, right-size means an affordable size of a city for the city to be able to handle (Ryan 2012). Schilling and Logan (2008) also specifically defined right-sizing as following: "stabilizing dysfunctional markets and distressed neighborhoods by more closely aligning a city's built environment with the needs of existing and foreseeable future populations by adjusting the amount of land available for development."

Policy makers and planners nowadays are revisiting urban vacant properties as an instrument in shrinking cities to smartly decline and right-size (Popper and Popper 2002, Schilling and Logan 2008, Németh and Langhorst 2014). Urban vacant land is not a threat but an available land for the future demand when development increases (Popper and Popper 2002). Considering the limited land available in urban areas, increased available urban vacant land can be a new opportunity for the upcoming future in growing cities.

Planning for shrinking cities, however, may not be easy. It is important to understand the social and economic demand as well as the existing structural and functional aspects of the supply (Ryan 2012). There may be some overflowed unnecessary structures such as overbuilt housing units. In this case, demolishing these structures can contribute a city's ability to right-size (Silverman, Yin, and Patterson 2013), or there may be still lack of green space even when vacancy has increased. For these reasons, the necessity to have a proper policy toward vacant land and to properly manage vacant land can be pointed out. Newman et al. (2016) Highlighted the importance of documenting and updating the inventory of vacant land as well as collaborating with private so that the land can be managed or developed for proper usages. One way to manage vacant properties is to find a right design solution for the commonly seen abandoned structures and sites that can be eyesores and may cause fear and negative perceptions (Ryan 2012).

- *Green infrastructure*

As an instrument for right-sizing, vacant lots and abandoned properties can be used more actively. One main aspect of vacant land in shrinking cities is that the land has potential to promote green infrastructure and activities in urban areas (Popper and Popper 2002, Schilling and Logan 2008, Németh and Langhorst 2014). A recent study shows that the amount of vacancy

can be a proxy to the greenness of the city (Deng and Ma 2015). The green infrastructure has potential to economically, socially, and environmentally benefit the urban areas by increasing housing demand, promoting sense of community, and supplying parks and recreation areas (Schilling and Logan 2008). Vacant land can be managed well and increase green spaces promoting a better quality of life. Green infrastructures can include parks, playgrounds, and recreation areas, community gardens, street and parkland trees, public landscape, waterfronts, green roofs and so on (Schilling and Logan 2008).

- *Temporary reuses*

The emergence of vacant land can be thought a part of urban change. This implies that it may not be necessary to find a long-term solution to fill empty lands (Németh and Langhorst 2014), because the empty lands are actually in the transition phase to change into possibly a new land use in the future (Newman et al. 2016). For this, temporary uses can be fit to utilize the vacant land given the limited time the land stays vacant. As the reuse of vacant properties has received much attention, the necessity to consider temporary reuses has also become more visible (Kirnbauer and Baetz 2014). Benefits of temporary uses include: instruments for right-sizing, management of abandoned sites, increased community involvement, improving low SES communities, and being prepared for trends for increased vacancy (Németh and Langhorst 2014).

2.2 NEIGHBORHOOD CHANGE AND URBAN VACANCY

2.2.1 Urban vacancies as a consequence of neighborhood decline

Early research was dedicated to the economic perspectives of urban vacancy because of the waning market conditions in the midst of the twentieth century. The common term, ‘Dead Space’ or ‘Dead Land’ represents deactivated or non-functional land that is not on the market

(Aschman 1949, Berkman 1956, Schenk 1978, Coleman 1982). The main concern around that time was to understand the causes of 'Dead Land' in order to rectify the prevailing vacancy. Schenk (1978) explained vacant land as an unemployed land with unemployed labor force in two ways – structural and frictional unemployment. He refers to the "tree-harvest problem" - the land that is held for the future, which was also introduced by Northam (1971)'s study. Also, some studies have tried to measure the amount of vacant land in America (Niedercorn and Hearle 1964, Northam 1971) in the 1960s and 1970s.

As vacant land was simply a non-functional land, the emerging vacant land was considered an inevitable consequence of neighborhood decline. When a neighborhood starts losing population and development activities decrease, physical conditions get worse and the neighborhood starts declining. During the declining process, abandoned and derelict properties emerge, and urban vacancy increases. Individual job losses and tax-back conditions may not explain all the reason vacant land emerges. Along with changes in economic conditions, abandonment can be accelerated in declining neighborhoods. Also, the conditions of the neighborhood can matter more than the house-level conditions and accelerate abandonment in declining neighborhoods (Morckel 2015). Morckel (2015) also suggests a possibility that a tipping point exists when neighborhood characteristics start to be influential more than the actual house characteristics.

Neighborhood change and vacancies

Theories on neighborhood change can explain neighborhood decline and the accumulating vacancies in urban areas. One major underlying theory is the Life-cycle Theory of neighborhood change. This theory explains the cycle of a neighborhood – how it grows and declines – in an ecological perspective ((Hoover and Vernon 1959). Abandonment or vacancy

occurs when it comes to the last stage of neighborhood cycle (Real Estate Research Corporation 1973). When physical conditions worsen and people begin leaving dying neighborhoods, investment activities decline and public efforts diminish, producing abandonment and vacancy. This well explains urban vacancy as a symptom of neighborhood decline.

One thing to point out is that policies toward neighborhoods can play an important role in the relationship between neighborhood change and emerging vacancy. With the example of Chicago, Illinois, Aschman (1949) pointed out that dead land emerged due to the restricted policies that blocked vacant land from being pulled back into the market system. He stated that the failure of proper planning and land uses is making land die. A land cannot be sold or redeveloped right after foreclosure unless the legal process clears the title or other procedures. Coleman (1982) also points out that dead space could be generated when a policy for demolition was considered a cure. Destructing the land uses that produce profits and increasing land uses that do not produce any economic benefits worsen the condition and generates dead spaces.

2.2.2 Theories of neighborhood change

The underlying theories of neighborhood change have been commonly explained with the ecological framework enlarged by the Chicago school. The ecological perspective puts more emphasis on the collective group level than individual level decisions. The characteristics of a group are predefined, and therefore, the outcome behaviors are pretty much predictable (Temkin and Rohe 1996). Based on human ecology, the ecological perspective explains neighborhood change according to population change (Schwirian 1983) such as in- and out-migration. However, there are some arguments against this perspective. One is the question of which aspect of population change influences the stability of neighborhoods since population change does not always lead to neighborhood change. Another is how the patterns of population change can be

explained by the growth of the city (Schwirian 1983). Still, ecological theories are dominant to explain the growth and decline as well as in- and out-migration in a neighborhood.

Invasion-succession theory (Burgess 1925)

The invasion-succession model was developed by Burgess in 1925. Initially adopted from plant ecology, this model considers urban area an ecological system, and any forces such as a certain land use can invade or succeed in an area depending on how dominant the forces are (Temkin and Rohe 1996). Mainly racial and socioeconomic changes in a neighborhood can be explained with this model. When two racial or social groups compete for the same space, only one of the two groups will successfully dominant the space. Either the original group succeeds or the new group invades. Therefore, the results can be in two ways. The newcomers can invade and settle down in the areas, or they may give up and let the original (or established) population succeed the area. Researchers have found a tipping point for this process when the existing population decides to leave when the number of invaders reach a certain point (Schwirian 1983). This model was later criticized because of its theoretical base that relies on plant ecology and the lack of considering the influence of economic conditions (Saunder 1986). For this reason, later ecological models include economic theory to explain neighborhood change more realistically. (Temkin and Rohe 1996).

Neighborhood life-cycle model

The concept of invasion and succession was later expanded to explain how a neighborhood changes over time. In line with the ecological perspective that neighborhood change is a natural process defined by the characteristics of populations within the neighborhood, neighborhood life-cycle explains how a neighborhood grows and declines over time. After Hoover and Vernon (1959) introduced five stages of neighborhood cycle, this model became the

representative neighborhood change model until now. The neighborhood life-cycle starts by developing single-family residential areas (stage 1). As a neighborhood grows over time, high-density developments replace this area and minority groups settle down in the crowded area (stage 2 & 3). Later, the neighborhood starts declining by losing population and physical deterioration (stage 4). When the neighborhood has declined, redeveloping the area can allow the neighborhood to start the life-cycle over (stage 5).

Downs (1981) also explains the life cycle of a neighborhood starting from vacant land being developed. As a neighborhood begins "aging," this process continues until the neighborhood entirely declines and is abandoned. Like the 5th stage of Hoover and Vernon's model, when it is in the declining stage, neighborhoods try to revitalize and be reconstructed. Although this life cycle theory does not tell when or how a neighborhood will be revitalized, Downs pointed out that a neighborhood cannot disappear and will be revitalized eventually. Understanding neighborhood change with life-cycle theory is very intuitive in understanding neighborhood change and even help predict how a neighborhood will change in the future.

One criticized feature of the life-cycle model is its assumption of low-income, minority populations in declining neighborhoods. While it is arguable whether low income populations tend to live in declining neighborhoods, this demographic-based assumption limits the potential neighborhoods can have. For instance, earlier redlining and limiting loans to those neighborhoods threatened minorities who wanted to put efforts into investment within the neighborhoods or get loans so that they can get a place to live (Metzger 2000). A recent study supports the idea with the study result showing that low socioeconomic status of the neighborhood is not always associated with the possibility for a property to be abandoned giving an evidence against the natural process of neighborhood change (Morckel 2013).

Filtering model

The filtering model modifies the invasion/succession model by including the economic aspect of neighborhood change (Temkin and Rohe 1996). It is also considered "as a series of invasion-succession cycles" (Schwirian 1983). When their housing becomes old, the residents leave to find a better housing stock leaving the empty house affordable for lower class residents. As this type of activity grows, all the residents will keep moving into a better environment not necessarily increasing the living expenses. Thus, filtering can be thought to be a process of aging in neighborhood housing and the following socioeconomic shifts. Not necessarily stating that old neighborhoods are prone to decline, this model is in line with the neighborhood life-cycle model explaining how a neighborhood can grow or decline over time. (Temkin and Rohe 1996). Recent theories on neighborhood change

Although the ecological perspective still remains the mainstream to explain neighborhood change, there are other perspectives that later on have tried to explain other factors than the natural process of a neighborhood with predefined ecological and economic conditions. Unlike the traditional ecological perspective that focuses on developing a well-defined theory that explains urban phenomena, these new perspectives tend to ask questions on social issues and external consequences that cannot be explained by the ecological perspective (Fossett 2005). Because of this, views on neighborhood change tend to be scattered and not have a well-defined theory basis like ecological viewpoints. Still, recent theories helped fill the potential gaps earlier theories may have.

Subculturalists criticized the ecological perspective pointing out that there are other factors influencing neighborhood change and a neighborhood can change in different ways depending on their cultural bond and sense of community (Temkin and Rohe 1996).

Neighborhood organizations play an important role here influencing decisions on neighborhoods (Schwirian 1983). An institutional force such as political influences is another perspective explaining the external force of neighborhood change (Schwirian 1983). Unlike the ecological and subcultural perspectives that analyze neighborhood with the concept of living environment, the political economy school points out that a city can be considered as a giant "machine" (Molotch 1976) that aims at growth and profits (Temkin and Rohe 1996). Resources are distributed by the interests of citywide actors and influences neighborhood as well (Schwirian 1983). A relatively recent perspective is the social movement that has been a strategy for declining inner city in London arguing that it can incorporate the other perspectives by citizen participation in the neighborhood planning process (Schwirian 1983). This perspective is more active than the ecological perspective that considers neighborhood decline an inevitable consequence.

2.2.3 Vacant land and its impact on neighborhoods

Vacancies as a neighborhood problem

As the descriptive definitions across the literature have pointed out the negative aspect of vacant land (Newman et al. 2016) , accumulated vacancies in urban areas have become a problem increasing crime rates and dropping housing values, which are eventually negatively affecting the overall quality of living environments. Vacant land, which has been unmanaged, not actively involved in any activities, can be thought to be dead (Aschman 1949). Vacant urban land of this type, which includes foreclosed properties and abandoned structures, can be a typical problem in a neighborhood and has been an indicator of low-quality environments. Below are some examples of impact vacant land can have on neighborhoods: crimes (for example, Perkins, Meeks, and Taylor (1992), Immergluck and Smith (2006), Németh and Langhorst (2014)), public

health -both physical and mental(for example, Garvin et al. (2013)) and housing values (for example, Han (2013), Whitaker and Fitzpatrick Iv (2013)).

Perceptions of crime can be changed due to the observable abandoned properties in a neighborhood and how well these properties are being managed (Perkins, Meeks, and Taylor 1992). Residents or passersby can perceive abandoned structures as a negative sign of neighborhood order. The negative perceptions on the abandonment not only make people unsatisfied with the eyesores but also make people fear of any potential crime (Immergluck and Smith 2006, Németh and Langhorst 2014). Unmanaged properties are often a space for illegal activities with the grown weeds that make a hidden space that blocks the "eyes on the street" (Jacobs 1961). Even if crime activities were not observed, these abandoned properties or empty spaces make people in fear of potential crime.

Not only the perceptions of crime, but also social disorder or crime can be increased by neighborhood abandonment (Immergluck and Smith 2006). Social disorder (or broken windows) can indicate a lack of management and make it a target for a crime. Studies have shown the evidence that neighborhood abandonment can increase crime activities (Ellen, Lacoe, and Sharygin 2013). A recent study shows that managed vacant land can reduce crime rate (Kondo et al. 2015). The underlying implication is that even if a land is vacant, it may not influence crime rates when it is being well-managed. For example, abandoned land or foreclosed properties may induce more crime activities than unused empty land. Vacant properties owned by private sector may be more neglected, and therefore, have more possibility to increase crime activities.

Another impact from neighborhood abandonment is public health. Garvin et al.'s (2013) qualitative study implies that the impact of vacant land is not limited to only negative perceptions but also influences both the physical and the mental health. To be specific,

abandoned properties are thought to increase crime and fear of it, which can influence the mental health. Poor maintenance of abandoned sites can also increase actual injury from the unmanaged physical conditions.

The presence of abandonment can influence nearby housing values as well (Han 2013, Whitaker and Fitzpatrick Iv 2013). Han (2013) examined the impact of abandoned properties on nearby property values in Baltimore (1991-2010). The result shows that abandoned properties have a contagion effect on the housing values in surrounding areas. Also, if a property stays vacant longer, this impact becomes larger. Whitaker and Fitzpatrick Iv (2013) also examined the impact of foreclosures and tax delinquency on nearby housing values using a hedonic price model; the results show that a nearby vacant property can drop a housing price by 1-2%.

Vacancies as a cause of neighborhood decline

As stated, increases of abandoned structures and foreclosed properties tend to rise social disorder and crimes depressing investment activities (for example, Perkins, Meeks, and Taylor (1992), Immergluck and Smith (2006), Han (2013), Whitaker and Fitzpatrick Iv (2013). This relationship can reflect the unwillingness to actively redevelop the areas and represent low demand in the areas as well. Decreased demand on these areas can also make the areas even more derelict and increase illegal activities, which can additionally make people leave the neighborhoods looking for a better living environment. Abandoned properties also have a spillover effect on nearby properties (Morckel 2014). All these various neighborhood changes are the causes of neighborhood decline – eventually causing disinvestment and depopulation.

Willingness to stay in declining neighborhoods

There is a possibility that the views on life-cycle theory have underestimated the importance of planning for the neighborhoods with vacancies. It has been pointed out that there

are residents who are willing to live even within so-called declining neighborhoods with an abundance of vacancies. (Dewar and Thomas 2012a, Nassauer and Raskin 2014). It may be convenient for developers and planners if they can consider a neighborhood empty when the neighborhood is experiencing a severe decline. Any urban renewal program can start by letting people move out and demolishing the derelict structures – so that the neighborhood can start a new life cycle. However, one premise of the condition of declining neighborhoods is that some of the residents will be still wanting to live there (Dewar and Thomas 2012b, Nassauer and Raskin 2014). There is realistically no neighborhood that has lost all of the residents become totally empty. Even in the neighborhoods that are sharply losing population, there are houses that persist. This can indicate that there are people still willing to stay in their houses even if the surrounding areas are being emptied (neighborhoods that are 71 percent vacant in Buffalo and 90 percent in Detroit still have residents willing to live there) (Ryan 2012). The fact that there are people willing to live in the neighborhoods leads to the necessity to have more thorough and integrated policy toward so-called declining neighborhoods.

Also, Dewar and Thomas (2012a) pointed out that low income populations, who generally need more services and protections, will suffer more from abandonment. Not considering the remaining population can lead to other social issues including unemployment, low quality of education, and safety. These are all the symptoms of social isolation or being disconnected with broader society. High income populations are less likely to confront this problem (Dewar and Thomas 2012a).

2.2.4 Underlying theories on urban vacancies

Broken Windows Theory

The underlying construct on the relationship between vacant land and neighborhood stability is that vacant land promotes negative perceptions of the area the land is located in and social disorder can be seen in largely vacant areas that are not managed and mostly public eyesores. The Broken Windows Theory explains that the negative perceptions of the physical environment such as broken windows tend to promote social disorder including crime, vandalism, and illegal behaviors. This process has been studied for the past 30 years (The Vacant Properties Research Network 2015) since Wilson and Kelling (1982) introduced the Broken Windows Theory that they illustrated with an experiment. The experiment conducted in 1969 by a Stanford psychologist, Philip Zimbardo, implies how crime or vandalism can occur differently depending on the condition of physical environment. Two cars with totally different conditions were parked and observed to test how the Broken Windows Theory works. The car with the hood up and no license plate showed far more damage at the end. From the experiment of leaving two cars with different conditions in similar neighborhoods, they found that the condition of car influences whether or not it is damaged when it is unmonitored. The car that had more preexisting damage was damaged more after being left on the street. Likewise, regardless of the socioeconomic status of a neighborhood, a broken window can spread out to nearby areas and such disorder can lead to more actual crime. At the community level, therefore, social disorder can be thought to influence criminal activities. This experiment implies how physical condition matters to the perception on the neighborhood and the decisions to commit crimes or immoral behaviors that can increase social disorder.

Contingency Theory

Apart from the approaches that analyze the underlying causes and effects of vacancy, another approach to urban vacancy is to look at the spatial pattern of vacancy over time and space. As a type of negative neighborhood characteristics vacant properties and abandoned structures tend to be clustered and also spread out. In fact, this idea can support the thought that vacant land can influence its neighborhood not only by increasing negative perceptions but also by accelerating the amount of vacant land over time. Many studies have supported the contagion effect of vacancy (Sternlieb et al. 1974, Greenberg, Popper, and West 1990). For example, introducing the TOADS as an emerging type of abandonment, Greenberg, Popper, and West (1990) mentioned the potential of urban vacancy to encourage further abandonment.

Collective Efficacy Theory

Neighborhood disorder and its influence on neighborhoods are the psychological process of how individuals perceive disorder and connect it to any actions that form the image of a neighborhood. The Broken Windows Theory explains how this disorder can lead to neighborhood problems such as increasing crime rates and fears on the environment. However, the Broken Windows Theory, which explains the direct exposure to the physical environment and how it influences neighborhood perception, might have underestimated the perceptions developed throughout the history of the neighborhood as well as by the socioeconomic status of the neighborhood.

In fact, the way we perceive neighborhood disorder can become different based on the cultural stereotypes we have of the neighborhoods and by the socioeconomic status of the neighborhood. The racial and class stigma of a neighborhood is the chief factor that makes the "implicit bias" when people judge a neighborhood (Sampson and Raudenbush 2004). This

perception collected by a higher level, such as overall features and sociodemographic of the neighborhood, can be explained by the Collective efficacy theory introduced by Sampson and Raudenbush (2004).

The result of the survey conducted by Sampson and Raudenbush (2004) shows that racial and economic factors are more influential to neighborhood perception than observed disorder. The observed disorder may not be the primary factor that influences the perception of the neighborhoods. For instance, being a marginalized neighborhood negatively influences perceptions of the neighborhood than observing vandalism within the neighborhood (Sampson and Raudenbush 2004). The basis of the theory is that the way we perceive vandalism depends on the neighborhood context. In fact, Sampson and Raudenbush (2004) claim that the perception of disorder is collected far "beyond the presence of broken windows".

It can imply that similar vacancies in low- and high-income neighborhoods might be treated in different ways due to the neighborhood effects. Vacancy in high-income neighborhoods can be considered an opportunity, whereas it can be seen as an unsafe environment in low income neighborhoods. More development activities can be brought into the neighborhoods where the vacancy is considered opportunity encouraging the land to be developed. In low income neighborhoods, however, vacancy can endure longer and eventually become a severe problem. While, theoretically, these different directions of life-cycle can plausibly occur, what kind of neighborhood context is associated with the fate of vacancies has not been fully studied to support this theory enough to adopt in vacant land scholarship.

2.3 GENTRIFICATION IN URBAN AREAS

2.3.1 Concept of gentrification

While there is no fixed definition of gentrification, one common consensus is that gentrification is a symptom and a response from market demand in inner city neighborhoods where the low-income populations live and housing values are affordable (Smith 1979, Freeman 2005). One similar term is displacement, which often point to similar phenomenon. However, they refer to different aspects of neighborhood change. Gentrification points out the newcomers and the changes occurred by them, which includes some positive changes in such physical environment, while displacement only refers to the population out-migration occurred from gentrification. The characteristics of gentrification do not always include displacement (Freeman 2005) – though, displacement tends to be the consequences of the newcomer's willingness to find their identifies (Redfern 2003).

Freeman (2005) attempted to introduce five dimensions of gentrification which includes location, population characteristics and attractiveness of the market. Two main characteristics that define gentrification are thought to be the characteristics of newcomers and the flow of investment coming back to the city (Freeman 2005). When the newcomers appear to have higher income levels than the original residents, and when the market starts to respond to the neighborhoods' attraction, gentrification begins.

History of gentrification

After sporadically being observed even in the early 1930s and 1940s, gentrification phenomenon started shown in many American neighborhoods and have become a major concern causing neighborhood change. This gentrification became a more widespread phenomenon in the 1960s and became one of the common social issues in city cores (Smith 2013). One main driver

was the inner city residential rehabilitation, which started in the 1950s. During the1960s and 1970s, gentrification became more intensified and affected many major American cities (Smith 1979). Nowadays, gentrification is considered a typical issue even in global cities (Sassen 1991) and the advanced cities in developed countries (Smith 2013),

2.3.2 Causes of gentrification

Demand side

A common way to explain how gentrification is caused is by the demand – the population who once left the city to suburbs but have decided to come back to the city. This trend is also in line with the cultural changes of the new preference and demand for suitable living environment as well as the economic aspect of commuting expenses and proximity to workplaces. For the new young, professional individuals who seek the amenities a city has, the rehabilitated city core has more attractions than existing suburbs (Smith 1979, Freeman 2006). This demand-side of gentrification explains the changes as an inevitable natural phenomenon occurred by the change of cultural tastes and preferences. People naturally change their preferences and make decisions based on the surrounding environmental change. Thus, understanding the human ecology has given us insights on how preferences and interests can influence decisions in urban space other than the market forces (Fossett 2005). One limit of this ecological view may be that gentrification is an inevitable phenomenon occurred from change of preferences in urban areas.

Another explanation of underlying demand on new moves is the membership the newcomers want to claim. The anxiety toward the membership makes the people move into the new neighborhoods while invading the space and culture – membership – of original residents who do not have same resources as the newcomers (Redfern 2003).

Supply side

However, the demand-side causes cannot solely explain the gentrification phenomenon without considering the supply side: revitalized land and housing markets as well as the shift of industry in the city. That is, urban cores with existing infrastructures show some potential for a new market with affordable cost to rehabilitate the areas. The market demand grows in city cores as the cost for constructing new infrastructure as well as raising land values in suburbs start to be barriers as a city sprawls and decentralizes farther. Urban cores with existing infrastructures show some potential for a new market with affordable cost to rehabilitate the areas. Inner city areas are where once centralized and populated before city had declined but where relatively affluent populations have left to suburbs. For these reasons, typical characteristics of current inner city neighborhoods are low-income minority populations. Within these neighborhoods, low demand on inner city as well as inferior physical environment have decreased housing and land values. When the cost of constructing housing in suburban areas gets higher than the costs of redeveloping and rehabilitating city core areas, however, the capital can flow back into urban core expecting high rate of return (Freeman 2006). In other words, when the market for the inner city starts to grow, the neighborhoods around city core will be rehabilitated and typically gentrified (Smith 1979).

Smith (1979) suggested that the fundamental feature, as well as the driver for gentrification, is the rent gap between the rent level expected and appreciated in inner city areas. In the process of filtering, capital depreciation lowers the rent while the potential developments increase the rent level. When the difference between the potential value and the actual value becomes obvious, and when the rent gap grows large, it can cause displacement and gentrification. The flow of capital generally follows any profit considering the rate of return.

Excess capital used to go to the suburban developments due to the available land in the periphery areas. Now the central cities that have lower land value and more space for newcomers than the past is bringing back the capital to the city When the flow of capital heads to central cities, the rent in inner city will go up considering development potential the areas have. This will create the rent gap and eventually gentrification. (Smith 1979).

Both demand and supply sides

Both demand and supply sides are plausible to explain what causes gentrification phenomenon, and they are not completely two different explanations (Smith 1979). The supply side commonly responds to the demand in market and demands also get used to the way supply shifts and make rationale choice based on existing market conditions. However, the major driver of gentrification can be more of the supply side that follows how the capital flows. One evidence for this argument is that the population who once moved into suburbs are not particularly considered the ones who decide to move back to the cities. Although the cause of gentrification includes the consequence of suburbanization, increasing gentrification trends are not particularly calming down the suburbanization (Smith 2013). This can imply that preference change is not the major cause for the 'back to the city' movement, and individuals' preference can only partially explain the gentrification phenomenon. In general, the gentrification phenomenon is thought to be caused by capital, and not by the people (Smith 1979). Also, it is necessary to understand both sides because pointing out only the demand side may lead to the misunderstanding that gentrification is an inevitable neighborhood change a declining neighborhood will confront.

