GIS IN ACTION

GIS and Housing

Principles and Practices

Laxmi Ramasubramanian
Jochen