Characteristics of gentrifiers

In a gentrifying neighborhood, the characteristics of newcomers can be influential to the changes of the neighborhood. There are two types of residents. The first is the new residents, newcomers, who are looking for a new neighborhood, and the second is the residents who have been living in the neighborhoods. Among new and old residents within a neighborhood, newcomers can be weighted more as the major driving force of neighborhood change. The characteristics of a neighborhood can be more important when people choose which neighborhood to move in than deciding whether they want to move out or not (Freeman 2005). In other words, newcomers have more expectations than the existing residents and are more willing to change the neighborhoods by the way they expected when moving in. The characteristics of newcomers in gentrifying neighborhood include white young populations who are singles or couples with professional jobs (LeGates and Hartman 1986) – typically who can make a choice when choosing their houses and neighborhoods. These characteristics of newcomers carry the potential to boost neighborhood change in a gentrifying neighborhood.

How a neighborhood starts to change by new newcomers can be explained in several ways. The middle- and upper- class populations tend to be more actively involved in the community issues and express the demand for their living environment (Freeman 2006). These movements to improve the environment can trigger the neighborhood to change in a positive direction –positive not in a sense that benefits everyone but improves the neighborhood. The newcomers are commonly willing to change or promote the neighborhoods. They are self-selecting where to live, therefore, influencing the neighborhood more than the original residents. In the class-view, even when all the people are willing to promote the quality of life and have 'anxieties about identity and status', these newcomers tend to be also more affluent and have

more power to express their ‘anxieties’ and takes the advantages of the resources around them. This can further cause the issues for residents who are pushed from the opportunity – supply of housing - by the newcomers (Redfern 2003). – the struggles over class status.

Also, newcomers tend to claim the membership stronger than the original residents. The anxiety toward the membership makes the people move into the new neighborhoods while invading the space and culture – membership – of original residents who do not have same resources as the newcomers (Redfern 2003). people who are trying to move into a new neighborhood tend to make a careful choice and find the best option based on their needs and affordability. The people who have been living in the neighborhood are not necessarily as sensitive as in-movers. In other words, dislikable neighborhood characteristics do not make the residents all leave the neighborhood quickly and become out-movers, while strongly influencing newcomers’ choices. These differences can lead to the idea that newcomers are more of the driver to lead neighborhood change (Freeman 2005). Also, newcomers tend to claim the membership stronger than the original residents. The anxiety toward the membership makes the people move into the new neighborhoods while invading the space and culture – membership – of original residents who do not have same resources as the newcomers (Redfern 2003).

Although the newcomers are the key factor that changes neighborhood and promotes the gentrification process, it does not mean that gentrification occurs by the increases of demand-side only. The distinctive characteristics of newcomers can trigger supply-side as well (Freeman 2006). For instance, local businesses will be more sensitive to the new residents who have more economic power over the old residents in the neighborhood. This perception can lead to the improvement of service even when the newcomers have not demanded for that.

2.3.3 Consequences of gentrification

The fear of gentrification mostly comes from the market force that can displace existing low-income residents and increases the financial burdens of the remaining residents. Not all the literature agrees as to the level of displacement caused by gentrification, but neighborhood change caused by gentrification is quite evident. The existing low-income residents of these communities tend to have fewer resources to improve the environment than the newcomers (Redfern 2003) who tend to have a higher social class – at least, middle class. Thus, it is easier for newcomers to claim the membership and change the identity that favors outsiders (Redfern 2003). Claiming the membership can begin by renovating houses and will eventually lead to the neighborhood change.

Specific neighborhood changes include improved safety issues and environmental improvements. Based on Freeman's research (2006), Gentrification in Clinton Hill and Harlem in NY had some benefits in the area of neighborhood safety. The crime rate has decreased, and police were present more often. However, residents still thought these benefits were not aimed at them but at the newcomers. Also, an increased police presence was viewed by the residents, many of whom were black or Hispanic, with suspicion because of historic tensions between those communities and law enforcement.

While the environmental improvement in gentrified neighborhoods is obvious, there may be several explanations as to how the environment changed. It could be due to the demand from the newcomers who have the power to change and therefore request better service and products in the neighborhood. Alternatively, it could be the businesses that responded to the newcomers. The perceptions of the white population who would demand higher quality than before could have induced neighborhood improvement. An exogenous force that push to favor the incoming

white population could have existed as well. In any case, these improvements may be something that should have occurred earlier. This neighborhood change can tell us that existing residents were not cared for enough and treated with indifference until now (Freeman 2006).

Whether or not gentrification leads to displacement is still disputable although either stance tends to be very firm. Massive literature tells us that gentrification causes displacement (LeGates and Hartman 1986) while some may argue that displacement is not significant (Freeman 2005) or gentrification can occur without displacement (Newman and Wyly 2006). Nonetheless, if gentrification did not threaten low-income communities with possible displacement and if residents did not fear the improved environment, gentrification would not have been an social issue (Redfern 2003). Also, many selectively used Freeman, Braconi, and Vigdor's studies (Freeman and Braconi 2004, Vigdor 2002) on the views that displacement is not huge when a neighborhood gentrifies – even though these authors have cautiously stated the necessity to consider the negative influence of gentrification.

Although understanding the mechanism of displacement along with neighborhood change is not an easy task (Newman and Wyly 2006), studies have found the potential disadvantages displaced populations can have. The displaced populations tend to be low-income or older populations who are more vulnerable to the neighborhood change. Besides, after moving out, the quality of their new neighborhood environment tends to decrease, and living costs tend to increase (LeGates and Hartman 1986). Another aspect of displaced populations is that they have also lost the 'spatial capital.' The gentrifiers have invaded areas with locational benefits as the characteristics of living styles and job market changed. Displacement not only made the low income residents suffer from being pushed out and incurring increased living cost, these displaced communities lost the spatial capital as well. (Rérat and Lees 2011).

Even if some residents survive and stay in the gentrified neighborhood, it does not mean that they can benefit from the improved environment. Without being displaced, low-income communities still suffer from gentrification. The benefits from the environment can be short lived while the financial shortage can be long-term (Newman and Wyly 2006) because the remaining residents tend to have less choice to move out or afford the living cost in and other areas (Marcuse 2016). Not only that, Shaw and Hagemans (2015) examined the concept of social mix which emerged from recent advocates of gentrification using the case study of Melbourne, Australia. Although there may be some potential for the social mix, it is still shown that "a sense of loss of place" was occurring in the gentrified neighborhoods without being displaced.

2.3.4 Conflicting views on gentrification

Starting from the late 1980s, politics of gentrification seem to focus on the positive influence of the incoming middle-class populations and the expanded definition of gentrification (Slater, Curran, and Lees 2004, Slater 2006, Wyly and Hammel 2001). For that, the critical and radical views on gentrification are being faded out, and more positive views on gentrification are emerging (Slater 2006). The appearance of local niches such as bars and restaurants started to be the evidence of the sign for revitalizing neighborhoods and the benefits of gentrification. There was a time when academics mainly focused on the causes of gentrification and how it brings injustice such as displacement of working class (Wyly and Hammel 2001). After 1980s, however, gentrification started to be called as a "savior" of urban neighborhood decay (Slater 2006).

Gentrification advocates believe that gentrification can bring back the middle class in urban neighborhoods with capital and cultural advantages (Zukin and Kosta 2004). Furthermore, current gentrification can be favored to be the result of the efforts middle class put to find an

alternative settlement than suburban lives (Caulfield 1989). As these middle-class populations vitalized the economic condition of the gentrified neighborhoods, increasing job opportunities can be expected as well (Byrne 2003). Gentrification can be also arguably thought to be a solution for urban decay (Byrne 2003, Duany 2001), promoting neighborhood revitalization. By increasing middle class populations into the poverty concentrated area, the poverty can be less concentrated and the opportunity toward social class can be expected (LeGates and Hartman 1986; Byrne 2003).

The reasons why the positive views emerged earlier were identified by Slater, Curran, and Lees (2004). They first claimed that too much focus on the middle-class populations led to the indifference on the existing residents. Focusing on the newcomers, gentrifiers, or middle-class populations do not explain the whole mechanism of gentrification. It is a part of the phenomenon, but missing the fears of communities that gentrification causes. One reason the middle class gentrifiers started to be focused is because they are easier to measure. So methodologically, instead of looking for the displaced populations, studies on gentrifiers emerged and made a positive conclusion on gentrifying neighborhoods. (Slater, Curran, and Lees 2004) Thus, focusing on the gentrifiers - middle class habitus – can exclude the issues on the working class. In the same vain, the understanding of the demand side seems to have led to the positive aspect of incoming middle class and inner city as their natural habitat. (Slater 2006)

The second claim of Slater, Curran, and Lees (2004) on the reason why the positive views prevail is that the definition of gentrification has extended. Due to the negative perceptions of gentrification, now political administrations use other terms “such as ‘urban regeneration’, ‘urban sustainability’, and ‘urban renaissance’. These terms are class neutral unlike gentrification, which is basically a class-change term (Wyly and Hammel 1999). It is also in line

with Marcuse (1985) who pointed out that gentrification can be evaluated differently depending on how we define the term. Likewise, how we define gentrification can change the way we evaluate the symptoms. Glass (1964) emphasized the class change through gentrification, and Hackworth (2002)and other scholars after Glass also defined gentrification with the concept of transforming space for more affluent users. Some studies (Tallon and Bromley 2004, Bromley et al. 2005) argued that the gentrification phenomenon is actually residentialization, which is the opportunities to revitalize city center with public and private capital to gain sustainability and social mix (Slater 2006).

It may be still arguable whether gentrification is beneficial or not and if displacement is crucial. Because gentrification entails newcomers who tend to be more affluent and have more power over original residents, these changes made from the newcomers tend to be more influential and better maintained. These characteristics of newcomers make gentrifying neighborhoods commonly experience to see places becoming safer and better maintained, and even getting more attentions and investments. However, an important thing to point out is that focusing on the market too much can neglect the issues on the poor residents. When housing value and rent price keep increasing, it can be a burden to the existing residents who cannot afford to live in the rapidly improved neighborhood. This issue leads to the competing views on the old residents whether they would stay in the neighborhoods due to the enhanced living environment or leave the neighborhoods due to the burdens on the rent (Freeman 2005). Even if the residents stay in the gentrified neighborhoods, without being supported, the benefits they experience can be temporary. Even though currently community organizations may be putting efforts to have affordable housing for these populations, policies from city, state, or federal level are also needed to help these populations (Newman and Wyly 2006).

It can be also pointed out that the disadvantaged populations might not have choices to move out. With the limited options the low income residents have, they tend to respond slowly to the neighborhood change. Freeman (2005)'s interviews on the existing residents also imply that they do not leave quickly and are not replaced quickly when gentrification occurs. This means that even when the improved environment increases the burden for the low-income populations, they likely stay in the neighborhood and have lives with increased burden – in overall decreasing the quality of life with the limited budget they have. When displacement occurs in gentrifying neighborhoods, it can be thought that the rent and expenses gaps have grown so much that disadvantaged populations cannot anymore stay in the neighborhood. In the class view, it can mean that the limited resources available for the existing residents were not enough to compete with the affluent newcomers (Redfern 2003).

2.3.5 Environmental gentrification and urban vacancies

Environmental gentrification specifies environmental improvement that does not favor the residents. Increasing parks and green space are thought to improve the quality of life but may also have an external effect such as increase in housing values. This environmental improvement can then trigger gentrification phenomena within the neighborhood (Eckerd 2010, Wolch, Byrne, and Newell 2014). Cleaning up brownfield can be another example of how environmental improvement can cause a negative side effect in low-income neighborhoods. By cleaning up the hazardous substances around the site, the land can favor development activities and increase land values (Eckerd 2010, Eckerd and Keeler 2012). Low-income populations which have been facing the contamination over the year do not usually get the benefits and tend to leave the neighborhood or suffer from the raised rent because of the increasing housing values.

This is an ironic situation that environmental improvement does not favor low-income populations. Low-income populations tend to be vulnerable to rapid neighborhood change because of their limited choice of living and financial budgets. Sometimes they suffer from neighborhood decline or contamination around the neighborhood, but they can also suffer from improvement within the neighborhood. Improving the environment in the low-income neighborhoods has the potential to increase property values and bring higher income populations leading to gentrification/displacement issue (Wolch, Byrne, and Newell 2014).

This should be understood well in order to limit the side effects when policy targets a low-income neighborhood. Wolch, Byrne, and Newell (2014) also pointed out that environmental improvement including increasing green space should be promoted only enough not to gentrify the neighborhood, only "just green enough" – a term introduced by Curran and Hamilton (2012) The concept of "just clean enough" means that it is necessary to clean up the contamination at the same time keeping the working class populations within the neighborhood (Curran and Hamilton 2012).

The concept of environmental gentrification requires the understanding of injustice issues in the neighborhoods with low political power and high risk of being exposed to environmental disadvantages – which is commonly referred to as environmental injustice. Early studies in the 1970s started to point out the relationship between environmental benefits and income level and kept spreading out across the US afterwards (Bowen 2002). This relationship between environmental benefits and income level can imply that low income populations are more exposed to potential or actual environmental hazards when the market system takes control (Kibel 1997). Specifically, contaminated sites can lead to health inequality (Maantay 2013) and even increase more tax delinquency problems (Leigh and Gradeck 1996), and low income

neighborhoods are prone to these risks. Low socioeconomic neighborhoods tend to be neglected regarding industrial contamination as well.

The High Line in New York City is a representative example of environmental gentrification. (Wolch, Byrne, and Newell 2014). The High Line was built on the railroad elevated from the ground level. It got its fame due to its creative idea and increased green space where it used to have a deteriorated urban infrastructure. Due to that, this project encouraged land values to go up and changed the low income area into an attractive space with distinctive landmarks. What was totally excluded was the factories and businesses that used to be in the areas – typically used for low-income populations. The railroad used to support the factories and businesses before, but this functional aspect was not taken into consideration when the High Line was built. As a result, the High Line ended up excluding the need-based population and favoring newcomers causing gentrification (Wolch, Byrne, and Newell 2014).

The Greenpoint neighborhoods in Brooklyn, New York can, otherwise, gives us an insight into environmental gentrification in such positive ways as environmental clean-up does not have to lead to gentrification when properly planned out. Greenpoint residents in New York experienced the risk to be displaced when the contaminated industrial site was being cleaned up by the newcomers of gentrification. Greenpoint is a working-class neighborhood with a long history of relying on the oil refining industry since 1800s. For this historical background, environmental issues have been claimed by the residents in this neighborhood since the late 1800s. A huge oil spill in Newtown Creek that surrounds the neighborhood was discovered decades after the incident occurred in the 1950s. Even with this existing environmental issue, however, the locational and environmental benefits of Greenpoint area have brought attention to newcomers in the 1980s like the other targeted neighborhoods for gentrification.

It was not until constructions began for gentrifiers that the oil contamination was discovered. Cleaning up the contamination around the Newtown Creek finally became a task to solve. Generally, such greening projects as cleaning-up old industrial sites include increasing recreational areas and parks. When considering sustainable neighborhoods, however, it is also required to think about the working class who rely on the industrial sites around Newtown Creek. Activists in Greenpoint made efforts to green the industrial sites enough to enhance the quality of life of the residents but not too much to threaten their life-base and favor only the newcomers. In other words, they tried to keep the industrial working-class residents have relied on, and at the same time, cleaned the contaminated sites. This brought the notion of "Just clean enough" to benefit the residents and not threaten them to leave (Eckerd 2010, Curran and Hamilton 2012).

Likewise, environmental gentrification extends the notion of the unequal impact of environmental hazards to the externality of neighborhood change such as gentrification in low-income neighborhoods. These examples show how low-income communities can confront potential displacement issues caused by the environmental improvement. These communities tend to be more environmentally vulnerable to contamination and abandonment issues. These cases also point out that regenerating or cleaning up existing vacant lands in urban areas have the potential to bring about gentrification. The gentrification flow in the Greenpoint neighborhood was triggered by a contaminated vacant site and the High Line case by regenerating an abandoned structure. Even when the vacant land is not being regenerated, maintaining the vacant properties can increase nearby property values caused by the improved environment (Heckert and Mennis 2012). While how the vacant land can trigger gentrification may differ by case, urban vacant land can be an actor in the gentrification flow.

CHAPTER III

RESEARCH DESIGN

3.1 CONCEPTUAL BASIS

This study expands the discussion of the life-cycle of vacant properties in urban areas described in Chapter II, analyzing urban vacant land in multiple contexts and scales. How land that eventually becomes vacant or stays vacant for a long time can be strongly determined by the characteristics of the land itself. For instance, a land stays vacant when the owner is passive or when the land has many physical restrictions. Alternatively, even if the vacant land is actively on the market, weak economic conditions or physically declining neighborhood conditions can contribute to long-term vacancies. Similarly, there are many aspects – in both a parcel and neighborhood scale – to look into when examining the causes and impact of vacancies. This study takes the land characteristics into consideration and examines longitudinal land vacancies in the neighborhood context by determining vacant land typology.

Additionally, as an extension of the argument that vacant land can be an opportunity to revitalize cities, this study amplifies the debate by examining the neighborhood change and gentrification phenomenon along with the existing vacant properties. How urban vacant land can impact human lives, physical structures, and economic conditions has been discussed in numerous ways. Yet, due to the complexity of the way land becomes vacant and remains so for a long time, the relationship between vacant land and our living environment cannot be explained in a simple way.

The Broken Windows Theory explains how vacant properties, as public eyesores, can increase negative perceptions, and furthermore, potential crime activities in a neighborhood (Wilson and Kelling 1982), which can eventually catalyze neighborhood decline. However, this

theory does not explain all the life-cycle of vacant urban land. Some vacant properties are actually utilized as a recreational area and promote active living around the properties. Or, even when a vacant property is an eyesore of the neighborhood, the context of the neighborhood may matter more, and the vacant property can be the targeted land for new development and trigger gentrification. According to the Collective Efficacy Theory, the same physical and maintenance conditions of a land can be seen differently depending on the social status and historical context of a neighborhood (Sampson and Raudenbush 2004). Thus, it can be questionable if the underlying theory of current vacant land scholarship is complete. The Broken Windows Theory would not explain the different life-cycle of vacancies associated with neighborhood context. This study adopts the concept of Collective Efficacy Theory with the life-cycle of vacant land to explore the heterogeneous spatial patterns and durations of vacant properties across different neighborhood status.

While many studies have identified numerous driving forces of gentrification in a neighborhood, how vacant properties interact with the flow of gentrification in a neighborhood has been understudied. Studies have shown conflicting ideas that vacant land is an opposite concept to gentrification (Marcuse 1985) or that a certain amount of vacancies is required for gentrification (Morckel 2013). What triggers gentrification can be different depending on the socioeconomic, locational, or functional characteristics of a neighborhood. Also, certain types of vacant properties can intensify or slow down the potential gentrification phenomenon in a neighborhood.

3.2 RESEARCH QUESTION AND HYPOTHESES

3.2.1 Research question

As discussed earlier, while a growing amount of research has been conducted on how vacant lands emerge in urban areas on a municipal scale, the causes and impacts of urban vacancies have not been fully discussed. Furthermore, the types of vacant land within neighborhoods in decline and potential inequity issues across space remain understudied. The research question directed by this inquiry is **"What types of vacant land are positively associated with neighborhood gentrification?"** To answer this question, this study examines 1) what are the land characteristics contributing to long-term vacancy, 2) how neighborhood socioeconomic characteristics are associated with spatially clustered vacant land, and 3) what types of vacant land are associated with the gentrifying process of a neighborhood.

3.2.2 Hypotheses

The research question can be specified with the hypotheses below:

Hypothesis 1	Parcel size, ownership, and land use determine the length of vacancies.
Hypothesis 2	Neighborhood-scale socioeconomic characteristics predict the type of vacant land.
Hypothesis 3	Certain vacant land types are positively associated with the gentrification process of a neighborhood.

3.3 RESEARCH SETTINGS

3.3.1 Three study approach

This study is designed to answer the research question by (1) examining the land characteristics that are associated with the long-term vacancies to designate types, (2) identifying relationships between vacant land types and neighborhood characteristics, and (3) analyzing the

influence of vacant land on neighborhood gentrification. Each approach will be examined as described below and as illustrated in the conceptual diagram (see Figure 4)

- ***Study 1 Vacant land typology designation.*** The first study includes specifying vacant urban land with identifiable land characteristics that can influence the duration of a vacancy. This study will develop a generalizable methodology to designate vacant land typology.
- ***Study 2 Neighborhood characteristics and vacancy types.*** This study examines the neighborhood socioeconomic characteristics around each vacant property. This phase explores the uneven distribution of vacant land and expands the discussion of the potential disadvantages to certain neighborhoods.
- ***Study 3 Vacant land in gentrifying neighborhoods.*** The third study emphasizes the gentrifying process of a neighborhood and how the accumulation of certain types of vacant land can influence the gentrification phenomenon.

3.3.2 Study area

The city of Minneapolis, Minnesota, was chosen as the study area for the examination of the vacant properties and their impacts on urban neighborhoods. Minneapolis, a city with a population of 410,939 (as of 2015), is within the Twin Cities Metro Area in Minnesota and shares a border with St. Paul, the state capital. Although the social and cultural border seems to encompass both cities, they have separate municipalities as well as different downtowns. Many neighborhoods in Minneapolis experienced population losses and increases in low-income populations from 2000-2010, which expanded arguments on inequity and poverty issues.

Furthermore, Minneapolis is one of the cities that experienced gentrification around its downtown (Hammel 1999). Many neighborhoods began to redevelop in the early 1970s, and the gentrification process had accelerated by the 1980s (Hammel and Wyly 1996). Minneapolis is

also characterized by a shift in racial demographics from a majority white population (over 93% until the 1970s) to a more diverse (but still white-dominant) population (63.8% as of 2010). Especially the North Loop area, which used to be a derelict warehouse area during the 1960s and 70s, has been rapidly revitalized since then with the advantage of being adjacent to the downtown (North Loop Neighborhood Association 2016, Minnesota Compass 2011).

Minneapolis has also run the Vacant Housing Recycling Program (VHRP) in recent years to increase home ownership and manage vacant properties. This program was initiated by the City of Minneapolis department of Community Planning and Economic Development. The program expects to increase mixed-income communities and develop affordable housing opportunities by offering city-owned properties (minneapolishomes.org). VHRP manages the land bank, renovates housing units, and sells the properties to individuals.

While neighborhoods in Minneapolis seem to have gone through various life-cycle phases, overall the city has been stable in economic and population growth despite national industrial and economic shifts over the last few decades. Choosing a city in a stable condition is necessary to understand how vacant land generally functions with other potential external effects controlled. Shrinking cities might have a rich inventory of urban vacant parcels. However, the market demand may be so low that properties may stay vacant for an extended time, and short-term durations may not be easily observed. In the same vain, rapidly growing cities may show faster vacancy turnovers with continuous development activities, but this market force can be too strong to examine the effects of vacant parcels on surrounding areas. Thus, by choosing a stable city like Minneapolis, while still carrying the limitation of a case study, the results of this study would be more generalizable, establishing external validity.

3.3.3 Dataset

The primary dataset is the "MetroGIS Regional Parcel Dataset" from the Twin Cities Metropolitan Area (Hennepin County 2016). This data includes information on ownership, land use (including vacant lands), and taxes in a geographical format useful for identifying vacancy patterns. The most current parcel data is updated quarterly and the year-end data from previous years are accessible and downloadable. Information on vacancies was included beginning from 2005 and, currently, the year-end data from 2005-2015 are available. This parcel data has been collected for tax purposes by Hennepin County.

Vacant properties were identified using the parcel dataset that includes vacancy information by Hennepin County for taxation purposes. These vacant properties may or may not have structures, but do not serve a function. This dataset can be equivalent to how Bowman and Pagano (2010) defined vacant land, which includes not only the abandoned urban properties but also the greenfield-type undeveloped vacancies.

This dataset provides parcel attributes with information on completeness assessment to provide reliability and validation of the data. The data shows the records of 95% completed and properly formatted showing high reliability for research purposes. Figure 3 shows the current vacant land inventory in Minneapolis, MN.

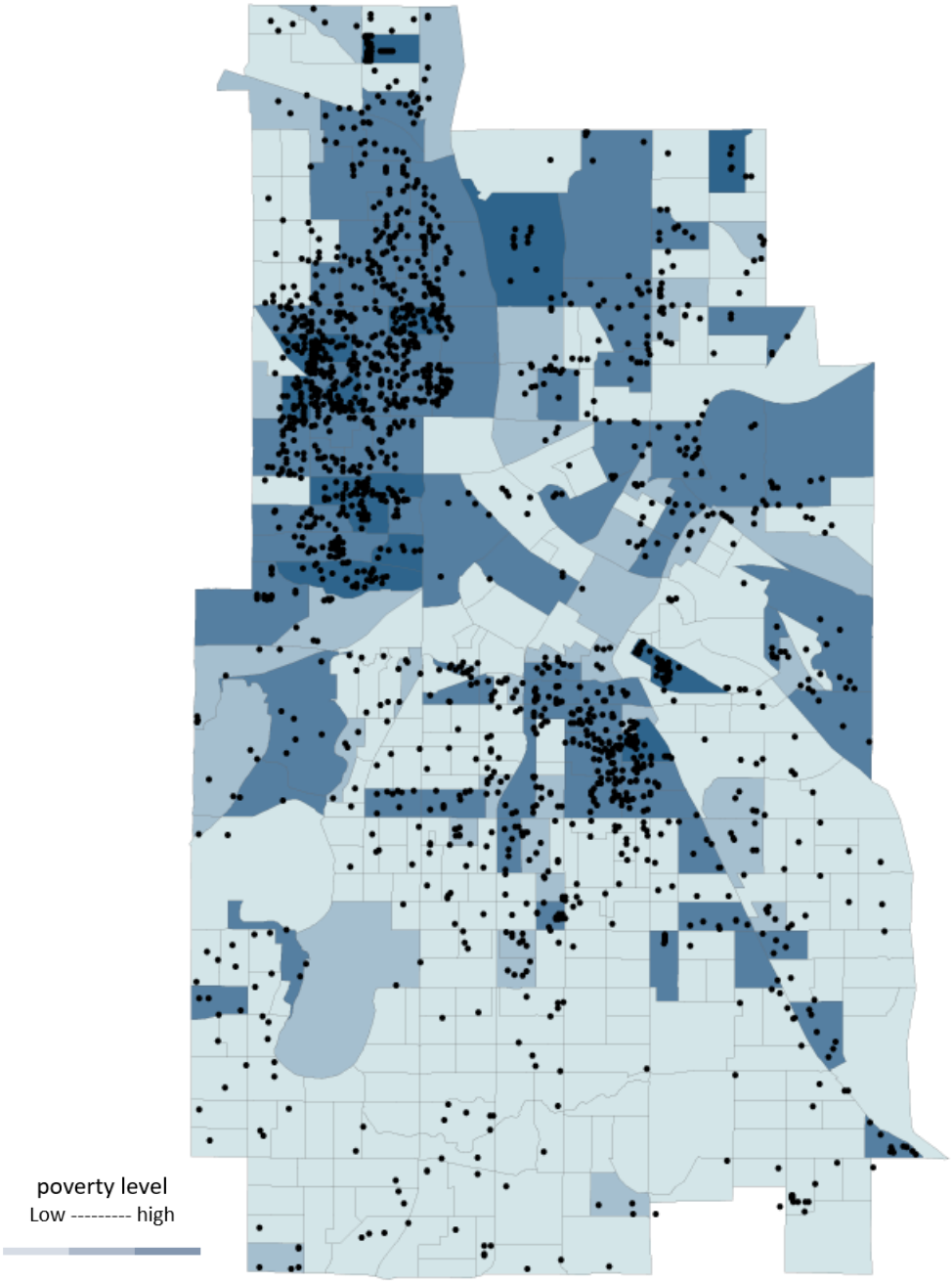

Figure 3 Study Area: Minneapolis, MN

3.4 CONCEPTUAL FRAMEWORK

This study includes three studies to answer the research questions and three hypotheses described above. The next diagram shows each study at a glance, and *3.3.1 Three study approach* section describes how each study builds into each other. Finally, Chapter IV, V, and VI will examine each hypothesis.

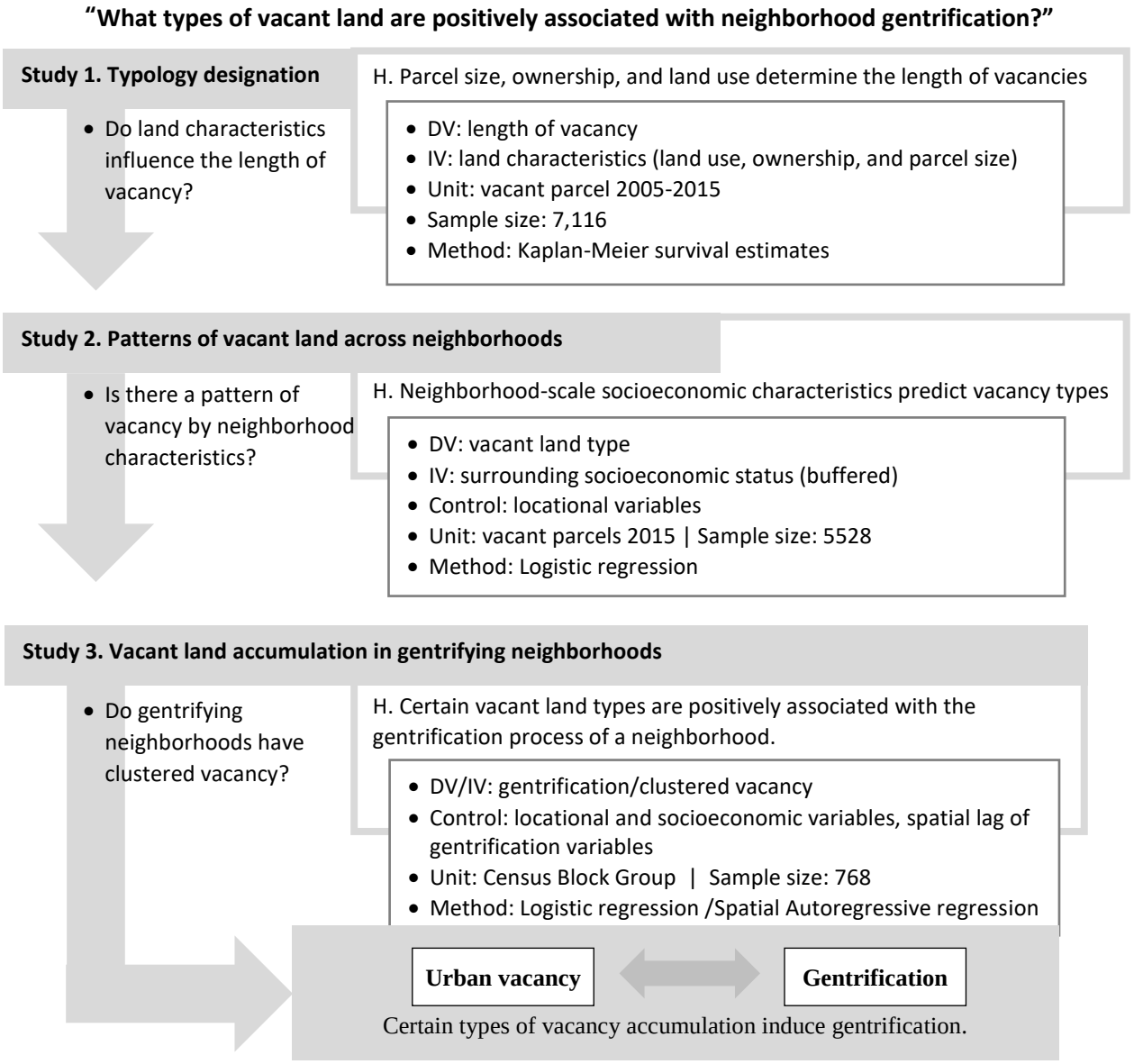

Figure 4 Conceptual framework

CHAPTER IV

VACANT LAND TYPOLOGY DESIGNATION

4.1 INTRODUCTION

The inventorying of urban vacant properties has become an important tool for planners and policy makers to strategically manage and repurpose vacant land of a city. However, the way the inventory is collected differs by city because of the multiple types of vacant land existing and different ways of defining vacant land by the purpose of collecting the information. Furthermore, vacant properties can have very different features depending on the way the vacant land was generated, which makes it more difficult to have a consistent measure of urban vacancies. Thus, the inconsistent measurement of urban vacancies has become a growing concern limiting the potential of vacant land research and possible application of a case study to other cases.

It is now essential to understand what types of vacant properties exist in urban areas and how they differ from each other. More vacant properties may appear when a neighborhood starts declining, or when an institute decides to keep land typically in an urban periphery. Likewise, the causes of vacancies and the fate of each property can be very distinctive. While it may not be feasible to individually track all the causes of vacant land in a city, some common features can be identifiable, which can also give us a hint to identify the differences and classify the vacant properties.

To understand the causes and potential impacts of vacancy accumulation in urban areas, this chapter examines the longitudinal vacancy trends. To measure the types of vacant properties that persist or become regenerated quickly, and how the land characteristics contribute to vacancy duration, the existing vacant land inventory between 2005 and 2015 in Minneapolis, Minnesota will be examined. Kaplan-Meier survival estimates will be used as a tool to analyze

the different vacancy duration and to come up with a methodology to identify the generalizable vacancy types across localities.

The Metro area for the twin cities including St. Paul has collected detailed parcel data and made it available as a GIS format for public since 2003. This dataset later includes vacant properties since 2005. The parcel information is being updated every quarter and uploaded on website every year (Metropolitan Council of Minneapolis-St. Paul 2016). This dataset includes parcel information including ownership, sale price, and tax information. In the case of the parcels in Minneapolis, Hennepin County (Hennepin County 2016) collects and stores the information.

Minneapolis has progressively managed abandoned and neglected properties by land banking and renovating the structures. Under the name of the Vacant Housing Recycling Program (VHPR), the city land-banked vacant properties and the city-owned abandoned structures were renovated and sold for the residents. The VHPR has later evolved to the current Minneapolis Homes program that provides opportunities for residents to 1) buy a renovated home, 2) build a home on the lot, and 3) rehabilitate a vacant property. By providing affordable lot or home, this program expects to increase citywide home ownership as well as manage existing vacant properties (Minneapolis 2018). While this study does not account for the effects of the city policies such as VHPR and Minneapolis Home, how Minneapolis progressively identifies vacant properties can be an effective example to potentially manage citywide long-term vacancies

4.2 OBJECTIVES

To measure the identifiable features of vacant land types, this chapter aims to examine the major land characteristics that contribute to long-term vacancy and use these characteristics to develop a typological classification shaped for vacant properties. Specifically, three common

land characteristics– land use, parcel size, and ownership –identified in Chapter 2.1.3, will be examined as the main variable to determine how they impact the length of vacancies. Furthermore, this study will classify vacant properties into a few types and develop a methodology for this procedure.

Hypothesis 1	Parcel size, ownership, and land use determine the length of vacancies.

4.3 METHODS

4.3.1 Study design

This study will examine the three major characteristics that can contribute to long-term vacancies: land use, ownership, and property size. Using these identifiable land characteristics, this study will measure how the lengths of vacancy differ by the land characteristics in Minneapolis. The vacancy durations of parcels by property size, ownership, and land use will be compared to determine whether the differences between land characteristics are significant. Last, using the land characteristics, a generalizable method to identify the vacant land typology will be introduced and designated for each vacant property in Minneapolis.

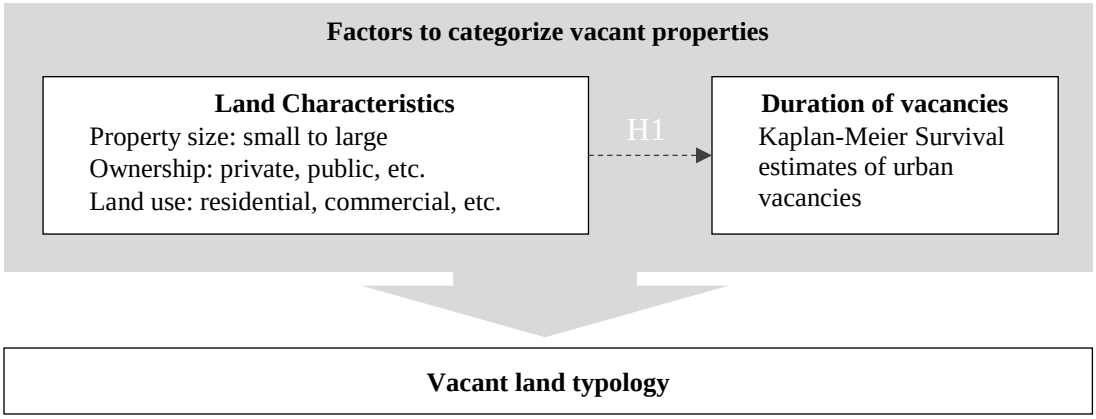

Figure 5 Study design for Study 1

4.3.2 Longitudinal measurement of urban vacancies

The duration of vacancies needs to be measured to examine any potentially different impact between the various vacant lands. Thus, the length of time that a parcel remained vacant in Minneapolis at any time between 2005 and 2015 will be measured by each parcel. If a land is vacant for only a short period of time, it will make less of a contribution to accumulated vacancies. If a vacant land is not regenerated for a long time, it will likely contribute to vacancy accumulation. Likewise, measuring the duration of a vacancy expects to capture the land characteristics contributing to longitudinal accumulation of vacancies.

The vacant parcel data from Minneapolis was longitudinally matched using a parcel identification number (PIN). Each parcel has its own identification number, which allowed this study to match parcels between 2005 and 2015. Some parcels had newly assigned PINs. In this case, two different PINs are geographically matched. Vacant land data prior to 2005 is not available so this study limits the study time only to the past 10 years.

While, theoretically, the duration of a vacancy can be a decent measure to understand the accumulation of vacancies, longitudinally tracking back all the vacant parcels may not be realistic. Operationally, there ought to be some left- or right-censored data; there may be some vacant land with no information in the past or there is no way to know what will happen in the future. The figure below shows the potentially limited information with left- or right-censored data between 2005 and 2015. This illustrates that the exact duration length of a vacancy itself cannot be calculated with the given secondary data. Thus, this study uses Kaplan-Meier survival estimates that takes into consideration of the right-censored data by adopting the concept of "possibility to be occupied" for the appropriate study variable. This variable is also called a

"hazard ratio." The left-censored data needs be excluded to measure the survival rates due to the limited information prior to 2005.

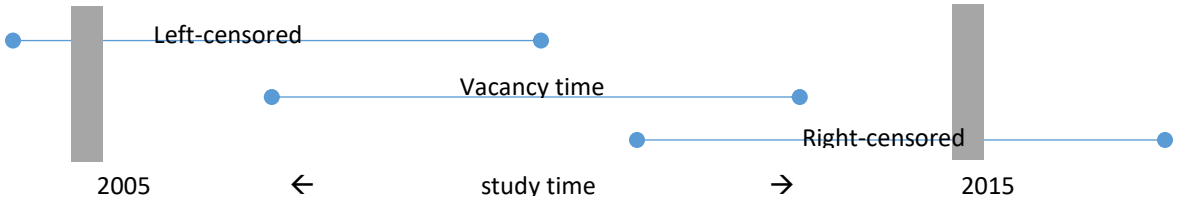

Figure 6 The concept of censored data

One assumption here is that when a parcel was merged or split, the life-cycle of the vacancy restarts. While it might be argued that the merging process does not change the land characteristics of a vacant parcel, the merging activities can be treated as a "significant event" of the parcel. Thus, if a parcel was merged or split, the duration of the earlier parcel ends, and if split, they are considered separate parcels. The table below (Table 2) shows the different types of operational adjustment made when matching the PINs.

Table 2 Vacant land data collection

Issues with matching parcels	Total data (2005-2015)	Valid data
Parcels merged	228	228
Parcels split	121	121
Parcels Changed (Reshaped)	303	303
PIN Matched and manually adjusted	38	38
Duplicates from adjusting PINs (excluded)	19	-
Duplicates (excluded)	626	-
Total	7761	7116

4.3.3 Classifying vacant land

As stated in Chapter II, parcel size, land use, and ownership are the main land characteristics that can determine the duration of a vacancy. Each land characteristic is briefly described below and will be analyzed using the survival estimate introduced in Section 4.3.2 Longitudinal measurement of urban vacancies

Parcel size

The size of a parcel is one of the main characteristics that blocks or promotes the reuse of vacant land. A parcel that is too small may not be eligible to be developed or the activities that are allowed on it are restricted (Schenk 1978). When a vacant parcel is excessively large, on the other hand, it could be vacant due to physical restrictions or a hazardous location (Northam 1971). Alternatively, a corporation may have kept vacant land in case they might need it in the future (Northam 1971).

This study specifies parcel size into three categories – small, moderate, and large – operationally using quantiles. When Parcels within the "small" category will represent the land that is too small and not very suitable to be occupied or regenerated. Parcels within the "moderate" category represent the land most suitable for regeneration. Parcels in the "large" category represent the ones that are excessively large for typical regeneration and may require a long-term plan to regenerate. It could be argued that breaking the sizes into categories may aggregate the specific size information and exaggerate the threshold of the size breaks, which will eventually increase bias when continuous data is categorized (Royston, Altman, and Sauerbrei 2006). However, this study expects to compare the duration of vacancy by different groups of land characteristics through Kaplan-Meier estimates, and therefore, needs to group the vacant properties by different parcel size. Furthermore, the size of vacant properties does not

have a linear relationship with the duration of vacancy and is expected to have a U-shape relationship. Categorizing vacant properties into three categories can help identify the potential U-shaped relationship (Altman 2005). Conceptually, breaking parcels into categories will help to understand more intuitively how different sizes of vacant land have a different influence on the duration of a vacancy. This study uses quantiles to divide the data into three categories – small, moderate, and large. Having the same number of observations in each category is thought to be the most usual method when grouping a categorical variable (Altman and Bland 1994, Altman 2005).

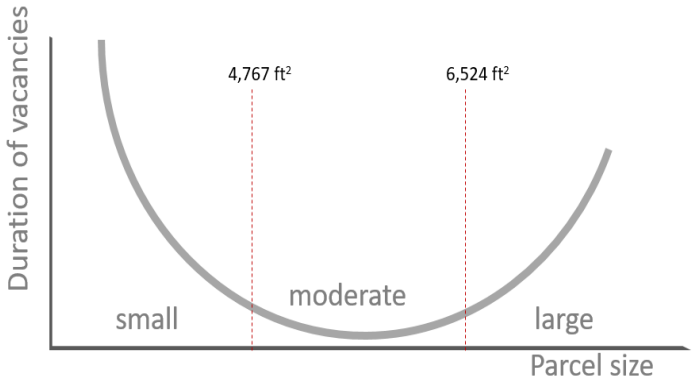

Figure 7 Operational size break

Table 3 Size groups: left-censored data and event occurance between 2005 and 2015

Sample	Size group	Event = 0 (no occupation occured)	Event = 1 (became occupied at some point)	Event %	Total
All	**Total**	**3,768**	**1,447**	**27.7%**	**5,215**
	Small	1,244	446	26.4%	1,690
	Moderate	1,218	538	30.6%	1,756
	Large	1,306	463	26.2%	1,769
Left-censored	**Total**	**2,464**	**906**	**26.8%**	**3,379**
	Small	978	354	26.6%	1,332
	Moderate	628	302	32.5%	930
	Large	858	259	23.2%	1,117
All – Left-censored	**Total**	**1,304**	**532**	**29.0%**	**1,836**
	Small	266	92	25.7%	358
	Moderate	590	236	28.6%	826
	Large	448	204	31.3%	652

Figure 7 shows how the parcels in Minneapolis were operationally broken into three categories using the vacant property date as of 2015. The same thresholds were used to identify size groups for the vacant properties prior to 2015. Table 3 shows the descriptive statistics on the size groups for total 5,215 vacant properties during the study time (between 2005 and 2015). Overall, 27.7% of the vacant properties in Minneapolis became occupied at some point within the study time. The left-censored sample shows the vacant properties that were already vacant when the study time began in 2005 and have no information prior to that. Among the 5,216 vacant parcels, parcels with left-censored information (3,379 parcels) will not be accounted for Kaplan-Meier survival estimate due to the missing information of the time a land became vacant.

Ownership

Additional to parcel size, ownership is as well highly related to the potential of a parcel to be repurposed (Németh and Langhorst 2014, Adams 1994, Kivell 1993). For instance, a complex ownership can restrict further development activities (Schenk 1978, Kivell 1993, Berkman 1956). Another noticeable mechanism is that land changes differently depending on whether the owner is active or passive (Adams 1994). Although intuitively, private sectors are more active than public sectors, it is not clear which owners are passive or active (Adams et al. 2002). Economic decline causes private owners to become passive actors. Thus, during the redevelopment phase, it is more challenging to determine which sector can be more active (Adams et al. 2002). While it may be still arguable whether public/private ownerships represent the active/passive actors, realistically distinguishing the passive actors from active may not be feasible. Having that variation kept as a limit, this study uses private/public ownership as a proxy to passive and active ownerships.

Table 4 shows the total number of samples, left-censored data, and event occurrence for each ownership group during the study time (between 2005 and 2015). While ownership can be switched anytime within the study time, this study mainly examines the ownership by the time a land becomes vacant. In the case the land was already vacant when the study time began, the ownership in 2005 was measured instead. The total number of samples are different from the size groups (Table 3) because only residential or commercial properties were examined for the size groups.

Table 4 Ownership groups: left-censored data and event occurance between 2005 and 2015

Sample	Ownership group	Event = 0 (no occupation occured)	Event = 1 (became occupied at some point)	Event %	Total
All	Total	5,390	1,726	24.3%	7,116
	Private	2,791	1,220	30.4%	4,011
	Public	2,599	506	16.3%	3,105
Left-censored	Total	3,875	1,140	22.7%	5,015
	Private	1,831	726	28.4%	2,557
	Public	2,044	414	16.8%	2,458
All – Left-censored	Total	1,515	586	27.9%	2,101
	Private	960	494	34.0%	1,454
	Public	555	92	14.2%	647

Land use

Lastly, land uses are taken into consideration. While vacant parcels do not have any uses on the land, the designated land use of a property can be identified from the original purpose of the subdivision. For instance, vacant properties in subdivided residential areas are typically 'Residential vacant land.' Urban parcels function differently according to the designated land use and therefore have distinctive characteristics depending on the land use type. Land use robustly determines the characteristics of parcels and does not usually change when being redeveloped.

Among the land use types, residential and commercial lands are the major uses in a land market and respond to the market more quickly than do other land uses. They are also the main actors of neighborhood change, either encouraging or discouraging development activities when vacant parcels are being developed–yet they function differently. Furthermore, looking at the land use helps to distinguish industrial sites, green space, institutional land from residential or commercial properties.

Table 5 shows the total number of samples, left-censored data, and event occurrence for each land use group during the study time (between 2005 and 2015). The way land use was measured is same as ownership using the information by the time a land becomes vacant or the information in 2005 in the case the land was already vacant.

Table 5 Land use groups: left-censored data and event occurance between 2005 and 2015

Sample	Land use group	Event = 0 (no occupation occured)	Event = 1 (became occupied at some point)	Event %	Total
All	**Total**	**5,390**	**1,726**	**24.3%**	**7,116**
	Residential/Commercial	3,673	1,430	28.0%	5,103
	Industrial	671	145	17.8%	816
	Institutional	412	78	15.9%	490
	Park & Recreational	634	73	10.3%	707
Left-censored	**Total**	**3,875**	**1,140**	**22.7%**	**5,015**
	Residential/Commercial	2,387	902	27.4%	3,289
	Industrial	564	119	17.4%	683
	Institutional	338	58	14.6%	396
	Park & Recreational	586	61	9.4%	647
All – Left-censored	**Total**	**1,515**	**586**	**27.9%**	**2,101**
	Residential/Commercial	1,286	528	29.1%	1,814
	Industrial	107	26	19.5%	133
	Institutional	74	20	21.3%	94
	Park & Recreational	48	12	20.0%	60

4.3.4 Measuring survival estimates

To analyze how the duration of a vacancy differs by the land characteristics discussed earlier, a Kaplan-Meier (K-M) survival estimate (Kaplan and Meier 1958) will be conducted instead of analyzing the actual duration of vacancies. This method is useful in describing the survival functions of a variable without including any additional explanatory variables (Allison 1984). A K-M survival estimate does not account for specific years but analyzes the duration of a vacancy within a given period.

For this study, the probability of a parcel remaining vacant or becoming occupied over time will be measured with K-M graphs using the vacant property data of Minneapolis, Minnesota, between 2005 and 2015. Presenting the risk for a vacant land to become occupied within the study period, this method allows comparing the survival estimates by land characteristics on a graph. It brings the benefit of understanding the different potentials for a vacant land to become occupied depending on the land characteristics or types that will be discussed in 4.3.5.

Figure 8 shows the overall survival estimates of vacant parcels in Minneapolis. Using the information from 2005 to 2015, this graph estimates how long a vacant parcel may stay vacant and when it should become occupied. The y-axis shows the survival rate, in other words, the probability for a parcel to stay vacant. It starts from 1 in the year 0 meaning that none of the vacant parcels became occupied. As time passes, the survival rate drops. The x-axis shows the analysis time, and in this case, the unit is the year. This chart shows that the survival rate of vacant parcels in Minneapolis had the highest drop during the first and second years and for the rest of the years shows a very low probability of being occupied. This can also be interpreted that

vacant parcels tend to be regenerated within a couple of years after the parcel becomes vacant and tend to stay vacant for a long time if not regenerated within the first two years.

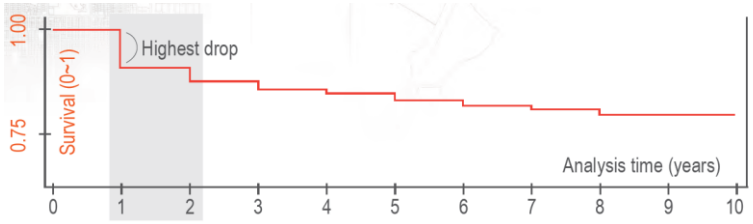

Figure 8 Kaplan-Meier survival estimate on vacant parcels in Minneapolis (2005-2015)

4.4 RESULTS

4.4.1 Kaplan-Meier survival estimates on land characteristics

The log-rank test results for the equality of survivor functions using land characteristics show that vacant properties have different survival rates. Overall, different types of ownership and land use significantly vary the probability for a parcel to stay vacant while parcel size was not influential. Figure 9 shows the survival graphs for three land characteristics; each land characteristic includes two graphs with and without adjusting for the other two land characteristics.

Parcel size

As for parcel size, this study hypothesized that too small or excessively large parcels would have longer vacancy durations. The result indicates that the null hypothesis that the survivor curves are equal for small, moderate, and large parcel sizes were not rejected at an 95% confidence level (p=0.1299). This means that the differences of the survivor curves between groups are not significant. However, when the size groups were separated into small vs larger parcels, the group differences became significant (p=0.0486). This implies that moderate to large

vacant parcels do not have different possibilities for being regenerated while small size parcels tend to be regenerated more quickly than the rest. When looking at the survival graphs by each size group, the differences between small parcels and larger parcels become more obvious. The survival rates for larger parcels drop to below 0.5 in the second year while the rate for small parcels is still higher than 0.75. Even though the differences between moderate and large sizes did not turn out to be significant, the graph indicates that larger size parcels still have a slightly higher duration of vacancies. In the tenth year, small parcels still have an above 0.5 survival rate showing a more than 50% chance of survival while the survival rates of larger parcels drop to below 0.25.

Existing literature posits that large parcels would be less developable and stay vacant longer than moderate size. However, the survival estimate results from above are showing patterns against the literature. Note that the survival rates were measured after excluding the left-censored data. While the survival rate for moderate and large parcels show no significant difference, left-censored data from Table 3 shows that large parcels tend to have the highest portion of long-term vacancies over 10 years. Specifically, almost 76.8% of the large parcels have stayed vacant during the whole study time. Compared to the moderate-size parcels that 67.5% accounts for 10-year vacancies, large parcels are showing more long-term vacancies. Thus, the counter-explanatory results from the survival estimates were possibly due to the exclusion of left-censored data.

Ownership

For land ownership, the null hypothesis that the survivor curves are equal for public and private ownership was rejected at a 99% confidence level ($p = 0.00$). The graph also shows that the survival rate for publicly owned parcels is higher than for privately owned parcels. When

controlling other land characteristics, the differences between public and private ownership becomes more pronounced. At the 10th year, public ownership still has a survival rate of over 0.75 while the private ownership rate drops to almost 0.5 showing a higher possibility of being reoccupied. This difference shows that privately owned vacant parcels tend to be regenerated more quickly than publicly owned parcels. While it may be argued that public and private ownership may not be able to fully capture the difference between active and passive ownership, the survival rate results show a significant difference in capturing different life cycles by ownership. It may still be argued that private ownerships do not fully capture the active owners actively regenerating parcels. Instead of specifying ownership in more detail, which might also be unrealistic, this study expects that the land use types and parcel sizes will control what public/private ownership may not capture. For instance, owners of a large undeveloped land would likely be passive owners. Owners of moderately sized residential properties are likely to be active owners.

Land use

For the land use types, the null hypothesis that the survivor curves are equal for residential, commercial, industrial, institutional, park and recreational land uses was rejected at a 99% confidence level ($p = 0.0015$). The Kaplan-Meier survival graph for land use shows that residential and commercial land has a lower survival rate than park and recreational land use types, or industrial and institutional land uses. When adjusted for ownership and parcel size, the differences between land uses becomes more obvious. Institutional and industrial vacant parcels keep survival rates at over 0.75 even at the 10th year showing very low possibilities of being regenerated. Alternatively, residential, commercial, and park and recreational vacant parcels

show survival rates that drop to almost 0.50 in the first year and lower than 0.25 in the 10^{th} year. This indicates a huge difference in life cycle by land use.

One thing to point out is that while park and residential land use is expected to stay vacant longer than any other land use type, the test results show an opposite result. This is because the parcels that have stayed vacant for the whole period of the study have been excluded from the Kaplan-Meier test due to left-censored information (see Table 5). When measuring survival estimates, left-censored parcels that did not include information prior to 2005 had to be excluded from the calculation, and the test excluded the majority of parks and recreational parcels that stayed vacant for more than a decade. While a majority of the park and recreational land use types tended to stay vacant longer than other types, when it comes to the newly generated park and recreational land use types, they have a shorter vacancy and are regenerated more quickly than other land use types.

To summarize the results, the size variable shows that small parcels tend to stay vacant longer than other parcels. Also, moderate sized parcels have a higher regeneration potential than other size groups even though the difference is not statistically significant. When each variable was adjusted for the other two variables, the graphs showed the different durations of vacancy more clearly for all the variables. This implies that these three variables need to be taken into consideration together, not separately.

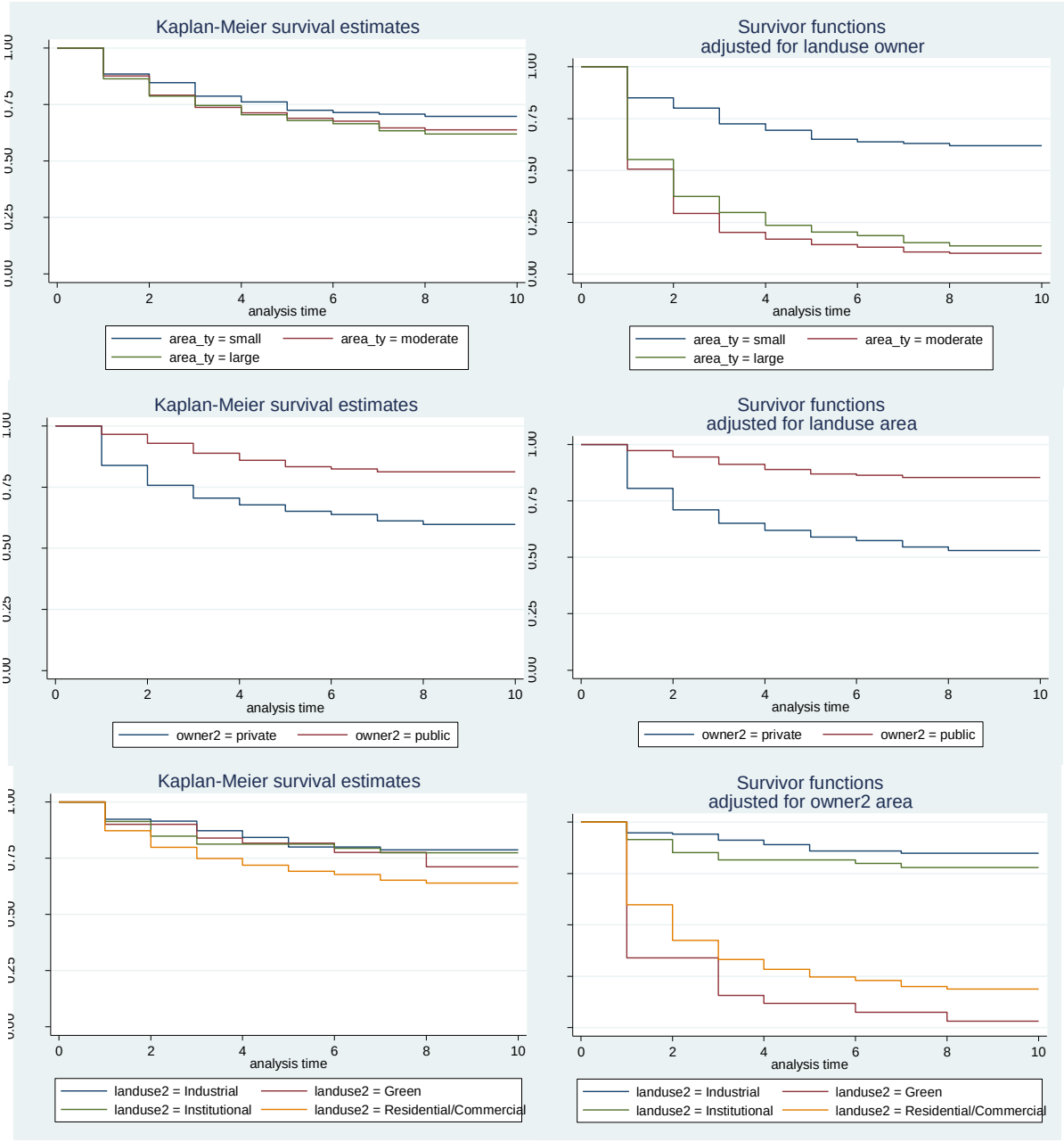

Figure 9 Kaplan-Meier survival graphs on land characteristics

4.4.2 Typology designation process

From Section 4.3.3 Classifying vacant land, three major land characteristics that can contribute to long-term vacancies were identified. Additionally, the life cycle of each land characteristic was measured using Kaplan-Meier survival estimates. These processes showed that small, publicly owned, institutional, or industrial vacant properties tend to have long-term vacancies. This implies that these land characteristics are contributing to the survival rates of vacancies, and therefore, different types can be identified using these characteristics.

Using the Kaplan-Meier survive estimate results from the previous section, six different types were identified. Industrial, institutional, and park and recreational properties typically have straightforward characteristics. Thus, each was identified as a vacant land type. Meanwhile, residential and commercial properties are expected to be more dynamic based on the land characteristics. So, parcel size and ownership were taken into consideration for residential and commercial properties. The final six types identified through this process are: Speculative, Remnant, reserved, Dormant, Recreational, and Civic. Each type is described below. Figure 10 and Table 6 describe what land characteristics each vacancy type accounts for.

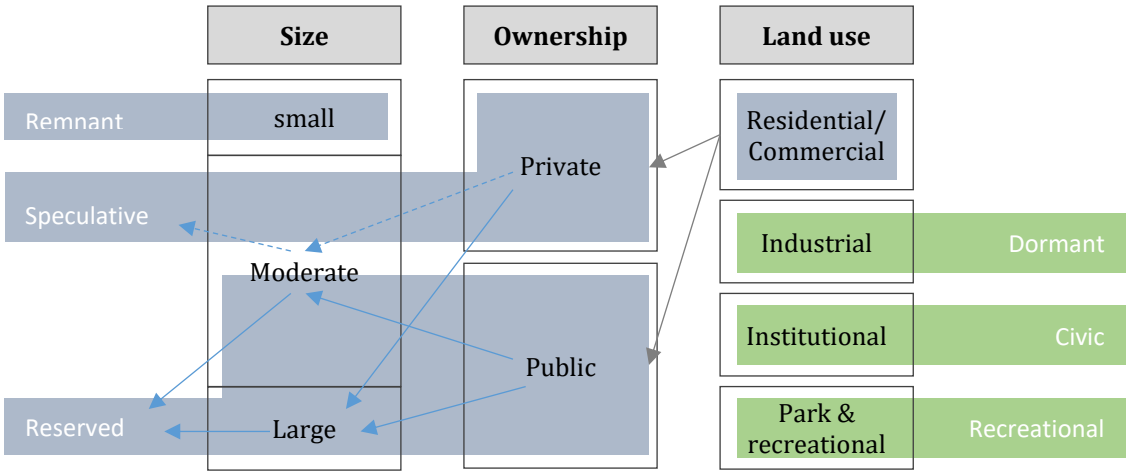

Figure 10 Six vacancy types by land characteristics

Speculative land

Speculative land represents the vacant parcels that are most active on the market. Expected to be owned by private owners, these parcels are a moderate size and can be developed without any physical restrictions. Considered to be the most active among vacant properties, these lands are identified as either residential or commercial. The parcels become vacant mostly because of a mismatch between demand and supply in the market but will soon be used when the proper time comes. For this reason, this type of vacant land tends to stay vacant for a shorter period of time than any other vacant parcels that have certain limits on regeneration. It is in line with the concept of the frictional unemployed land of (Schenk 1978). Frictional (wait) unemployment occurs due to the heterogeneity between the demand and supply – the amount of jobs and workers. Similarly, vacancies also emerge from not enough demand for the available land. Speculative land could have been either abandoned or managed depending on the owners. This type is not listed in the vacant land typology of Northam (Northam 1971) that does not discuss vacant land that is soon-to-be active.

Remnant land

Remnant land includes residential or commercial land that is unbuildable due to the small parcel size. Physical restrictions can lead to land that is hardly active in the market and is therefore considered dead (Aschman 1949). Whether or not the land is being managed well, this type of vacant land does not benefit municipal governments because of lost revenue and increasing maintenance. This type of land can be harmful to a community (Aschman 1949).

Reserved land

Reserved land includes residential or commercial properties kept vacant for certain purposes by either public or private ownership. This includes vacant properties reserved for

certain uses in the future. Sometimes a massive piece of land is being kept for the relocation of a corporation or potential needs for the municipals (Northam 1971). Due to passive ownership or a tax-exemption, even public properties with a moderate size tend to stay vacant longer than Speculative private properties.

Dormant land

Dormant land represents the brownfield type that was once an industrial site but has become vacant at some point in the past. This land could be contaminated or still be hazardous due to earlier land use (Kivell 1993). Dormant land tends to stay vacant a long time because, once the dominant industry shifts, it is hard to replace it with another industry. Also, the cost of converting it from industrial to another land use is a consideration in regenerating this vacant land.

Recreational land

Recreational land represents the green infrastructure from the vacant land inventory. Sometimes vacant properties are used as a park or a space for leisure but is still designated as vacant land without serving an official purpose. Operationally, this study identifies Recreational land by examining the current land use along with the vacant land inventory.

Civic land

Civic land represents institutional properties including schools, public facilities, and land associated with religions. These properties may be owned by either the public or private sector and can be any size. By serving the specific purpose of each institution, these parcels wait for the harvest time for the best profit (Schenk 1978) or are reserved to be used in the future (Northam 1971). Because the land use dataset does not identify vacant land with a civic purpose, Civic land

was operationally identified using the ownership information of each parcel. Thus, properties with institutional ownership are identified as Civic land.

Table 6 Typology designation process

Type	Description	Land use	Ownership	Size
Remnant land	• Parcels with restricted uses		Public/Private	Small
Speculative land	• Parcels active in market	Residential/ Commercial	Private	Moderate
Reserved land	• Parcels reserved for future uses		Public Private	Moderate to large Large
Civic land	• Parcels used for civic purposes	Institutional	-	-
Dormant land	• Parcels that used to be for industrial uses	Industrial	-	-
Recreational land	• Parcels for park and recreational uses	Park & Recreational	-	-

4.4.3 Kaplan-Meier survival estimates on vacant land types

Using the criteria suggested from the previous section, 5,440 vacant parcels in Minneapolis, MN (Table 7) were designated as one of the six types. Residential and commercial vacancies (Remnant, Speculative, and Reserved lands) accounted for almost 64% of the total vacancies in Minneapolis. Dormant land accounted for 12.8% of the citywide vacancies indicating that more than 10% of the vacant properties of the city are industrial. Civic land accounted for 9% and Recreational land for 13.1%. Note that the Recreational land is expected to be the undeveloped empty vacancies, which may not be counted for abandonment or blight types of vacancies.

To identify the different life cycle of each vacant land type, log-rank tests of survivor functions were conducted on the six vacant land types. The results indicated that the null hypothesis that there is no difference between the types was rejected (p=0.000). The graph in Figure 11 shows the different survival functions of each type. The graph indicates that

Speculative land has the lowest survival rate of over 10 years. In the first year after a parcel becomes vacant, the rate drops to below 0.80 showing a higher possibility of being regenerated than other vacancy types. Remnant and Reserved lands follow showing the survival rates dropping to below 0.75 points in the 10th year. Dormant, Civic, and Recreational lands show relatively higher survival rates indicating more potential for having long-term vacancies.

Table 7 Vacant land types in Minneapolis, MN.

Vacant land typology	Remnant	Speculative	Reserved	Dormant	Civic	Recreational
Freq.	1,180	645	1,716	696	489	714
Percent (%)	21.69	11.86	31.54	12.79	8.99	13.13

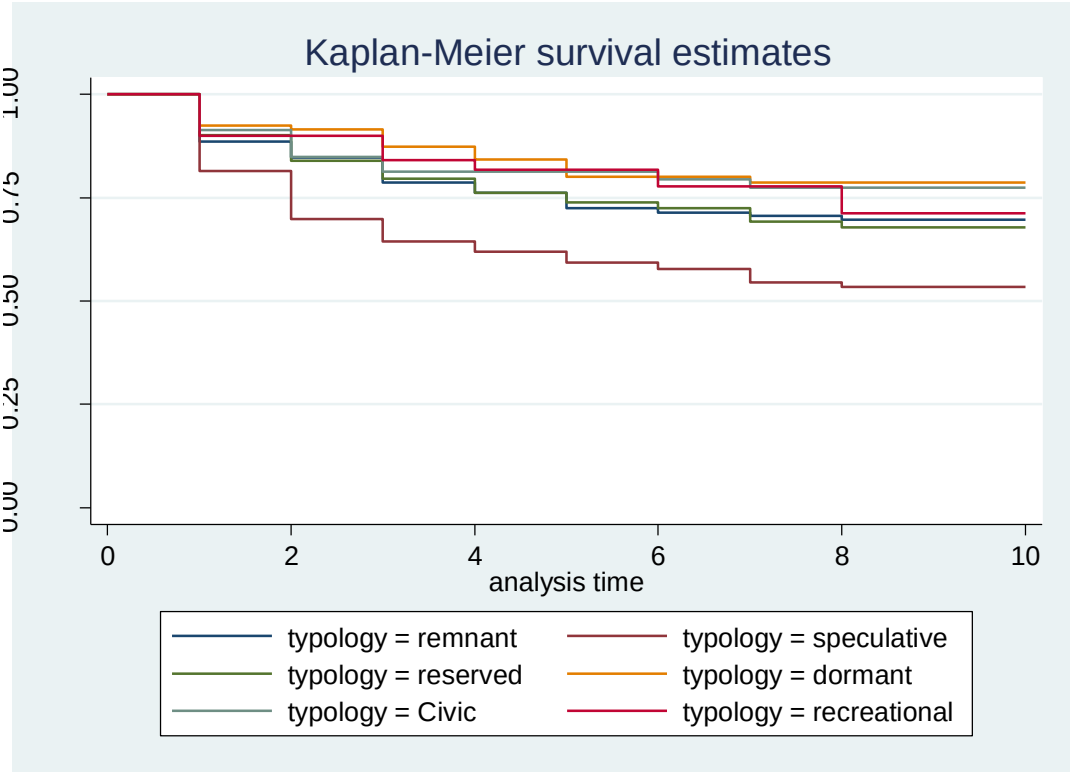

Figure 11 Kaplan-Meier survival graphs on vacant land type

4.4.4 Mapping vacant land in Minneapolis

Figure 12 shows the current distribution of vacant properties in Minneapolis, MN as of 2015. Each vacant property was mapped by the duration of vacancies. Red areas indicate where the long-term vacancies are located. Many large size parcels show long-term vacancies along the river and the outskirt of the city. Residential areas show the mixture of both long-term and short-term vacancies.

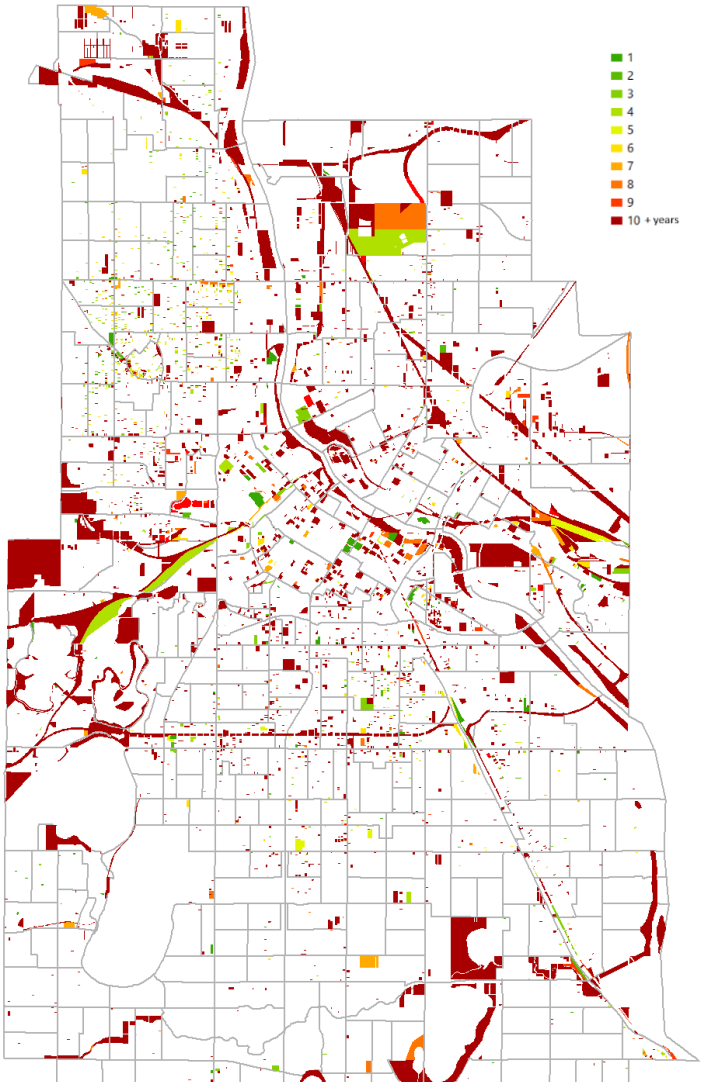

Figure 12 Distribution of vacant land by duration (Minneapolis, MN)

Figure 13 illustrates the distribution of vacant properties by vacancy type: Remnant, Speculative, Reserved, Dormant, Civic, and Recreational lands. Many long-term vacancies identified from Figure 12 turned out to be either green space or industrial vacancies. The right map in Figure 13 shows the five vacancy types excluding Recreational land with the intention to exclude undeveloped greenfield. This process shows how the different features of vacancies such as greenfield and brownfield can be controlled using the typology developed in Study 1.

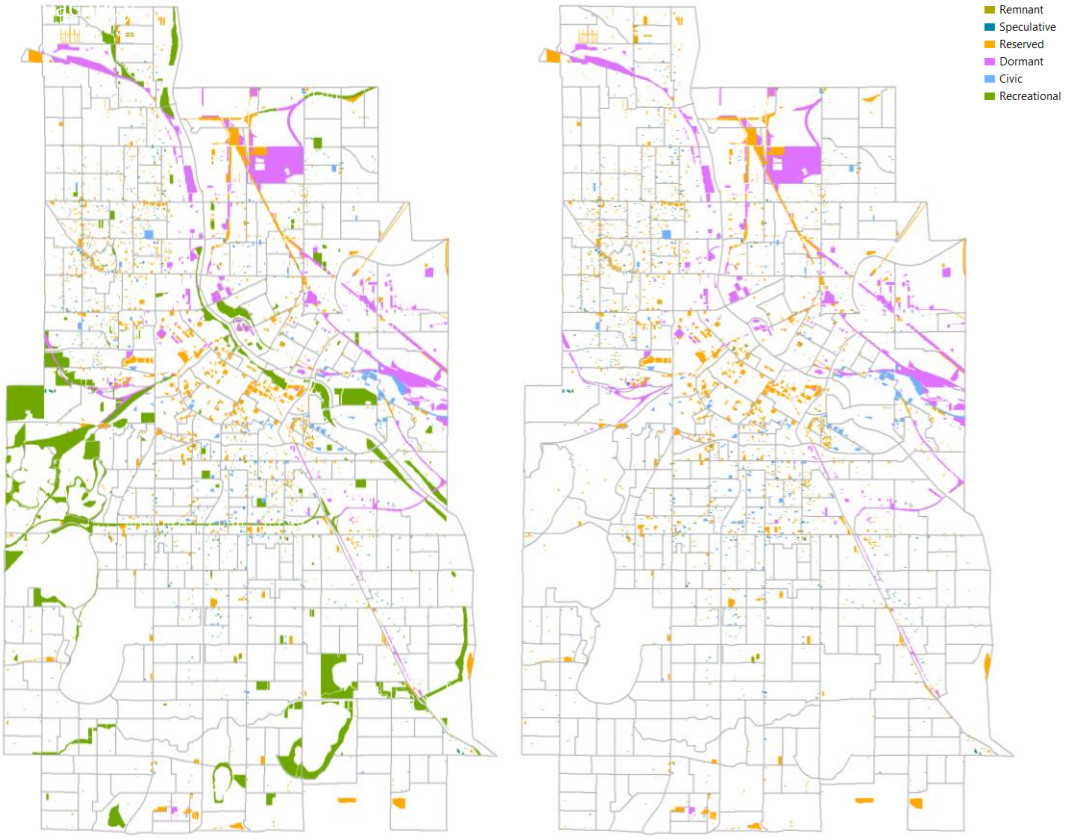

Figure 13 Distribution of vacant land types (Minneapolis, MN)

4.5 CONCLUSION

Vacant land scholarship has explored urban vacancies in diverse directions due to the broad concept of vacant land. While it has enriched the urban dynamic associated with vacant

land, the necessity to identify different types of vacant land has increased. This study examines urban vacancies and suggests a new methodology to identify the vacant land typology. Using only the secondary data, six types were introduced along with the different survival rates of vacancies by land characteristics suggesting that these land characteristics contribute to the life cycle of vacancies. The following summarizes the finding from this study and the potential implications of the findings.

Foremost, three major land characteristics that can contribute to long-term vacancies were discussed. Parcel size was broken into three categories representing small, moderate, and large parcels. Private and public ownership was identified to represent the active and passive owners which can determine the length of vacancies. Land use was taken into consideration as well to measure the different functions of the properties. The Kaplan-Meier survival estimates for each land characteristic suggest that these three land characteristics can determine the different lengths of vacancies leading to different life cycles of vacancies by land characteristics. Specifically, small vacant parcels turned out to have higher survival rates indicating long-term vacancies. Publicly-owned vacant parcels also have higher survival rates than privately-owned vacant parcels. When different land uses were compared, institutional and industrial vacant parcels showed higher survival rates than others.

Using the three land characteristics, six types of vacant land were identified. Three types were identified using the land use types - institutional, industrial, and park and recreational land. In the case of residential and commercial vacant land, ownership and parcel size were thought to be more influential than the land use itself. Thus, using ownership and parcel size, residential and commercial vacant parcels were divided into three categories: Remnant, Speculative, and

Reserved land. This typology designation process expects to capture different life cycles of six vacant land types.

When the six types were mapped in Minneapolis using the typology designation process, Speculative land, which has the shortest duration of vacancies and the highest potential to be active in the market, accounts for 11.9% of the total vacant properties in Minneapolis. Also, 13.1% of the total vacant properties turned out to be undeveloped greenfield-type Recreational land indicating that it is necessary to exclude this type of vacant land when examining urban abandonment using the vacant land inventory. Table 7 describes the amount of vacant land by each vacancy type from 5,440 vacant properties in Minneapolis as of 2015.

By introducing a vacant land typology using land characteristics and duration of vacancies, this study suggests a new methodology to measure vacant land and identify different types using the current inventory of citywide vacancies. While designating six types might aggregate the information on parcel size, ownership, and land use, identifying typology can be a more straightforward and simplified way to measure vacant land potentially as a diagnostic tool of a neighborhood. This typology will be examined in Study 2 and 3 in the context of neighborhood surrounding the parcels.

Furthermore, while it would be ideal if each vacant parcel can be measured and surveyed individually, the typology suggested from this study can be a realistic alternative for cities and researchers to use to measure different types of urban vacancies using only secondary information for potential policies or vacant land research in the future. Further examination by adopting the vacant land typology for other cities or regions should be done to contribute to generalizing the typology designation.

CHAPTER V

NEIGHBORHOOD CHARACTERISTICS AND VACANCY TYPES

5.1 INTRODUCTION

While existing studies have pointed out that certain neighborhood socioeconomic status is associated with the patterns of vacant land, what is lacking is the theoretical explanation onto this association and the specification of vacant land when measuring the relationships of it to the characteristics of neighborhoods where vacant land exists. Existing studies have shown that low socioeconomic neighborhoods tend to have long-term vacancies (Kremer, Hamstead, and McPhearson 2013, Foo et al. 2014) and spatially clustered vacancies (Kremer, Hamstead, and McPhearson 2013, Sternlieb et al. 1974). However, attempts were made without specifying the types of vacant properties by which these patterns can differ. For instance, certain types of vacancies may be more prevalent than other types in low income areas and may show significant associations to neighborhood characteristics.

Furthermore, a deeper question about the relationships between vacant land and neighborhood characteristics is whether the locational characteristics of vacant land can lead to an uneven geography of opportunity. Recent views on vacancy shed light on a positive aspect that these properties can serve as green infrastructure and available land for future development (Kim, Miller, and Nowak 2015, Schilling and Logan 2008, Németh and Langhorst 2014). However, if the vacant properties lying in certain areas cannot serve the same opportunity due to the land characteristics – e.g. Remnant parcel, contaminated land, etc. – these areas would have geographically less opportunity.

This chapter identifies the relationships between neighborhood characteristics and vacant properties using the vacant land typology introduced in Chapter IV (Study 1). Each parcel was

designated a type using land characteristics such as land use, ownership, and parcel size information. These land characteristics are also the main factors that determine long-term vacancy, which is the key identification of the patterns of vacancy at a neighborhood scale.

The inventory of vacant properties in Minneapolis will be examined, and the socioeconomic characteristics will be compared. Minneapolis is known for stable economic condition with high education level and home ownership (Miller 2015, Guo 2015). Even when the whole nation went through the economic crisis, the city managed well relative to other major cities in the U.S. However, when looking into the different neighborhoods within the city, the city shows different urban dynamics characterized by racial groups.

Minneapolis used to have 94% white population in ’70s, and it decreased to 64% as of 2010. While the city is being diversified nowadays, racial segregation still exists in the city. Racial segregation becomes a social problem when it brings the gap on quality of life characterized by racial differences (Guo 2015). For instance, the education achievement by racial group in Minneapolis shows huge gap between white and African American population groups (Miller 2015, Guo 2015). This is just one example of the racial gap as education level is a critical indicator to measure a potential opportunity for a low class to move upward in the future. The racial segregation and its impact on the neighborhood requires deeper understanding of urban dynamic and human behavior. This chapter focuses on the patterns of vacant land and how neighborhood context can dictate the types of vacant land in Minneapolis.

5.2 OBJECTIVES

This chapter examines the site- and neighborhood-scale socioeconomic characteristics that are associated with urban vacancies. Certain types of vacancies may be more observable more and stay vacant longer in neighborhoods where residents have a low socioeconomic status.

Additionally, the neighborhood-scale may be more influential than the site-scale characteristics when predicting the type of vacant land. Here, I hypothesize that neighborhood-scale characteristics can predict the types of vacant land.

Hypothesis 2	Neighborhood-scale socioeconomic characteristics predict the type of vacant land.

5.3 METHODS

5.3.1 Study design

To examine the hypothesis, the potential associations between neighborhood socioeconomic characteristics and vacant property types classified in Study 1 were analyzed. Six vacancy types were measured separately to examine if the neighborhood-scale characteristics can predict any of the vacancy types more than site-scale. The locational characteristics of vacant properties were included in the model to be controlled. The model design for this study is shown in Figure 14. While the specific measurements for neighborhood characteristics will be described in the later sections, it is worth pointing out that the influences of the site- and neighborhood-scales of the surrounding areas were compared to identify which scale can better predict the vacancy types.

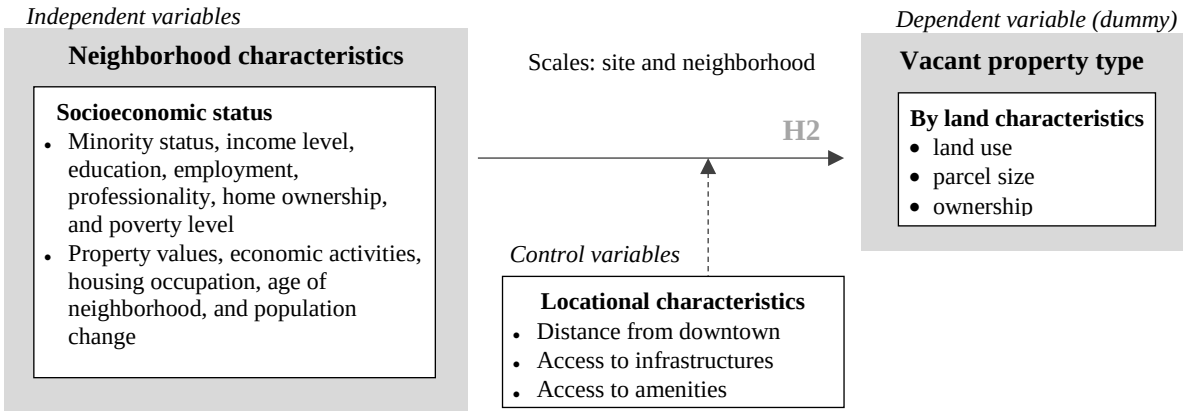

Figure 14 Study design for Study 2

The unit of analysis is vacant properties in Minneapolis MN. Vacant property types were assigned to each vacant parcel for the year 2015 following the designation process introduced in Study 1 (from Chapter IV) using the length of duration and land characteristics including land use, parcel size, and ownership. All the data were geocoded into GIS format and calculated using ArcGIS software. The neighborhood characteristics around these 5,440 vacant properties were examined and identified by each vacant land type.

5.3.2 Measurements

Vacancy types were measured using the typology designation process from Study 1. The vacant land types are designated based on land characteristics that can lead to different durations of vacancies. Examining the urban vacancies specified by the typology will determine if the neighborhood characteristics are associated with different land characteristics. Each type was regressed separately as a dummy dependent variable to identify whether or not the neighborhood characteristics can predict one vacancy type rather than another.

Note that this study follows the vacant land typology designated from Study 1 instead of using the three specific land characteristic variables such as parcel size, ownership, and designated land use of vacant properties. By measuring vacancy types, this captures the combined effect of the three land characteristics instead of measuring them separately. Also, the interpretation on each parcel can be more straightforward by designating only one type on each property. The construct for neighborhood characteristics is described in Table 8.

The major socioeconomic characteristics of a neighborhood include: minority status, income level, educational level, unemployment status, professionality, home ownership, poverty

level, vacant housing units, age of neighborhood, and property values. The locational characteristics of vacant land includes distance from infrastructure and amenities.

Table 8 Construct for Study 2

	Variable	Description	Var.
Vacant land accumulation			
Vacant land types	Remnant, Speculative, Dormant, Recreational, reserved, and Civic land		dummy
Neighborhood characteristics			
Socioeconomic characteristics			
Minority status	Nonwhite population %		MIN
Income level	Median household income		INC
Education level †	Population with high educational %		EDU
Employment status †	% of unemployed population		EMP
Professionality †	Population with professional jobs %		PRO
Ownership †	Renters %		OWN
Poverty level †	Household below Poverty level %		POV
Occupation/Vacancy †	% vacant housing		OCC
Age of neighborhood †	Units built before 1940		AGE
Property value	Average property value		PCH
Locational characteristics			
Distance from infrastructure	School		INF
	Hospital		
	Grocery store		
	Downtown †		
	Highway		
Distance from amenities	Park		AME
	Waterfront		
	Commercial node		
	Retail center		

†: These variables were not used due to the multicollinearity issue

The socioeconomic characteristics around vacant properties were measured at two different scales: 1) site, and 2) neighborhood scales. Differentiating scales is expected to help in comparing which level of socioeconomic status can really predict the vacancy type. These three scales were operationally measured using a buffer zone around vacant parcels. Site-level

socioeconomic characteristics were measured using a 100-ft buffer zone around vacant parcels. This should capture the characteristics of face blocks surrounding vacant parcels. Neighborhood-level socioeconomic characteristics were measured using 0.25-mile and 0.5-mile buffers. Identifying multiple ranges of buffers expect to diminish the limitation of using the operational neighborhood boundaries.

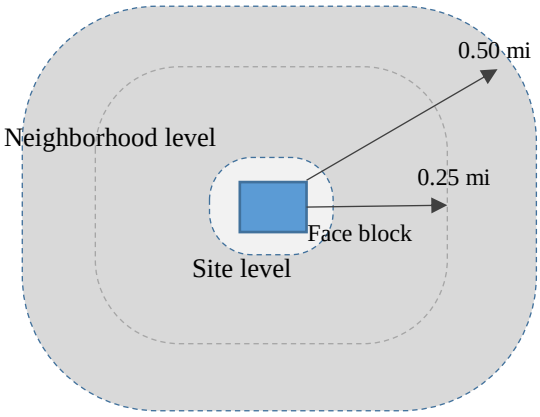

Figure 15 Operational measurements of different scales

It may also be possible to use existing neighborhood boundaries, such as a census tract, block group, or municipal neighborhood boundaries instead, to measure the neighborhood socioeconomic characteristics. Using census boundaries for neighborhood characteristics can be beneficial because these boundaries match American Community Survey boundaries increasing the validity of the data. Alternatively, using existing neighborhood boundaries designated by the city of Minneapolis might increase the convenience of interpreting the results in a way that can be directly adoptable to each neighborhood, and therefore, easy for policy implications. However, if a vacant parcel is located at the edge of a neighborhood, the characteristics may not represent the surrounding area of the vacant parcel. Furthermore, if a vacant parcel is located across multiple neighborhoods, merging all the neighborhoods' characteristics also does not

represent the characteristics of surrounding areas. Thus, I used the buffered boundaries to measure the characteristics of surrounding areas instead of using existing neighborhood boundaries. Identifying multiple ranges of buffer expects to increase the reliability of the operational boundaries.

The socioeconomic status within these buffer boundaries were measured using the 5-year estimates of American Community Survey (ACS, 2011-2015). The lowest-level of ACS information publicly provided is at the block-group level. Thus, the mismatched boundaries of block-group level ACS data and the operational three levels (site-neighborhood-context) of this study needed to be corrected. I calculated the average ACS information by adding the proportion of each block group area as shown below. Note that the area of where an actual vacant property is located is excluded in this calculation to increase accuracy and eliminate misinterpretation caused by the large area of vacant property.

$$Socioeconomic\ Variable_{bufferA} = \sum_{i=1}^{n} (Socioeconomic\ Status_i \times \frac{Proportional\ Area_i}{Total\ Area_{\ bufferA}})$$

Where, i = Census Block Group

A = buffered surrounding area

Finally, these representative variables for the construct of neighborhood socioeconomic characteristics were cross-examined to identify potential multicellularity and some variables were excluded according to the Pearson correlation test. Table 9 shows the results of the Pearson correlation test on the variables at the neighborhood level (0.25-mile buffer area) showing high correlations between many variables. Among the eleven variables in the construct, only three variables were included in the final models. Average income level was included to identify the economic status. Average property values per ft^2 were included to measure investment potential.

The percentage of minority population was measured using non-white population to represent the social status of the population.

Table 9 Correlation between socioeconomic variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Income level	1.00										
(2) Property value	-0.10	1.00									
(3) Employment status †	-0.62	0.18	1.00								
(4) Poverty level †	-0.84	0.29	0.87	1.00							
(5) Minority status	-0.61	0.00	0.89	0.79	1.00						
(6) Education level †	0.59	0.27	-0.55	-0.51	-0.80	1.00					
(7) Professionality †	0.67	0.31	-0.46	-0.49	-0.71	0.97	1.00				
(8) Built after '00 †	-0.43	0.60	0.48	0.66	0.19	0.24	0.24	1.00			
(9) Built before '69 †	0.44	-0.57	-0.49	-0.63	-0.21	-0.18	-0.18	-0.94	1.00		
(10) Occupation/Vacancy †	-0.72	0.33	0.82	0.89	0.73	-0.47	-0.43	0.63	-0.68	1.00	
(11) Ownership †	-0.56	0.58	0.47	0.69	0.22	0.19	0.15	0.90	-0.87	0.64	1.00

†: These variables were not used due to the multicollinearity issue

5.3.3 Analytic approach

As discussed in Section 5.3.1 Study design, to examine whether certain neighborhood characteristics can predict the types of vacant land, the dependent variables will be dichotomized to measure whether a vacant land is a certain type among the six types identified in Chapter III. Thus, a binary regression logistic analysis (logistic regression) will be performed on each vacancy type. The logistic regression identifies the odds for a vacant parcel to be a certain type. The general model can be stated as below (Pampel 2000, Menard 2002):

$$\text{Log}\left(\frac{p}{1-p}\right) = \beta_0 + X_1\beta_1 + X_2\beta_{2+\ldots}$$

Furthermore, to gauge the size of an influential area, four different scales were generated, and the socioeconomic variables within the buffered zones were measured. This

procedure generates three models with different buffers for each type, leading to a total of eighteen models to run for six types. The conceptual model for this study can be stated as below:

$$\text{Log}(\frac{\text{P}_i}{1-\text{P}_i}) = \beta_1\text{MIN}_d + \beta_2\text{INC}_d + \beta_3\text{VAL}_d + \beta_4\text{INF} + \beta_5\text{AME} + \varepsilon_i$$

Where (1) P is the probability that a vacant land is designated to be typology *i*; (2) MIN, INC, and VAL are the socioeconomic characteristics of the surrounding buffered area *d* defined by minority status, income level, and property value, respectively; (3) INF and AME are the locational characteristics of the vacant parcel defined by the distance to infrastructures, amenities, highways, and downtown, respectively; (4) *i* represents one of six vacant land types; (5) *d* represents one of four buffered areas; (6) β_i are regression coefficients; and (7) ε is the measurement error term.

5.4 RESULTS

5.4.1 Model fit: Pseudo R-Squared

While a logistic regression model does not calculate the coefficient of determination, the R^2 value, that describes the variance, the Pseudo R-square in a logistic regression model describes the goodness of fit using chi-square statistics (Menard 2002). Figure 16 compares the Pseudo R-squares of models that predict each vacant land type. Note that these models used the same variables, sample size, and construct, which makes it easier to carefully compare the Pseudo R-square values across models. This figure indicates that models predicting Recreational and Dormant lands show the best fit followed by Civic land. This implies that the socioeconomic status can best predict vacancies for Recreational, Dormant, and Civic land. These vacancy types have straightforward land uses – park & recreational, industrial and institutional. It also can be

pointed out that neighborhood-scale models tend to have higher pseudo R^2 indicating that neighborhood-scale characteristics predict vacancy types better than the site-scale. However, the differences are not large enough to identify a distinctive change of pseudo R^2 across scales.

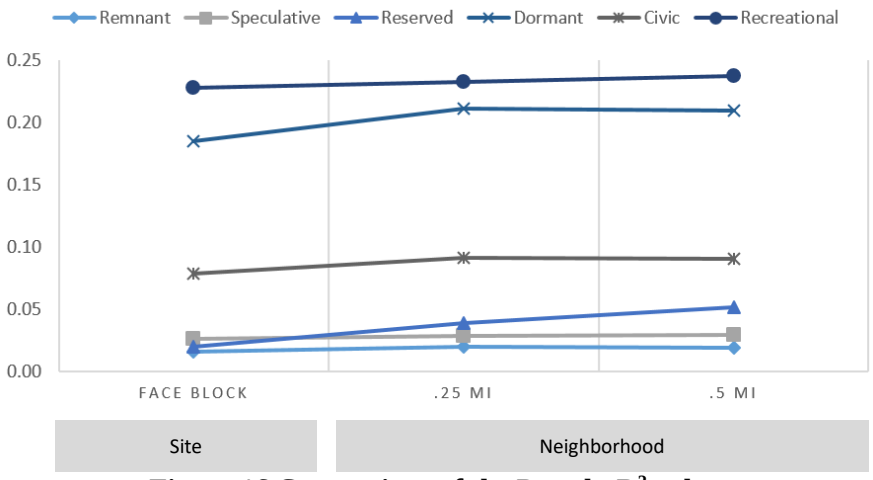

Figure 16 Comparison of the Pseudo-R^2 values

5.4.2 Socioeconomic characteristics by vacancy type

The socioeconomic characteristics around each vacancy type was examined to see if these characteristics can predict the vacancy type. When examining across different scales – site, and neighborhood, a few patterns can be found. The overall results are described in Table 10.

First, the minority population turned out to be a variable predicting vacancies for Remnant, Speculative, and Reserved land across all scales – site, and neighborhood. These three vacancy types represent the residential and commercial properties indicating that the residential and commercial properties have a high association with a minority population. At the site scale, a one percent increase in the minority population increases the odds of finding Remnant land by 0.51% (OR = 1.0051, $p < 0.01$) and Reserved land by 1.08% (OR = 1.0108, $p < 0.001$). At the neighborhood scale within a 0.25-mile buffer zone, a one percent increase in the minority

population increases the odds of finding Remnant land by 1.25% (OR = 1.0125, $p < 0.001$), Speculative land by 0.87% OR = 1.0087, $p < 0.01$), and Reserved land by 1.87% (OR = 1.0187, $p < 0.001$). The same pattern can be found at the neighborhood scale within a 0.5-mile buffer zone, with the odds of finding Remnant land increased by 1.33% (OR = 1.0133, $p < 0.001$), Speculative land by 1.12% (OR = 1.0112, $p < 0.01$), and Reserved land by 0.76% (OR = 1.0076, $p < 0.001$) when the percentage of the minority population increases by one percent holding other variables constant.

Areas with a high-income level tend to predict vacancies for Speculative and Recreational lands across all scales. Speculative land tends to be active in the market bringing potential investment to the site. Recreational land can be or has served as a green space. Likewise, both Speculative and Recreational lands can favor the residents in different ways. At the site scale, the increase of average income level by one thousand dollars is likely to increase the odds of finding Speculative land by 0.4% (OR = 1.004, $p < 0.1$) and Recreational land by 1.03% (OR = 1.0103, $p < 0.001$). At the neighborhood scale within a 0.25-mile buffer zone, the increase of average income level by one thousand dollars increases the odds of finding Speculative land by 1.02% (OR = 1.0102, $p < 0.001$) and Recreational land by 1.05% (OR = 1.015, $p < 0.001$). At the neighborhood scale within a 0.5-mile buffer zone, the increase in income level is likely to increase the odds of finding Speculative land by 1.36% (OR = 1.0136, $p < 0.001$) and Recreational land by 1.54% (OR = 1.0154, $p < 0.001$).

Civic land shows an interesting pattern with a strong association with low income level and a low minority population. It can indicate potential inequality issues for the minority population if Civic land is serving a future opportunity to provide public service in the area. At the site scale, the increase of average income level by one thousand dollars is likely to decease

the odds of finding Civic land by 1.52% (OR = 0.9848, p < 0.001). A one percent increase in the minority population is likely to decrease the odds of finding Civic land by 1.83% (OR = 0.9817, p < 0.001). At the neighborhood scale within a 0.25-mile buffer zone, the increase of average income level by one thousand dollars is likely to decrease the odds of finding Civic land by 3.36% (OR = 0.9664, p < 0.001). A one percent increase in the minority population decreases the odds of finding Civic land by 2.51% (OR = 0.9749, p < 0.001). At the neighborhood scale within a 0.5-mile buffer zone, the increase of average income level by one thousand dollars increases the odds of finding Civic land by 4.31% (OR = 0.9569, p < 0.001). A one percent increase in the minority population decrease the odds of finding Civic land by 2.79% (OR = 0.9621, p < 0.001).

Table 10 Socioeconomic characteristics predicting vacancy types

	Remnant OR (SE)	Speculative OR (SE)	Reserved OR (SE)	Dormant OR (SE)	Civic OR (SE)	Recreational OR (SE)
Site (Face block)						
Income (K)	1.0025	1.004+	1.0011	0.9869***	0.9848***	1.0103***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)
Property value (K/ft)	1.0008*	1.0001	1.0018***	0.9703***	0.9996	1
	(0)	(0.001)	(0)	(0.002)	(0.001)	(0.001)
Minority (%)	1.0051**	1.0038	1.0108***	0.9746***	0.9817***	1.0065*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Neighborhood (0.25 mi)						
Income (K)	1.0086***	1.0102***	0.998	0.9872***	0.9664***	1.015***
	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)
Property value (K/ft)	0.9998	1.0005	1.0061***	0.9687***	1.001	0.9967**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Minority (%)	1.0125***	1.0087**	1.0187***	0.9594***	0.9749***	0.9966
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
Neighborhood (0.50 mi)						
Income (K)	1.0108***	1.0136***	0.9958	0.9873***	0.9569***	1.0154***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.005)	(0.003)
Property value (K/ft)	0.9993	1.0001	1.0076***	0.9675***	1.0007	0.9953***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Minority (%)	1.0133***	1.0112**	1.0233***	0.9538***	0.9721***	0.9885**
	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)

+p < .1. *p < .05. **p < .01. ***p < .001.
OR: Odd Ratio, SE: Standard Error

5.4.3 Scales: site and neighborhood

After looking into the consistent socioeconomic patterns by vacancy type in the previous section, this section focuses on what scale most predicts the vacancy types.

The site and neighborhood scales are compared by examining three different scales – Face block, a .25-mile buffered neighborhood, and a .50-mile buffered neighborhood scales. These different scales were expected to capture the boundary of the neighborhood effect on each vacancy type. To better distinguish the effects from different scales, all the significant effects are visually highlighted with an emphasis on the higher effects throughout Table 11 to Table 16.

Table 11 Different scales predicting Remnant land

	Site				Neighborhood	
Vacancy type:	**Face block**		**0.25 mi**		**0.5 mi**	
Remnant land	**OR**	**SE**	**OR**	**SE**	**OR**	**SE**
Socioeconomic Status						
Income (K)	1.0025	0.002	1.0086***	0.002	1.0108***	0.003
Property value (K)	1.0008*	0.000	0.9998	0.001	0.9993	0.001
Minority (%)	1.0051**	0.002	1.0125***	0.002	1.0133***	0.003
Inversed Distance (1K ft)						
Highway	0.9586+	0.023	0.9517*	0.023	0.9595+	0.023
Commercial node	0.9742	0.023	0.9467*	0.024	0.9397*	0.024
Downtown	0.9998	0.008	1.0074	0.008	1.0092	0.009
Grocery store	1.217***	0.042	1.2395***	0.043	1.2322***	0.042
Hospital	0.9926	0.010	0.9865	0.010	0.9907	0.010
Retail center	0.954***	0.013	0.9455***	0.013	0.9469***	0.013
Park	0.9086+	0.046	0.8949*	0.045	0.8884*	0.045
School	0.9733	0.033	0.9412+	0.032	0.9428+	0.032
Waterfront	0.8925***	0.024	0.8868***	0.024	0.8841***	0.024
constant	-2.2466		-3.027		-3.1059	
chi2	91.32		112.53		108.34	
Pseudo R^2	0.0161		0.0198		0.019	

+p < .1. *p < .05. **p < .01. ***p < .001. OR: Odd Ratio, SE: Standard Error

Remnant land shows the highest influence from the neighborhood-scale socioeconomic characteristics (Table 11). An increase in the average income level by one thousand dollars is

likely to increase the odds of finding Remnant land by 0.86 – 1.08% ($p < 0.001$). A one percent increase in the minority population is likely to increase the odds of finding Remnant land by 0.51 – 1.33% ($p < 0.05$) at any scale while showing that the neighborhood-scale predicts Remnant land with the highest odds. The increase in the property value at the site scale increases the odds of finding Remnant land by 0.08% ($p < 0.001$) as well, but the effect size is small.

Table 12 Different scales predicting Speculative land

	Site				Neighborhood	
Vacancy type:	**Face block**		**0.25 mi**		**0.5 mi**	
Speculative land	**OR**	**SE**	**OR**	**SE**	**OR**	**SE**
Socioeconomic Status						
Income (K)	1.004+	0.002	1.0102***	0.003	1.0136***	0.004
Property value (K)	1.0001	0.001	1.0005	0.001	1.0001	0.001
Minority (%)	1.0038	0.002	1.0087**	0.003	1.0112**	0.004
Inversed Distance (1K ft)						
Highway	0.9229**	0.027	0.9258**	0.027	0.929*	0.027
Commercial node	1.1314***	0.035	1.1336***	0.036	1.1216***	0.036
Downtown	0.9813+	0.010	0.9846	0.010	0.9868	0.010
Grocery store	1.1063*	0.046	1.1214**	0.047	1.1215**	0.046
Hospital	1.0078	0.012	1.0077	0.013	1.0091	0.013
Retail center	0.9762	0.016	0.9697+	0.016	0.9678+	0.017
Park	0.9408	0.060	0.9311	0.060	0.9228	0.060
School	0.9749	0.043	0.9658	0.043	0.9607	0.043
Waterfront	0.8388***	0.028	0.8226***	0.028	0.8188***	0.028
constant	-2.8786		-3.4924		-3.7859	
chi2	103.38		114.52		116.45	
Pseudo R^2	0.0261		0.0289		0.0294	

+p < .1. *p < .05. **p < .01. ***p < .001. OR: Odd Ratio, SE: Standard Error

Speculative land shows the influence from the neighborhood-scale socioeconomic characteristics (Table 12). An increase in the average income level by one thousand dollars is likely to increase the odds of finding Speculative land by 1.02 – 1.36% ($p < 0.001$) at the neighborhood-scales. A one percent increase in the minority population is likely to increase the odds of finding Speculative land by 0.87 – 1.12% ($p < 0.01$) at the neighborhood--scales as well.

The increase in the property value increases the odds by 0.01 – 0.05%, but the effect is insignificant ($p > 0.10$).

Reserved land shows the highest influence from the neighborhood -scales of socioeconomic characteristics (Table 13). The income level was not a predictor of Reserved land. A one percent increase in the minority population is likely to increase the odds of finding Reserved land by 1.08 – 2.33% ($p < 0.001$) at any scale while showing that the .5-mi buffer zone predicts Reserved land with the highest odds. The increase in the property value increases the odds of finding Reserved land by 0.18 – 0.76% ($p < 0.001$) at both the site- and neighborhood-scales.

Table 13 Different scales predicting Reserved land

	Site		Neighborhood			
Vacancy type:	**Face block**		**0.25 mi**		**0.5 mi**	
Reserved land	**OR**	**SE**	**OR**	**SE**	**OR**	**SE**
Socioeconomic Status						
Income (K)	1.0011	0.001	0.998	0.002	0.9958	0.003
Property value (K)	1.0018***	0.000	1.0061***	0.001	1.0076***	0.001
Minority (%)	1.0108***	0.002	1.0187***	0.002	1.0233***	0.002
Inversed Distance (1K ft)						
Highway	1.0159	0.022	0.9932	0.022	0.9851	0.022
Commercial node	0.9782	0.021	1.0065	0.023	1.0167	0.023
Downtown	0.9945	0.007	0.9813**	0.007	0.9701***	0.007
Grocery store	0.9478+	0.029	0.9551	0.029	0.9662	0.030
Hospital	0.999	0.009	0.9754**	0.009	0.964***	0.009
Retail center	1.0377**	0.012	1.0183	0.012	1.0109	0.012
Park	0.9366	0.043	0.9594	0.045	0.9519	0.045
School	1.0281	0.031	0.9959	0.031	0.9738	0.030
Waterfront	0.9836	0.023	0.9597+	0.023	0.9535*	0.023
constant	-1.4733		-2.386		-2.8333	
chi2	137.31		263.92		351.45	
df	12		12		12	
Pseudo R^2	0.0202		0.0389		0.0518	

+p < .1. *p < .05. **p < .01. ***p < .001. OR: Odd Ratio, SE: Standard Error

Dormant land shows the highest influence at the neighborhood- scales of socioeconomic characteristics (Table 14). An increase in the average income level by one thousand dollars is likely to decrease the odds of finding Dormant land by 1.27 – 1.31% ($p < 0.001$). A one percent increase in the minority population is likely to decrease the odds of finding Dormant land by 2.54 – 4.62% ($p < 0.001$) at any scale while showing that the neighborhood-scale predicts with the highest odds. The increase in the property value decreases the odds of finding Dormant land by 2.97 – 3.25% ($p < 0.001$) with the highest effects from the .5-mi buffer zone.

Table 14 Different scales predicting Dormant land

	Site				Neighborhood	
Vacancy type:	**Face block**		**0.25 mi**		**0.5 mi**	
Dormant land	**OR**	**SE**	**OR**	**SE**	**OR**	**SE**
Socioeconomic Status						
Income (K)	0.9869***	0.002	0.9872***	0.003	0.9873***	0.003
Property value (K)	0.9703***	0.002	0.9687***	0.002	0.9675***	0.003
Minority (%)	0.9746***	0.002	0.9594***	0.003	0.9538***	0.003
Inversed Distance (1K ft)						
Highway	1.2298***	0.044	1.3348***	0.050	1.3485***	0.050
Commercial node	0.985	0.033	0.8979**	0.032	0.9108*	0.033
Downtown	1.0702***	0.011	1.0993***	0.011	1.1329***	0.012
Grocery store	0.8321***	0.041	0.8555**	0.044	0.823***	0.042
Hospital	0.9419***	0.013	0.9759	0.015	0.9742+	0.015
Retail center	1.0411*	0.019	1.0634**	0.020	1.0724***	0.020
Park	0.4777***	0.030	0.5042***	0.032	0.5105***	0.033
School	1.0623	0.045	1.1264**	0.049	1.1471**	0.050
Waterfront	1.2857***	0.045	1.4531***	0.055	1.4665***	0.055
constant	1.1419		3.2168		3.9262	
chi2	767.11		877.43		870.54	
Pseudo R^2	0.1844		0.2109		0.2092	

+p < .1. *p < .05. **p < .01. ***p < .001. OR: Odd Ratio, SE: Standard Error

Civic land shows the highest influence from the .5-mile buffered socioeconomic characteristics (Table 15). An increase in the average income level by one thousand dollars is

likely to decrease the odds of finding Civic land by 1.52 – 4.31% ($p < 0.001$) at any scale. A one percent increase in the minority population is likely to decrease the odds of finding Civic land by 1.83 – 2.79% ($p < 0.001$) at any scale with the highest effect at the .5-mi buffer zone. The property values were not a predictor of Civic land at any scales.

Table 15 Different scales predicting Civic land

	Site				Neighborhood	
Vacancy type:	**Face block**		**0.25 mi**		**0.5 mi**	
Civic land	**OR**	**SE**	**OR**	**SE**	**OR**	**SE**
Socioeconomic Status						
Income (K)	0.9848***	0.003	0.9664***	0.004	0.9569***	0.005
Property value (K)	0.9996	0.001	1.001	0.001	1.0007	0.001
Minority (%)	0.9817***	0.003	0.9749***	0.003	0.9721***	0.004
Inversed Distance (1K ft)						
Highway	0.9887	0.040	0.9618	0.039	0.9398	0.038
Commercial node	1.1973***	0.043	1.2041***	0.047	1.175***	0.047
Downtown	1.0518***	0.015	1.0252+	0.015	1.0181	0.016
Grocery store	1.134*	0.065	1.0945	0.064	1.102+	0.065
Hospital	1.1388***	0.019	1.1135***	0.020	1.0979***	0.020
Retail center	0.9647	0.024	0.9891	0.025	0.9947	0.025
Park	1.1949*	0.097	1.218*	0.099	1.2278*	0.100
School	1.031	0.056	1.073	0.061	1.0567	0.060
Waterfront	0.898*	0.038	0.9238+	0.039	0.9474	0.040
constant	0.77		1.724		2.1792	
chi2	258.42		300.84		298.09	
Pseudo R^2	0.0786		0.0915		0.0906	

+p < .1. *p < .05. **p < .01. ***p < .001. OR: Odd Ratio, SE: Standard Error

Recreational land shows the highest influence from the neighborhood-scale socioeconomic characteristics (Table 16). An increase in the average income level by one thousand dollars is likely to increase the odds of finding Recreational land by 1.03 – 1.54% ($p < 0.001$) at the site- and neighborhood-scales. A one percent increase in the minority population is likely to increase the odds of finding Recreational land by 0.65% ($p < 0.05$) at the site scale while decreasing the odds by 0.34 – 1.15% ($p < 0.01$) at the neighborhood-scales. Non-minority

population may avoid living right next to vacant properties while still preferring recreational type of infrastructure in the neighborhood. The increase in the property value at the neighborhood scale decreases the odds of finding Recreational land by 0.33 – 0.47% ($p < 0.01$) at the neighborhood scales.

Table 16 Different scales predicting Recreational land

	Site				Neighborhood	
Vacancy type:	**Face block**		**0.25 mi**		**0.5 mi**	
Recreational land	**OR**	**SE**	**OR**	**SE**	**OR**	**SE**
Socioeconomic Status						
Income (K)	1.0103***	0.002	1.015***	0.003	1.0154***	0.003
Property value (K)	1	0.001	0.9967**	0.001	0.9953***	0.001
Minority (%)	1.0065*	0.003	0.9966	0.003	0.9885**	0.004
Inversed Distance (1K ft)						
Highway	0.943*	0.028	0.9665	0.028	0.9744	0.028
Commercial node	0.9071**	0.028	0.9213*	0.030	0.9322*	0.031
Downtown	0.9543***	0.009	0.9582***	0.010	0.9613***	0.010
Grocery store	0.9647	0.041	0.9693	0.041	0.959	0.040
Hospital	0.9887	0.013	1.0258+	0.015	1.0464**	0.015
Retail center	1.0465**	0.017	1.0643***	0.018	1.074***	0.018
Park	7.5818***	0.898	7.0107***	0.825	6.914***	0.809
School	1.0108	0.041	1.035	0.042	1.0673	0.043
Waterfront	1.2164***	0.045	1.1997***	0.046	1.2008***	0.045
constant	-1.9302		-1.0629		-0.3485	
chi2	961.23		981.1		1000.67	
Pseudo R^2	0.2273		0.232		0.2366	

+p < .1. *p < .05. **p < .01. ***p < .001. OR: Odd Ratio, SE: Standard Error

5.5 CONCLUSION

This study aims to identify the neighborhood socioeconomic characteristics around vacant land types to see if the neighborhood-scale characteristics can predict vacant land types stronger than site-scale characteristics. Sixteen total regressions were tested from a logistic model specified to predict vacant land types. The socioeconomic characteristics were measured

using a buffered zone around each vacant property. To compare the site- and neighborhood-scale characteristics, three different buffers were drawn – 100-foot buffer to represent face block, .25-mile buffer to represent the walkable neighborhood, and .50-mile buffer to represent the large-scale neighborhood. The results show that the socioeconomic characteristics around vacant properties can be a predictor of vacant land types. Among the six vacant land types, Civic and Recreational lands show the highest Pseudo R-squared indicating that the socioeconomic characteristics can predict these types the most.

To identify any distinctive spatial patterns around each vacancy type, the socioeconomic characteristics by vacancy type were analyzed from the logistic regression results.

First, the minority population turned out to be a strong predictor of Remnant, Speculative, and Reserved lands. It indicates that residential and commercial vacant properties tend to be located in an area with a high portion of minority populations.

Second, the vacancy types associated with high-income areas turned out to be Speculative and Recreational lands. Speculative land represents the residential/commercial vacancies with private ownership, which tend to have shorter vacancy durations and higher potential to be repurposed. Recreational land represents the unused greenfield-type vacant land, which can serve the function of green infrastructure. The similarity between Speculative and Recreational lands is the potential to become an opportunity for neighborhoods by bringing more investment activities or supporting more green infrastructure to the neighborhood.

Third, Civic land turned out to be associated with low-income and low-minority populations. Civic land tends to have a longer duration of vacancy according to Kaplan-Meier survival estimates from Study 1 and restricted potential uses because these properties have non-interchangeable purposes designated for the future such as school, hospital, or other public

services. While this vacancy type expects to support the areas serving as a public function in the future, the results also show an evidence that minority populations may not have the same opportunity.

After examining the spatial patterns by vacancy type, the logistic regression results are compared across different buffer zones to see if the neighborhood context can be influential to determine the types of vacancies, as stated in Hypothesis 2. The results show that neighborhood-scale socioeconomic characteristics are better predictors of vacancy types. Specific patterns by vacancy type are stated below:

- Remnant land shows that neighborhood context predicts vacancy types more than the site scale. Both the income level and the minority status were the predictors increasing the odds of having Remnant land ($p < 0.01$).
- Speculative land shows that only the neighborhood-scale socioeconomic status is influential to predict the type ($p < 0.01$). The property values showed no significance to predict Speculative land.
- Reserved land shows that the property value and minority status can predict the type both at the site- and neighborhood-scale ($p < 0.001$) while the income level was not a predictor. While both scales were significant, neighborhood-scale socioeconomic status shows a higher effect with a larger coefficient.
- Dormant land shows significant associations with low-income level, low property values, and fewer minority populations. While all the models across different buffered zones are strongly significant ($p < 0.001$), the .5-mile buffer zone shows the highest effect.
- Civic land shows that the income level and minority status can predict the type both at the site- and neighborhood-scale ($p < 0.001$).

- Recreational land shows that the income level, property values, and minority status can predict the type the most at the .5-mile buffer zone ($p < 0.01$). Property value was not a predictor at the site-scale showing that there are no immediate effects from the face block.

While vacant properties are known to bring negative perceptions and be a proxy to neighborhood decline, this study (Study 2) identified that the types of vacancy can be dictated by the neighborhood context. If neighborhood socioeconomic characteristics are associated with vacancy types, and furthermore, with the duration of vacancies as identified from Study 1, more contextual issues such as historical stereotype of a neighborhood may need to be looked into to understand the neighborhood effect onto properties and potential long-term vacancies. The next chapter (Study 3) looks into the gentrification phenomenon to specify neighborhood change associated with the vacancy types.

CHAPTER VI

VACANT LAND IN GENTRIFYING NEIGHBORHOODS

6.1 INTRODUCTION

This chapter expands Study 1 and 2 to look into the gentrification phenomenon in a neighborhood by vacancy type. Gentrification is typically seen in a neighborhood recovering from decline. As urban vacancy is thought to be a symptom of neighborhood decline, gentrification and urban vacancy can be seen as opposite conditions in a neighborhood. However, vacant land is not just seen in declining neighborhoods. A certain amount of vacancy may be necessary to bring gentrification, and the relationship between vacant land and gentrification is not so straightforward. To examine these controversial views, this chapter carefully scrutinizes how urban vacancy is associated with the flow of gentrification.

Looking into the relationship between vacancy and gentrification also could answer the question about whether vacant land in urban neighborhoods is an opportunity for revitalization or a threat bringing an upper-class population and widening the rent gap enough to bring gentrification (Smith 1979). Here, gentrification can be defined as the "social class change" in a neighborhood. This term includes the concept of potential displacement and invasion from an upper class, which goes beyond the concept of neighborhood revitalization that includes positive characteristics of physical upgrade and active investments.

While the effects of gentrification are typically fairly negative as stated in Chapter II, debates on gentrification still continue due to its various effects and consequences. Minneapolis has shown a steady reinvestment trend in and around downtown with increased housing values and rent prices. Arguably, some state that there is not much evidence to say that neighborhoods are gentrifying in Minneapolis when looking at the racial, market, and rent changes over time

(Institute of Metropolitan Opportunity 2016, Lindeke 2016). Rent is obviously going up, but it can be more of a regional trend than a gentrification phenomenon that disadvantage low-income residents.

Yet, other studies are continuously supporting the side that Minneapolis neighborhoods are gentrifying. North Side of Minneapolis, which includes Folwell and McKinley neighborhoods, is indicating a potential market in the near future with great access to city infrastructure and amenities along with the recent developments in North Loop (Buchta 2017). The gentrification maps are also showing that there are gentrifying areas in Minneapolis, and it is and has been accelerated since 2000 when compared to the time period between 1990-2000 (Governing 2015). Moreover, a recent study conducted by the University of Minnesota brings more in-depth evidence of gentrification in Minneapolis, with both qualitative and quantitative research approaches (Center for Urban & Regional Affairs 2018).

As stated earlier, gentrification discourse cannot be simply concluded, possibly due to the complex nature of the gentrification phenomenon and the ways it impacts neighborhoods. Thus, it can be limited with quantitative evidence of gentrification to fully understand the expected neighborhood change associated with gentrification. However, what can hurt more is when not enough questions are asked. Examining and questioning gentrification is what academia can posit to identify potential or already-existing risks residents are experiencing in gentrifying neighborhoods.

6.2 OBJECTIVES

This chapter explores the relationship between vacant land and neighborhood gentrification by looking into the accumulated vacancies and their potential to bring the flow of gentrification. To measure this relationship, I hypothesized that vacant land accumulation is

positively associated with the gentrification process of a neighborhood. To examine this hypothesis, neighborhoods that are being gentrified and the types of vacancies associated with the gentrification phenomenon will be identified.

Hypothesis 3	Certain types of vacant land are positively associated with gentrification process of a neighborhood.
Hypothesis 3-1	Vacant land accumulation contributes to neighborhood gentrification
Hypothesis 3-2	Neighborhood gentrification contributes to vacant land types

6.3 METHODS

6.3.1 Study design

To determine the relationship between vacant land accumulation and the degree of gentrification, first, whether certain types of vacant land accumulation can predict gentrification will be examined (Hypothesis 3-1). To examine this, a regression model that predicts gentrification was designed. The dependent variable is a gentrification score calculated by the characteristics of the entering middle income population. For independent variables, along with the known-factor of gentrification, items such as proximity to infrastructures, amenities, and jobs are included in this model that hypothesizes that certain types of accumulated vacant land can also contribute to gentrification.

Then, whether the characteristics of gentrification can predict vacant land accumulation will be examined responding to Hypothesis 3-2. The dependent variable for this model is whether or not a neighborhood is experiencing a significant accumulation of a certain type of vacant land. A total of six dummy dependent variables will be generated using Getis-Ord Gi* statistics (Getis and Ord 1992) to measure the vacancy accumulation for six types of land. The independent variables include the driving forces of gentrification as well as the indicator of an

incoming middle class. This will determine if the variables representing gentrification are associated with significantly clustered vacancies. To measure each type of vacant land individually as a dependent variable, a total of six regression models will be run using the same conceptual model. The overall study design, or Study 3, is described in Figure 17.

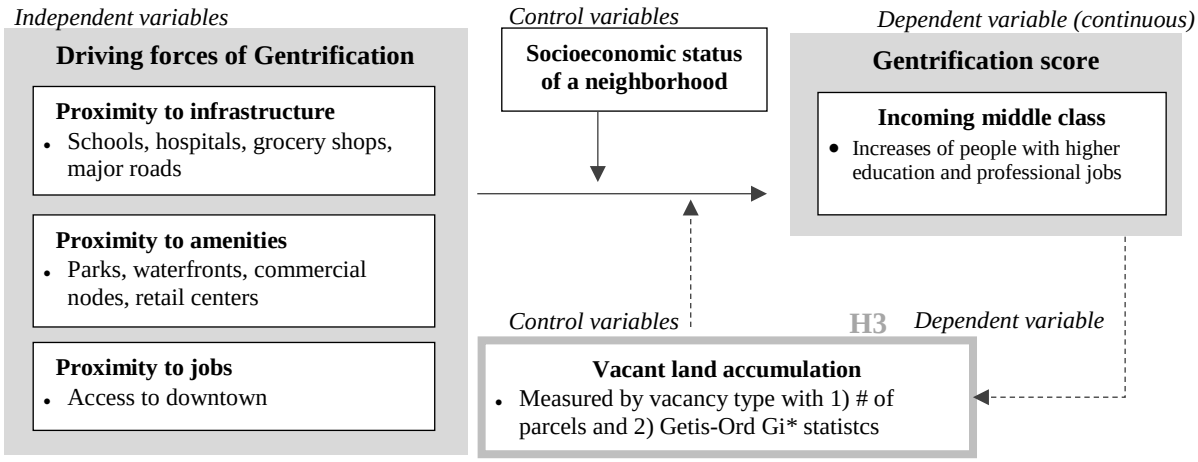

Figure 17 Study design for Study 3

The unit of analysis for this chapter is neighborhoods to see how the accumulated vacant land is associated with the gentrification phenomenon in neighborhood scale. To do this, the accumulation of vacancies will be calculated by aggregating vacant properties to a neighborhood scale. Minneapolis officially has 83 neighborhoods which belong to 6 communities. While the boundary of neighborhoods in general can be defined in many ways, this study operationally defined the boundary of a neighborhood using the census block group boundaries instead of the official neighborhood boundary. Minneapolis has 374 census block groups, which have smaller areas by neighborhood than the official neighborhood boundary designated by the city. While capturing the neighborhood-scale gentrification phenomenon, this study also finds it beneficial to measure neighborhoods in smaller areas for precise measurement of vacant land accumulation.

6.3.2 Measuring clustered vacancy

Measuring urban vacancy at the neighborhood scale likely aggregates the individual vacant property data and causes misleading vacancy information. To reduce a potential issue from this procedure, I chose to measure the degree of clustered vacant land using Getis-Ord Gi* statistics (Getis and Ord 1992) instead of simply calculating the total number of vacant properties in Census Block Groups. Measuring the amount of vacancies using the actual area of vacancies has potential to fail in capturing the accumulated influence of vacant land. Instead, calculating z score of Getis-Ord Gi* statistics can identify significantly clustered vacancies in neighborhood scale. Figure 18 shows how the variables will be generated. This method is known as Hot Spot Analysis as well and helps to identify not only the degree of clustering but whether the clustering is significant. Getis-Ord Gi* statistics can be more useful than the commonly used Moran's I for spatial clustering when measuring at the neighborhood scale because Getis-Ord Gi* takes polygons into consideration while Moran's I only measures the cluster of centroid points (Van Zandt and Mhatre 2013).

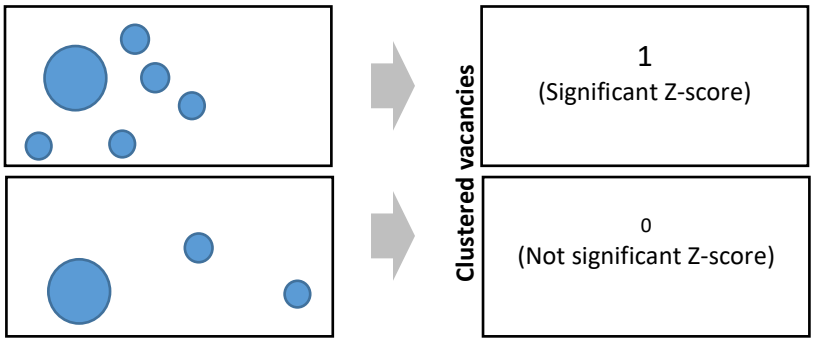

Figure 18 Measuring clustered vacancies using Getis-Ord Gi* statistics

Using the Getis-Ord Gi* statistics, whether or not the neighborhoods in Minneapolis have any clustered vacancies was measured. For this study, I will identify if there is a significant

cluster of a vacancy type as a dummy variable. If the Z value of the Gi* statistics rejects the null hypothesis that there is no significant clustering (P<.05), it is considered to have a significantly clustered vacancy in the neighborhood. To specify vacancy types, each vacancy type was separately measured using three land characteristics: parcel size, ownership, and designated land use. These three variables were not measured individually for the same reason as Study 2 – to see the combined effect of land characteristics specified by each type. Figure 20 shows the patterns of clustered vacancies in Minneapolis. The map on the left shows the neighborhoods with significantly clustered vacant land before taking the six types into consideration.

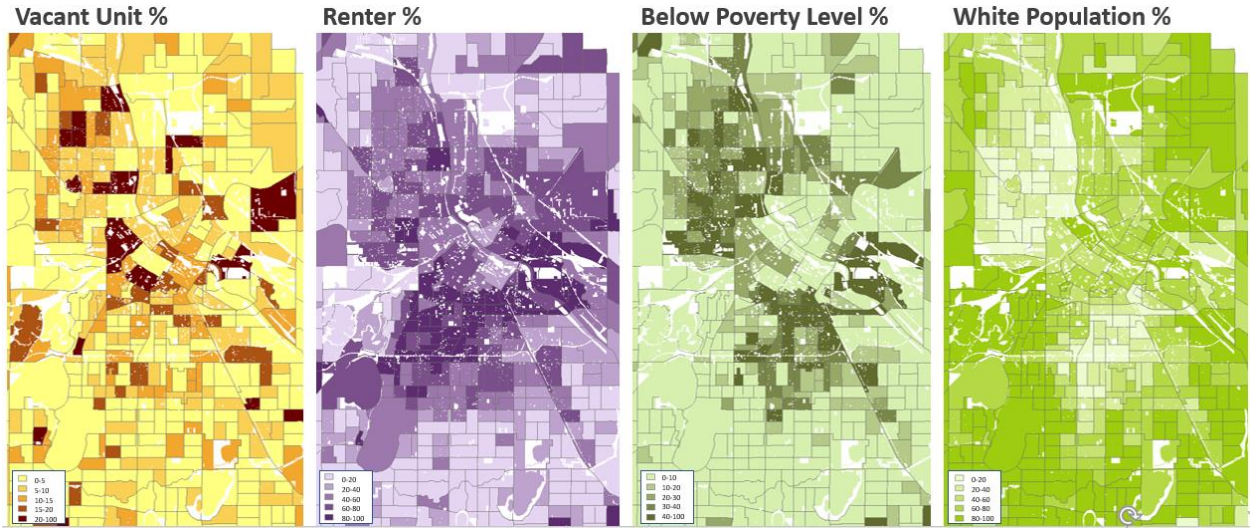

Figure 19 Socioeconomic status of neighborhoods in Minneapolis

When the clustered vacancies were examined by each type and compared with the socioeconomic status of the neighborhoods (Figure 19), Remnant, Speculative and reserved parcels show significant clustering around the downtown area and neighborhoods in the northwest regions where marginalized neighborhoods are located. Clustered Recreational land can be observed in southern neighborhoods with a higher socioeconomic status.

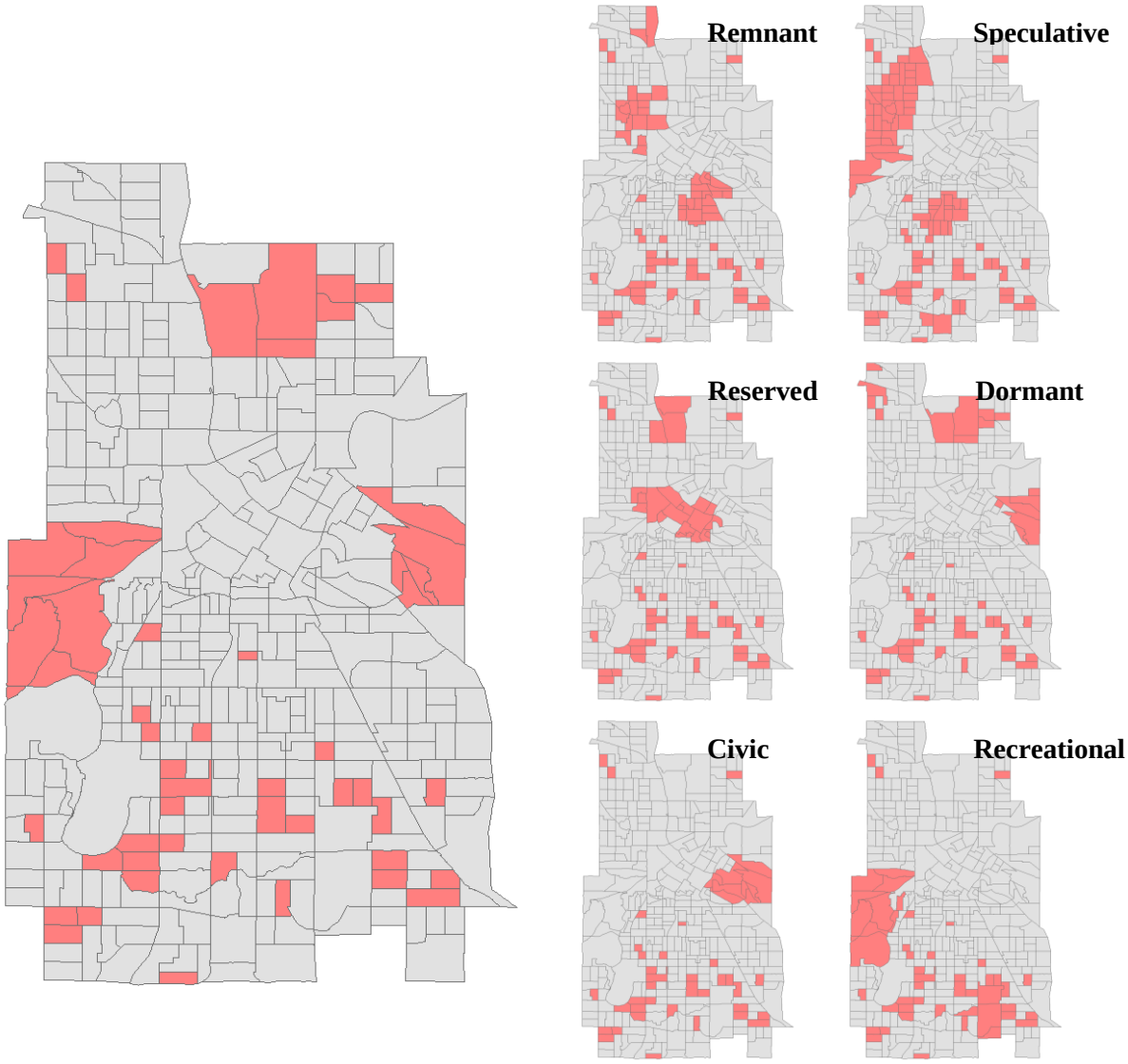

Figure 20 Significantly clustered vacancy measured with Getis-Ord Gi* analysis

6.3.3 Measuring gentrification

To identify if a neighborhood is gentrifying, the degree of gentrification needs to be measured. The degree of gentrification will be identified by each neighborhood at the census block group level. While gentrification can be measured in numerous ways depending on the way it is defined or by study purposes, this study will measure it by the concept of incoming middle-class populations in a neighborhood. In other words, the social class changes will be

measured for this study using a demographic profile to gauge the degree of gentrification in a neighborhood. By measuring the class change, this study will measure any potential threat at the neighborhood level driven by existing vacancy patterns.

Operationally, this study follows the methods Ley (1986) and Eckerd (2010) used to measure gentrification levels. While it may be argued that the calculation lacks a theoretical basis, existing studies have validated that this measure can capture the gentrification of neighborhoods (Eckerd 2010). The z scores of each variable will be totaled and the change in the z score between two time periods will identify the degree of gentrification for each neighborhood.

$$\text{Gentrification} = ((\%\ \text{Professional workers}_{2015} + \%\ \text{Bachelor's degree}_{2015}) - (\%\ \text{Professional workers}_{2000} + \%\ \text{Bachelor's degree}_{2000}))/\ 2$$

The equation is described in the following steps. First, the percentages of professional workers and people with a bachelor's degree will be added together and standardized for two time periods. Then, the difference between the two time periods will be calculated and divided by two. Finally, these scores will be compared with the city average to see if the social status has increased more than the average. These values will represent the degree of upgraded or downgraded social class of the neighborhood. When it shows a positive value, it means that the neighborhood is gentrifying (or socially upgrading). If the value is negative, the neighborhood is socially downgrading and does not show the gentrification phenomenon.

For this study, a gentrification score for each neighborhood was measured using educational and professional job level changes in Minneapolis between 2000 and 2015. The educational level was calculated using the percentage of the population with a bachelor's degree or above. The professional job level was calculated using the percentage of the population with a

professional career. The data was collected from the U.S. Decennial Census and American Community Survey at a block group level. A majority of the neighborhoods in Minneapolis turned out to have an improved social status from 2000 with a city average increase of 8.39% (See Figure 21). This led to the necessity to operationally define gentrifying neighborhoods as the areas in which social status had improved more than the city average. Figure 22 shows the areas where the social status has improved. Areas that had more than an 8.39% improvement are defined as gentrifying areas.

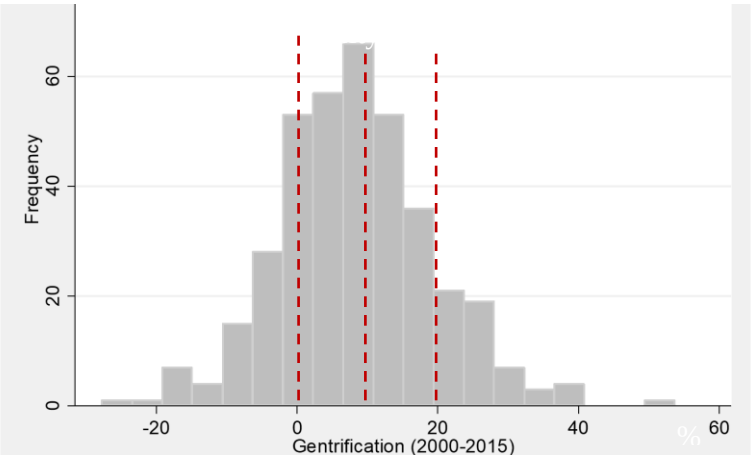

Figure 21 Gentrification scores in Minneapolis, MN

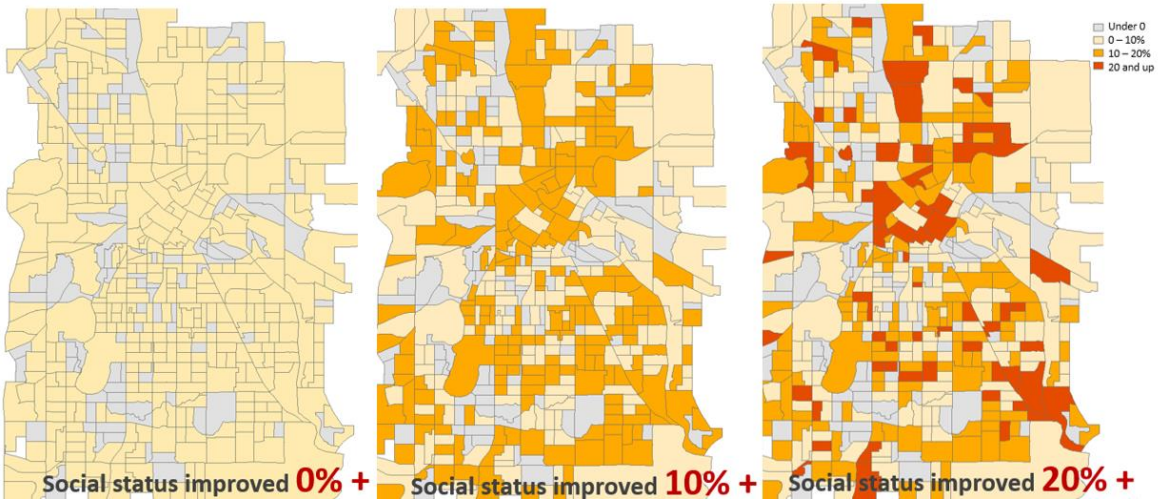

Figure 22 Gentrifying areas in Minneapolis, MN

An important aspect of the gentrification phenomenon across neighborhoods is that gentrification tends to have a spillover effect on nearby neighborhoods. Rather than occurring sporadically, gentrification can be observed more in a spatially clustered form; a neighborhood adjacent to a gentrifying neighborhood is also expected to confront the gentrification wave. For instance, low-income neighborhoods close to a high-income neighborhood tend to have larger income growth than the neighborhoods without any adjacent high-income areas (Guerrieri, Hartley, and Hurst 2013, Kolko 2007). This is because relatively higher-income populations move into the adjacent neighborhoods. Likewise, development activities and market forces tend to flow gradually into nearby areas. This type of neighborhood change, including the gentrification phenomenon, is mostly expected on the edge of a gentrifying neighborhood. Thus, it is reasonable to expect an interdependency in the degree of gentrification between neighborhoods spatially adjacent. This leads to the necessity of a spatial lag for gentrification in the model.

6.3.4 Measuring driving forces of gentrification

Existing studies have identified many evidences that there are spatial characteristics of a neighborhood that can catalyze investments and bring gentrification (For example, Freeman (2005)). While gentrification can be observed in a neighborhood at the stage of decline, not all old neighborhoods experience gentrification (Beauregard 1986). This represents the existence of other forces in neighborhoods that can bring about gentrification. As Rérat (2011) described the locational advantages that can bring gentrification as “spatial capital,” certain spatial characteristics of a neighborhood can become the driving forces of gentrification. The

operational construct of the driving forces of gentrification includes proximity to jobs, amenities, and infrastructures. More detailed measures are described in Table 17.

The first construct is proximity to jobs. Gentrification can be typically seen in central cities where the city economics have shifted to the service industry bringing people with professional jobs back into the city (Lipton 1977, Ley 1986). To represent this construct, a variable that measures the distance from the neighborhood to the downtown is included. The distance values will be inversed to weight more when the neighborhood is located closer to the downtown. It might be argued that the direct distance between a neighborhood and the downtown does not take public transportation and roadways into consideration for accessibility to the downtown area. However, I separated the benefits of transportation and roadways in the construct for infrastructure from the proximity to jobs in order to better capture the spatial proximity to the downtown rather than the benefits of infrastructures.

Another aspect that can bring the flow of gentrification is the accessibility to city amenities. The demand for a city lifestyle meets the existing amenities in and around a neighborhood. This leads to an environment that can bring reinvestment and valuable assets (Ley 1986). Thus, areas with better access to city amenities can have a stronger flow of gentrification. Many studies have supported the role of amenities to gentrification phenomenon (Heidkamp and Lucas 2013, Beauregard 1986, Atkinson 2004, Douglas 2016). To measure this construct, the distances to the nearest parks, waterfronts, commercial nodes, and retail centers were identified. This measures the accessibility to city amenities and an urban lifestyle. The distance between a neighborhood and each amenity is inversed to weight more for a closer distance.

Last, the accessibility to infrastructures is included to measure the catalyst of gentrification. Easy access to decent infrastructures and the proximity to downtown area of a

neighborhood can attract newcomers (Beauregard 1986, Douglas 2016). This represents the functional aspect of a neighborhood that can bring gentrification. The measures of this construct include distance from schools, hospitals, grocery stores, and highways.

Table 17 Variables for the driving forces of gentrification

Construct	Measurement	Citation
	Proximity from infrastructure	
Schools	Distance from schools	Beauregard (1986), Douglas (2016)
Hospitals	Distance from hospitals	
Grocery shops	Distance from grocery shops	
Highways	Distance from highways	
	Proximity from amenities	
Park	Distance from parks	Heidkamp and Lucas (2013), Beauregard (1986), Atkinson (2004), Douglas (2016)
Waterfront	Distance from waterfronts	
Commercial nodes	Distance from commercial nodes	
Retail center	Distance from retail centers	
	Proximity from jobs	Ley (1986), Lipton (1977), Douglas (2016)
Distance from downtown †	Distance from downtown	

†: These variables were not used due to the multicollinearity issue

Data source: MetroGIS website (Metropolitan Council of Minneapolis-St. Paul 2016)

6.3.5 Analytic approaches

Two models were developed to test each of the two sub-hypotheses in this Chapter. First, the influence of vacancy clusters on the degree of gentrification in neighborhoods was measured. A spatial model was specified to take the theoretical spillover effect of gentrification into consideration; the gentrification phenomenon has been shown to have spillover effects on nearby areas (Guerrieri, Hartley, and Hurst 2013, Liu and O'Sullivan 2016). The global Moran's I and the Lagrange Multiplier (LM) tests were conducted beforehand to statistically diagnose the spatial interdependency (Anselin et al. 1996). These diagnostic tests are expected to help if any spatial interdependency is captured, and to identify which spatial relationship is statistically

plausible. The global Moran's I test on the gentrification variable will help to gauge broadly if a spatial model needs to be taken into consideration. The LM diagnostic tests can suggest if a spillover effect of the dependent variable is expected and if an unobservable spillover effect is diagnosed in the error term.

A possible spatial model for the first sub-hypothesis would be the spatial autoregressive model (SAR) introduced by Anselin (Anselin 2003), which captures the spillover effect of the dependent variable, and gentrification from a theoretical perspective. Typically a SAR model is beneficial when a spatial lag on the dependent variable is expected with no other lag on the explanatory variables or the error term (Halleck Vega and Elhorst 2015). This model will help capture the spillover effects of the gentrification phenomenon across neighborhoods as well as the influence from nearby areas. This spatial interdependency will be weighted by calculating the weight matrix using the inversed distance between neighborhoods so closer neighborhood characteristics can be set to have more influence.

The general model for the SAR can be stated as below (Anselin 2003):

$$Y = \rho W y + X\beta + \varepsilon$$

$$Y = (I - \rho W)^{-1} (X\beta + \varepsilon) \ldots \text{SAR}$$

Accordingly, the model for this study can be stated as:

$$G = (I - \rho W)\text{-}1\ (\beta_0 + X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + X_4\beta_4 + X_5\beta_5 + \ldots + X_n\beta_n + \varepsilon)$$

where,
- G = Gentrification score
- β_0 = Intercept
- $\beta_1 \sim \beta_n$ = Regression coefficients
- $X_1 \sim X_4$ = Vacancy types (Z of Getis-Ord Gi)
- $X_5 \sim X_n$ = Driving forces of gentrification
- W = Spatial weight matrix
- $(I - \rho W)^{-1}$ = Spatial multiplier
- E = Error term

While the SAR model measures how the accumulation of certain vacancy types can lead to the gentrification phenomenon, the second sub-hypothesis examines how the variables representing gentrification can predict the vacancy types. This sub-hypothesis will be measured using a dummy dependent variable for the vacancy type. Taking the spillover effect of gentrification into consideration again, a binary regression logistic analysis (or logit model) with a spatial lag of X effect was performed on each vacant land type. The dependent variables for this examination represent whether or not a type of vacancy is significantly clustered in the neighborhood. A logit model identifies the odds of having significant clusters by each vacancy type. The general logistic regression can be stated as below (Pampel 2000, Menard 2002):

$$\text{Log}\left(\frac{p}{1-p}\right) = \beta_0 + X_1\beta_1 + X_2\beta_{2\,+\,\ldots}$$

The general model with a spatial lag of X (SLX) can be stated as (Halleck Vega and Elhorst 2015):

$$Y = X\beta + WX\theta + \varepsilon \ldots \text{SLX}$$

The modified model for this study can be stated as:

$$\text{Log}\left(\frac{p_a}{1-p_a}\right) = \beta_0 + X_1\beta_1 + X_2\beta_2 + \ldots + X_n\beta_n + WX_1\theta_1 + \varepsilon$$

where, Pa = Probability that a vacant land type is statistically clustered
$\beta 0$ = Intercept
$\beta 1 \sim \beta n$ = Regression coefficients
X1 = Gentrification score
X2 ~ Xn = Driving forces of gentrification
$\theta 1$ = Coefficient of a lagged gentrification
W = Spatial weight matrix
ε = Error term

6.4 RESULTS

6.4.1 Gentrification score by vacancy type

Before measuring the relationships between vacant land accumulation and the gentrification process, an analysis of variance (ANOVA) was performed on each vacancy type to examine if the neighborhoods with clustered vacancies are experiencing a higher or lower degree of gentrification. When vacancy types are not taken into consideration, there is no significant difference between clustered and non-clustered neighborhoods. However, when each vacancy type was examined, neighborhoods with clustered reserved and Speculative vacant parcels showed a significantly different gentrification score compared to the neighborhoods without any clustering. Table 18 shows the ANOVA results for neighborhoods with clustered vacancies by type. Neighborhoods with clustered Speculative and Reserved vacant land showed significantly higher gentrification scores than the other neighborhoods ($p=0.0051$, $p=0.0021$). The other types showed that there is no significant difference between clustered vacancy types and gentrification scores. Even when the clustering was calculated without considering the specific types, the P value shows no significant differences.

Table 18 ANOVA results on gentrification scores and clustered vacancies

Total neighborhoods (n=376)	Clustered neighborhoods		Other neighborhoods		
Vacancy types	Mean	Std. Dev.	Mean	Std. Dev.	P
Remnant clusters (n=88)	7.56	12.11	8.65	10.86	0.4265
Speculative clusters (n=68)	11.81	12.70	7.64	10.66	0.0051 *
Reserved clusters (n=54)	12.70	12.46	7.67	10.78	0.0021 *
Dormant clusters (n=48)	9.29	11.42	8.26	11.13	0.5504
Civic clusters (n=44)	8.08	11.23	8.44	11.16	0.8409
Recreational clusters (n=50)	7.97	10.41	8.46	11.28	0.7735
Total clusters (n=53)	7.96	11.54	8.46	11.11	0.7601

The ANOVA results, shown in Table 18 and Table 19, indicate that the clustering of Speculative and Reserved lands have higher gentrification scores than areas without any clustering. This may imply that massive regeneration of vacant land may be related to the gentrification process. However, without taking into consideration other variables such as the driving forces of gentrification or the lag term of the spillover effect of gentrification, the interpretation is limited.

Table 19 Clustered vacancy and gentrification scores

Type	Land use	Ownership	Size	Gentrification score of clustered areas
Remnant	Residential/ Commercial	Public/Private	Small	Low
Speculative		Private	Moderate	High *
Reserved		Public/Private	Moderate to large/Large	High *
Civic	Institutional	-	-	Low
Dormant	Industrial	-	-	High
Recreational	Park & Recreational	-	-	Low

6.4.2 Spatial diagnostics

The Moran's I result on the gentrification variable shows that the null hypothesis that the local Moran's Is are the same as the Global Moran's I is rejected ($p = 0.000$). This implies that the gentrification scores are possibly spatially clustered, and there is a possibility for some spatial interdependency. The Lagrange multiplier (LM) test results also indicate a potential spatial lag on gentrification when the model is taken into consideration. The regular LM tests on both error and lag turned out to be insignificant. However, the robust LM tests support that there is a possible spatial lag on gentrification. The test rejected the null hypothesis that there is no spatial lag on gentrification at a 90% level ($p = 0.065$). Meanwhile, the LM tests did not show

any evidence toward the spatial error on residuals. Table 20 shows the spatial diagnostic test results. These spatial diagnostics indicate that a spatial model that includes a spatial lag on gentrification needs to be taken into consideration.

Table 20 Spatial diagnostic tests

Test	Statistic	p-value
Global Moran's I on Gentrification:	0.019	0.000
Spatial error:		
Moran's I	2.885	0.004
Lagrange multiplier	0.143	0.705
Robust Lagrange multiplier	2.777	0.096
Spatial lag on Gentrification:		
Lagrange multiplier	0.777	0.378
Robust Lagrange multiplier	3.411	0.065

6.4.3 Spatial Autoregressive models

The first sub-hypothesis was tested with the full SAR model estimating the effect of clustered vacancies on gentrification. Table 21 shows the results including the base SAR model without the vacancies variables as well as the non-spatial OLS model to compare the results with the full SAR model. The base model indicates that without taking the clustered vacancies into consideration, poverty level ($b = -0.131$, $p < 0.01$), minority status ($b = -0.071$, $p < 0.05$), structures built after 2000 ($b = 0.308$, $p < 0.001$), structures built before 1969 ($b = 0.09$, $p < 0.05$), and property values ($b = 0.023$, $p < 0.05$) are the predictors of gentrification.

When the vacancy variables were included in the full SAR model, the effects from the poverty level, minority status, structures built after 2000, and structures built before 1969 continue to be predictors of gentrification, but not the property values. Among the clustered vacancy variables, Speculative, Reserved, and Civic lands are the significant predictors of

gentrification. Specifically, the presence of significantly clustered Speculative land in a neighborhood increases the gentrification score by 5.985% ($p < 0.05$). The presence of Reserved land increases the gentrification score by 6.971% ($p < 0.05$). In contrast, the presence of significantly clustered Civic land in a neighborhood decreases the gentrification score by 8.472% ($p < 0.01$). The non-spatial OLS model also indicates that the presence of Speculative and Reserved land increases the degree of gentrification while Civic land decreases the gentrification score.

The potential driving forces of gentrification such as proximity from infrastructure and amenities did not turn out to be predictors of gentrification. The proximity to a waterfront shows a negative association with gentrification ($p < 0.01$) probably because the waterfront tends to be located in suburban areas and not in the downtown area. Also, the variable representing the construct of *proximity from jobs* – proximity to downtown – was excluded from the model due to a multicollinearity issue.

6.4.4 Logistic regressions with SLX effects

The second sub-hypothesis was tested by regressing six vacant land types onto gentrification along with the variables representing socioeconomic status and proximity from infrastructure and amenities. Table 22 and Table 23 show the results of six logistic regressions with SLX effects. An increase in the degree of gentrification was associated with increased odds of clustered Speculative land by 3.5% (OR = 1.035, $p <0.05$) and clustered Reserved land by 3.4% (OR = 1.034, $p < 0.05$). Also, the lagged gentrification turned out to be a significant predictor for clustered Speculative land indicating that a 1 percent increase in the gentrification score is likely to increase the odds of clustered Speculative land in the nearby neighborhoods by

72.8% on average (OR = 1.728, $p < 0.05$). Gentrification was not a predictor of clustered Remnant, Dormant, Civic, or Recreational land.

Table 21 Impact of clustered vacancies on gentrification

	Base SAR model		Full SAR model		Non-spatial OLS	
	B	**SE**	**B**	**SE**	**B**	**SE**
Socioeconomic status						
Unemployment %	0.077	(0.092)	0.036	(0.091)	0.029	(0.094)
Income (K$)	-0.033	(0.024)	-0.034	(0.024)	-0.036	(0.025)
Below poverty %	-0.131**	(0.04)	-0.093*	(0.04)	-0.095*	(0.041)
Minority %	-0.071*	(0.032)	-0.089**	(0.033)	-0.092**	(0.034)
Built after 2000 %	0.308***	(0.062)	0.3***	(0.061)	0.300***	(0.063)
Built before 1969 %	0.09*	(0.043)	0.108*	(0.042)	0.107*	(0.044)
Vacant housing units %	-0.017	(0.081)	-0.037	(0.078)	-0.041	(0.081)
Values ($/ft)	0.023*	(0.011)	0.007	(0.011)	0.007	(0.012)
Proximity from infrastructure, amenities, jobs						
Highway	0.286	(0.345)	0.278	(0.337)	0.301	(0.347)
Commercial node	0.539	(0.417)	0.613	(0.409)	0.646	(0.421)
Grocery store	0.372	(0.507)	0.355	(0.493)	0.404	(0.508)
Hospital	-0.075	(0.133)	-0.022	(0.13)	-0.04	(0.133)
Retail center	-0.191	(0.178)	-0.225	(0.175)	-0.250	(0.179)
Park	0.511	(1.407)	0.825	(1.386)	0.811	(1.433)
School	0.98+	(0.563)	0.763	(0.557)	0.792	(0.575)
Waterfront	-1.17**	(0.431)	-1.186**	(0.42)	-1.240**	(0.431)
					Significantly clustered vacancies	
Remnant land			-1.891	(1.726)	-1.967	(1.783)
Speculative land			5.985*	(2.352)	6.225*	(2.421)
Reserved land			6.971*	(2.748)	7.096*	(2.838)
Dormant land			0.285	(2.939)	0.176	(3.036)
Civic land			-8.472**	(3.237)	-8.633*	(3.343)
Recreational land			-2.399	(2.52)	-2.402	(2.605)
Intercept	-4.723	(4.779)	-4.88	(4.632)	-4.714	(4.786)
λ (lag on Y)	0.61**	(0.23)	0.396	(0.366)		
$sigma^2$	101.415***	(7.402)	94.67***	(6.908)		
Adjusted R^2					0.188	
N of neighborhoods	376		376		376	

+p < .1. *p < .05. **p < .01. ***p < .001.

Table 22 Impact of gentrification on Remnant, Speculative, and Reserved lands

	Remnant			Speculative			Reserved		
	B	**SE B**	**OR**	**B**	**SE B**	**OR**	**B**	**SE B**	**OR**
Gentrification	0.004	0.013	1.004	0.034*	0.015	1.035	0.034*	0.016	1.034
Lag of gentrification	0.014	0.189	1.014	0.547*	0.212	1.728	0.302	0.211	1.352
Socioeconomic status									
Unemployment	0.033	0.021	1.034	0.062*	0.028	1.064	0.044	0.029	1.045
Income (K$)	0.005	0.006	1.005	0.012+	0.007	1.012	0.009	0.007	1.009
Below poverty	0.009	0.009	1.009	0.010	0.012	1.010	0.000	0.014	1.000
Minority	0.019*	0.008	1.019	0.003	0.010	1.003	-0.006	0.010	0.994
Built after ‘00	0.003	0.014	1.003	-0.028	0.018	0.973	0.008	0.018	1.008
Built before ‘69	-0.011	0.011	0.990	-0.023+	0.012	0.977	-0.009	0.013	0.991
Vacant units	0.001	0.019	1.001	0.008	0.024	1.008	0.005	0.024	1.005
Values ($/ft)	0.000	0.003	1.000	0.017**	0.005	1.017	0.004	0.003	1.004
Proximity from infrastructure, amenities, jobs									
Highway	-0.076	0.089	0.927	-0.063	0.096	0.939	-0.008	0.098	0.992
Commercial node	0.083	0.111	1.087	0.063	0.138	1.065	0.131	0.144	1.140
Grocery store	0.063	0.130	1.065	-0.078	0.148	0.925	-0.049	0.146	0.952
Hospital	-0.008	0.036	0.992	-0.004	0.040	0.996	-0.006	0.041	0.994
Retail center	-0.032	0.045	0.969	-0.007	0.055	0.993	-0.031	0.055	0.970
Park	0.262	0.364	1.299	-0.292	0.384	0.747	-0.435	0.392	0.647
School	-0.082	0.147	0.921	0.016	0.155	1.016	-0.295+	0.153	0.745
Waterfront	-0.012	0.112	0.988	0.096	0.134	1.101	0.103	0.144	1.109
Intercept	-2.161			-2.206			-2.590		
Chi^2	35.66			63.23			35.33		
DF	18			18			18		
Pseudo R^2	0.0871			0.1779			0.1142		

+p < .1. *p < .05. **p < .01. ***p < .001.
OR: Odd Ratio (e^B)

Table 23 Impact of gentrification on Dormant, Civic, and Recreational lands

	Dormant			Civic			Recreational		
	B	SE B	OR	B	SE B	OR	B	SE B	OR
Gentrification	0.005	0.017	1.005	-0.004	0.017	0.996	-0.003	0.017	0.997
Lag of gentrification	-0.207	0.225	0.813	-0.121	0.239	0.886	0.059	0.228	1.060
Socioeconomic status									
Unemployment	-0.027	0.039	0.974	0.020	0.035	1.020	-0.028	0.043	0.973
Income (K$)	0.001	0.008	1.001	0.004	0.008	1.004	0.017*	0.007	1.017
Below poverty	0.018	0.016	1.019	0.032*	0.014	1.032	-0.004	0.021	0.996
Minority	-0.028*	0.012	0.973	-0.041**	0.012	0.960	-0.018	0.013	0.982
Built after ‘00	-0.011	0.030	0.989	0.013	0.024	1.013	-0.052	0.037	0.949
Built before ‘69	0.006	0.016	1.006	0.003	0.017	1.003	-0.008	0.015	0.992
Vacant units	-0.015	0.027	0.985	-0.017	0.029	0.984	-0.010	0.028	0.991
Values ($/ft)	-0.008	0.009	0.993	0.002	0.005	1.002	-0.004	0.006	0.996
Proximity from infrastructure, amenities, jobs									
Highway	0.013	0.105	1.013	0.020	0.106	1.020	0.110	0.102	1.116
Commercial node	0.314+	0.180	1.369	0.290+	0.171	1.336	0.003	0.147	1.003
Grocery store	-0.083	0.145	0.921	-0.026	0.152	0.974	-0.093	0.145	0.911
Hospital	0.024	0.041	1.024	0.029	0.045	1.030	0.013	0.041	1.013
Retail center	-0.123*	0.055	0.884	-0.138*	0.060	0.871	-0.030	0.058	0.970
Park	-1.033*	0.403	0.356	-0.393	0.510	0.675	-0.285	0.433	0.752
School	-0.194	0.167	0.824	-0.231	0.168	0.794	-0.249+	0.151	0.779
Waterfront	0.180	0.163	1.197	-0.008	0.168	0.992	0.125	0.158	1.133
Intercept	-1.779			-2.653			-1.452		
Chi^2	45			42.9			56.15		
DF	18			18			18		
Pseudo R^2	0.1567			0.1581			0.1905		

+p < .1. *p < .05. **p < .01. ***p < .001.
OR: Odd Ratio (e^B)

6.5 CONCLUSION

6.5.1 Summary of results

This study examined the relationship between accumulated vacancies and neighborhood gentrification. The first SAR model examined whether or not certain types of vacant land can contribute to neighborhood gentrification. The second part examined, using a Logit model for each vacant land type, whether or not the gentrifying process of a neighborhood contains certain types of vacant land. Table 24 shows the regression results of two sub-hypotheses on six vacancy types.

Table 24 Regression results on vacancy types

Vacancy type:	Remnant	Speculative	Reserved	Dormant	Civic	Recreational
Model 1. SAR Model IV: Vacancy DV: Gentrification	-2.0481 (1.6669)	6.326 ** (2.2764)	5.7864 * (2.6818)	0.3865 (2.9204)	-8.0504 ** (3.1121)	-2.1246 (2.4583)
Model 2. Logit Model IV: Gentrification DV: Vacancies	1.0002 (0.0129)	1.0347 * (0.0157) + lag *	1.0319 * (0.0163)	1.0057 (0.0171)	0.9947 (0.0174)	0.9962 (0.0176)

Notes: Model 1: b, Model 2: OR (Standard Error)
*** p < 0.001; ** p < 0.01; * p < 0.05

From Table 24, the SAR model indicates that clustered Speculative and Reserved lands are positively associated with gentrification. Civic land shows a negative association with gentrification. The logit model shows that gentrifying neighborhoods show more clustered Speculative and Reserved lands, which support the SAR model. Civic land can discourage gentrification while the gentrification phenomenon does not limit the clustering of Civic land.

The regression results can be interpreted as shown in Table 25 using the typology description identified in Study 1.

Table 25 Characteristics of vacancies associated with gentrification

Not significant vacancies	Vacancies discouraging gentrification	Vacancies encouraging gentrification
Small residential/commercial properties	Institutional properties	Short-term vacancies
Industrial properties		Moderate-sized Privately-owned residential/commercial vacant land
Parks & recreational uses		Large private land and moderate to large publicly owned residential/commercial land

6.5.2 Vacanct land types associated with gentrification

The types of vacancies encouraging gentrification are 1) Speculative land: moderate-sized privately-owned residential or commercial vacant land and 2) Reserved land: large private and moderate to large publicly owned residential or commercial land. It can be pointed out that both Speculative and Reserved lands can be found in neighborhoods with a high minority population indicating communities with low political power (See 5.4.2 Socioeconomic characteristics by vacancy type).

1) Speculative land

Speculative land is the vacancy type that shows the shortest vacancy durations among the six vacancy types. This implies that neighborhoods with accumulated Speculative land can experience quick vacancy turnover and significant reinvestments onto these vacant properties. The socioeconomic characteristics around Speculative land imply a condition of relatively high income level with a high minority population at the neighborhood scale. The income level tends to be high around Speculative land, which creates a condition for bringing reinvestment. A high proportion of minority population can indicate lower social and political power that pushes the

flow of gentrification. Likewise, Speculative land tends to be located in areas with socioeconomic characteristics that favor investors and gentrification.

2) Reserved land

Reserved land has a different socioeconomic condition from Speculative land according to Study 2. Reserved land can be found in an area with higher property values. Income level was not a significant indicator of Reserved land at both site- and neighborhood-scales while the presence of a minority population is positively associated with Reserved land. This condition indicates that Reserved land could trigger gentrification due to its high surrounding land values and low political power of minority populations.

The vacancy type discouraging gentrification is 3) Civic land: institutional properties.

3) Civic land

Study 2 has identified that Civic land can be found in neighborhoods with a low-income population and a low percentage of minority population. Civic land does not have the typical socioeconomic characteristics that can trigger gentrification, such as having a high-income population to regenerate vacant properties, or a high minority population with less political power.

The types without any significant association with gentrification are 4) Remnant land: small residential and commercial properties, 5) Dormant land: industrial properties, and 6) Recreational land: park and recreational uses.

Furthermore, the results of this study can be summarized as below:

1) Clustered short-term vacancies are positively associated with neighborhood gentrification

- Speculative land turned out to be positively associated with neighborhood gentrification. This type tends to be repurposed more quickly than other vacant land types according to Study 1,

which examined the survival rate of each vacancy type. This implies that short-term vacancies can encourage gentrification by having been actively repurposed bringing more potential investment activities into the neighborhoods.

2) Clustered institutional vacancies are negatively associated with neighborhood gentrification

- Civic land turned out to be negatively associated with neighborhood gentrification. This land includes vacant institutional properties for schools, hospitals, and other public services. Study 1 results indicate that Civic land has a higher survival rate than other vacant land types indicating long-term vacancies. Furthermore, each property remained vacant for a reason such as future development. Thus, neighborhoods with clustered Civic land would not expect frequent activities on these properties.

3) Clustered small-size, industrial, and recreational vacancies do not predict gentrification

- While some vacancy types have an association with the gentrification process, some types turned out to be an insignificant factor in the gentrification phenomenon. Clustered small vacancies did not predict gentrification. This is probably because these properties are too small to bring active investments.
- Clustered industrial vacancies also did not predict gentrification. Neighborhood gentrification is typically associated with regenerating residential or commercial properties and not with industrial land. Unless these industrial properties are being regenerated into residential or commercial uses, they will not bring gentrification.
- Unlike the notion of green space that can favor gentrification, clustered Recreational land did not predict gentrification. While it may be counterintuitive, Recreational lands do not represent a citywide green space. Thus, it can be pointed out that these recreational parcels

identified as vacant land may have fewer features that favor gentrifiers than other parks and recreational areas.

The summarized results go back to the question of whether or not a vacancy itself can be the catalyst to bring more investment and gentrification to a neighborhood. It can be answered in several ways. First, Speculative and Reserved land can be a catalyst for gentrification through frequent turnovers or high property values within the context of high minority populations, which can potentially bring more investment activities. Second, Civic land will discourage gentrification through restricted land use and long-term vacancies. Third, the other vacant land types are insignificant factors for gentrification.

This study has several limitations including some measurement issues. First, measuring neighborhood-level gentrification and parcel-level vacancies in one model forced the aggregation of vacancy information into neighborhood-level block groups. Instead of measuring the individual effect, therefore, this study looked at the aggregated vacancies. This study mitigated this issue and enhanced the results by measuring the clustering of vacancies instead of summing the amount of vacant land. Future studies can use a multilevel modeling technique to include two different levels of the unit in one model. Second, this study measures gentrification using educational and professional levels to measure the incoming upper-class population in the neighborhood. However, gentrification is a complex phenomenon entailing dynamic neighborhood change. This includes not only a social class change but also physical improvement and increased investment activities. This means that social class may not capture all the gentrifying process of the neighborhoods. Measuring physical change and property sale activities can enhance the current measurement. It can also be argued about whether the incoming population actually led to displacement. While gentrification can still be a burden for

tenants even without displacement due to increased rent, displacement is still what makes gentrification an issue. Thus, in future research, gentrification can be measured in multiple ways to capture the multi-dimensional neighborhood dynamics.

In sum, findings from this study suggest that some vacant land can be positively associated with gentrification. While it also implies that not all vacant properties bring gentrification, the vacant land typology from Study 1 contributed to identifying different functions of vacant land by types and their relationship to gentrification in Minneapolis.

Examining the relationship between different types of vacant land and the gentrification phenomenon in a neighborhood expands vacant land scholarship to include more dynamic characteristics of vacant land. Furthermore, understanding different types of vacant land with neighborhood dynamics can lead to potential policy directions and implications. The last chapter describes the implications of this study in more detail.

CHAPTER VII.

CONCLUSION

7.1 INTRODUCTION

This chapter summarizes the findings from the three studies. Chapters IV, V, and VI describe the three studies to examine H1, H2, and H3. These studies interweave with each other to finally answer the main research question, "What types of vacant land are positively associated with neighborhood gentrification?" Additionally, this chapter discusses potential planning implications driven from the three studies focusing on the three main aspects – methodological improvements, theoretical contributions, and practical implications.

7.2 SUMMARY OF FINDINGS (H1, H2, H3)

This research looks into the relationships between urban vacant land and neighborhood gentrification using Minneapolis, MN as a case study site. The longitudinal vacancies between 2005 and 2015 were examined with a total of 7,116 vacant parcels including 5,440 parcels as of 2015. Additionally, 768 block groups were examined to identify neighborhood gentrification. The durations of vacancies were measured using Kaplan-Meier survival estimates to identify six different vacancy types. Neighborhood effects on vacant land types were measured using logistic regressions. The relationships between vacant land types and gentrification were as measured using a spatial autoregressive model and the logistic regressions with a spatial lag of x effects to capture the spillover effects of gentrification.

7.2.1 Findings from Hypothesis 1

Hypothesis 1	Parcel size, ownership, and land use determine the length of vacancies.

The first study examined the land characteristics that can contribute to long-term vacancies as the first hypothesis and suggested a new vacant land typology. Using parcel size, ownership, and land use types as the main actors of long-term vacancies, six types were introduced. Remnant land represents residential or commercial land with physical restrictions due to the small size. Speculative land represents vacant parcels that are most active in the market. Reserved land represents lands with future potential. Dormant land represents industrial vacancies. Civic land represents vacant properties for future institutional uses. Recreational land represents greenfield-type undeveloped vacancies. The Kaplan-Meier survival graphs show that Speculative land show the lowest survival rates indicating short-term vacancies. These results support the hypothesis that these land characteristics can lead to a different length of vacancies in urban areas.

7.2.2 Findings from Hypothesis 2

Hypothesis 2	Neighborhood-scale socioeconomic characteristics predict the type of vacant land.

The second study looked into the heterogeneous socioeconomic characteristics around vacant properties using buffer zones around each property. Also, three different scales were measured to identify the different influential boundaries of site and neighborhood scales. The results showed that the neighborhood-scale socioeconomic characteristics can predict the types of vacant land more than site-scale characteristics supporting Hypothesis 2. Furthermore, the types of socioeconomic status differ by type and scale suggesting a further discussion on the neighborhood conditions that favor certain types of vacancies. A few points can be made with the findings. First, vacant residential and commercial vacancies tend to be located in areas with a high minority population. Second, institutional vacant properties are located in low-income areas

with a low minority population indicating potential inequality issues. Third, neighborhood scales predict the vacancy types better than the site-scale socioeconomic status indicating that neighborhood contexts can be more influential than the actual site conditions.

7.2.3 Findings from Hypothesis 3

Hypothesis 3	Certain vacant land types are positively associated with the gentrification process of a neighborhood.

This study looked into the relationships between the vacancy types identified from Study 1 and neighborhood gentrification at the census block group level. The social class change was measured to identify gentrifying neighborhoods, and vacancy information was aggregated to neighborhood-level using Getis-Ord Gi* statistics. The results suggest that only a few vacancy types are significantly associated with gentrification. Speculative and Reserved lands are positively associated with neighborhood gentrification supporting the hypothesis. However, Civic land showed a negative association and Remnant, Dormant, and Recreational lands showed no significant relationship with gentrification.

7.3 PLANNING IMPLICATIONS

This dissertation suggests three major contributions for the planning field. First, this research improves the methodology to identify different types of vacant land that can be adopted across localities (See section 7.3.1 Methodological improvements). Second, this research contributes to the current theory of urban vacancies by identifying neighborhood effects on the vacancy types (See section 7.3.2 Theoretical contributions). Third, this research describes implications for planners and policymakers in utilizing vacant properties as a tool to identify and control gentrification in a neighborhood (See section 7.3.3 Practical implications). Figure 23 summarizes the overall planning implications.

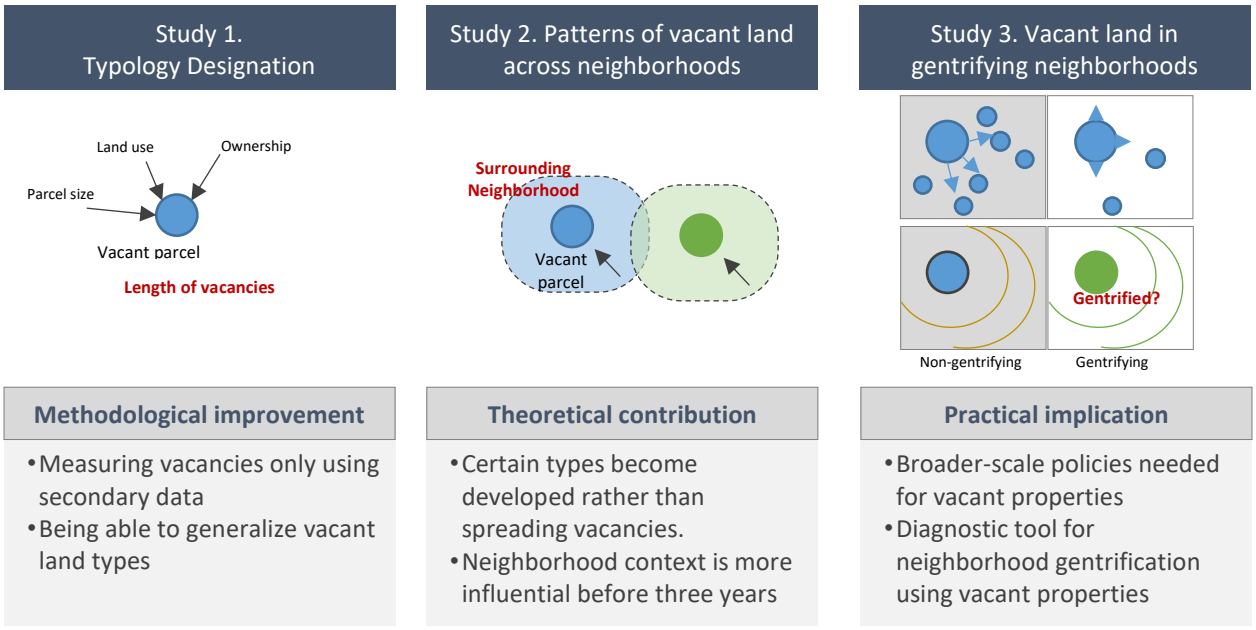

Figure 23 Planning implications

7.3.1 Methodological improvements

With the trend of increasing planning concerns as well as the scholarly attractions of vacant urban land, the necessity to improve the methodology to measure vacant land has grown. How urban vacant land increases or decreases, and how it influences urban dynamics are the main questions vacant land researchers seek to answer. However, the broad definitions in the past have led to limited studies to either compare citywide inventories or focus on a specific measurable type. Many studies have used different types of urban vacancies with multiple resources from a citywide database to the nationwide USPS vacant addresses or the Census for vacant housing units. While only a handful of cities have kept a vacant parcel inventory to manage and control urban vacancies, how these vacant parcels are specified vary by city. To improve this methodological limitation, Study 1 suggests a new methodology to measure and identify different types of vacant land using only a secondary inventory. Surveying each vacant property and identifying the conditions would ideally give the most accurate information on

vacant land. However, this may not be so realistic considering the massive number of vacant parcels in a city. Even if a city has a detailed inventory of vacant land, the same data is not available in other cities. Hence, the study results will not be applicable across localities.

Study 1 suggests a new vacant land typology including six types – Remnant, Speculative, Reserved, Dormant, Civic, and Recreational lands – using land characteristics that can contribute to long-term vacancies. Each type is expected to serve different functions in a neighborhood and for the city. Differentiating vacant land by the distinctive life-cycle of vacancies helps to understand the role of vacant land in neighborhood dynamics for Studies 2 and 3. Not only that, the typology introduced in Study 1 can be potentially utilized as a new methodology for identifying the different types of vacant land for future studies that look into urban dynamics and vacancies.

7.3.2 Theoretical contributions

How vacancies spatially spread out and cluster can be well explained with the broken windows theory (Wilson and Kelling 1982). Urban vacant land has been known to bring negative perceptions and promote further social disorder. However, it can be pointed out that in addition to the site condition the locational and socioeconomic contexts of the neighborhood can also be influential as well. Collective efficacy theory is known to identify the neighborhood effect caused by the historical stereotype and the context of the neighborhood (Sampson and Raudenbush 2004). While recent views on vacant land show a positive potential of urban vacancies to serve a function in the urban system, Study 2 points out that the neighborhood contexts can also be influential in the life-cycle of urban vacancies.

Study 2 looks into the potential neighborhood effect on vacant properties by measuring if the socioeconomic status of the neighborhoods can predict the types of vacancies. The results

show an interesting pattern that indicates more neighborhood effect than the effect from the site characteristics. It can be suggested that urban vacancies appear within the context of neighborhoods and neighborhood characteristics can dictate certain types of vacant land within the neighborhood. Furthermore, due to the distinctive neighborhood characteristics, urban vacancies may not spread or cluster as broken windows theory typically describes. Typically, a vacant property becomes a long-term vacancy after three years according to Study 1. Before then, neighborhood context can be more influential; vacant land in certain neighborhoods may be rather quickly repurposed and utilized as an opportunity when the neighborhood context supports developable conditions, as collective efficacy theory explains.

7.3.3 Practical implications

While there are multiple functions vacant properties serve in a neighborhood, what types are related and how they are related to neighborhood dynamics and gentrification have not been studied yet in vacant land research, and therefore, provide less guidance for planners and policymakers. Managing vacant land goes beyond the field of physical planning; vacant urban land can be a threat to the city as a proxy of an unhealthy economy, or an opportunity for the city to bring more green space, or for potential alternative uses. Repurposing vacant land can potentially increase nearby property values and be a trigger for the flow of gentrification. Alternatively, a vacant land itself can be a target for reinvestment and development, which can potentially catalyze gentrification. In this vein, how to plan for and manage existing vacant properties have been a concern for city planners and policymakers.

This dissertation research suggests a new direction for city policies.

First, broader neighborhood-scale policies are needed for managing vacant land rather than current parcel-base. Study 2 examined the heterogeneous neighborhood characteristics

around vacant land and identified that neighborhood socioeconomic characteristics can dictate vacancy types. This implies that vacant properties need to be controlled and managed in a neighborhood scale.

Second, cities need to act fast to regulate vacant properties. Study 1 identified that vacant properties in Minneapolis tend to stay vacant longer after the three-year threshold. This implies that vacancies can be widespread, if not controlled, in a couple of years after the land has become vacant.

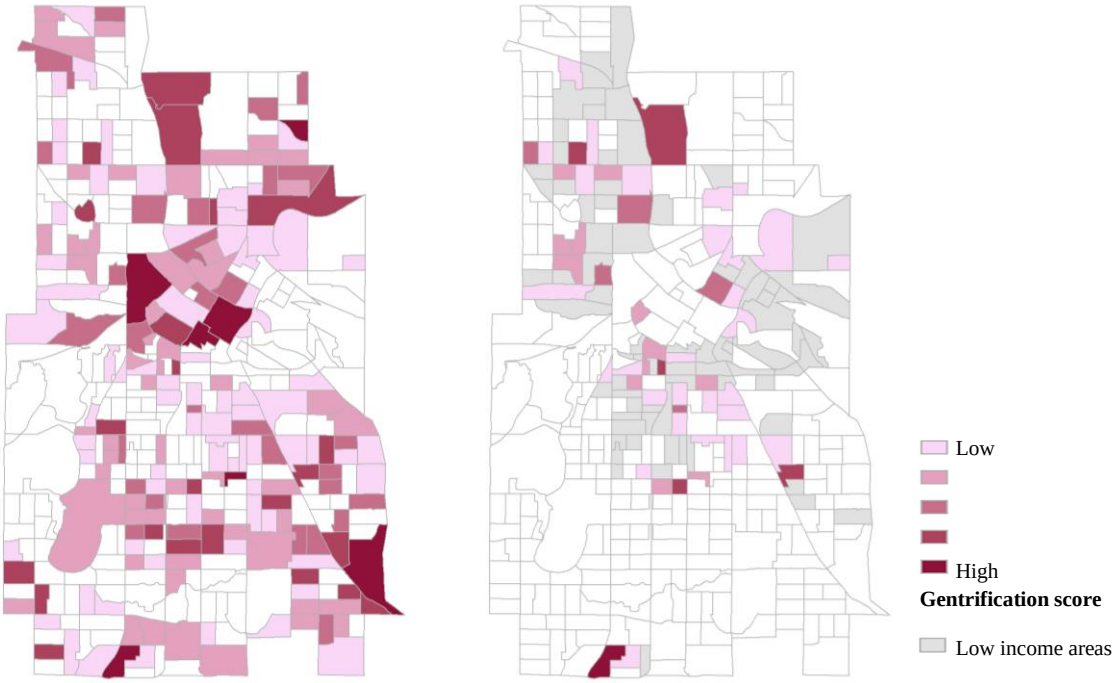

Figure 24 Gentrifiyng areas in low income neighhborhoods in Minneapolis, MN

Third, examining clustered vacant land types can be a tool to diagnose neighborhood risks by examining the relationships between vacant land and neighborhood dynamics – mainly in regard to the gentrification phenomenon. The results from Study 3 indicate that Speculative and Reserved lands are the vacancy types that can potentially bring a threat of gentrification to

the neighborhood. In the case of Minneapolis, almost 43% of the vacant properties are either Speculative or Reserved lands with frequent turnovers and high property values according to Study 1, 2, and 3. It can be pointed out that low-income neighborhoods with clustered Speculative and Reserved lands should be carefully examined to diagnose a potential flow of gentrification (see Figure 24 for the gentrifying areas). Also, these vacant land types can be a tool to control the pace of gentrification since repurposing these vacant lands can be highly associated with the gentrification flow.

Fourth, cities and researchers can use the diagnostic tool for other neighborhood risks as well. For example, Civic land turned out to accounts for 9% of vacant properties in Minneapolis. According to Study 2, Civic land can be typically found where there are less minority populations. It means that minority populations may not have the benefits of Civic land that can potentially bring public services to the neighborhood. Likewise, neighborhood socioeconomic characteristics associated with each vacancy type can be a way to utilize vacant land typology as a diagnostic tool for neighborhood risks and lead future policy directions.

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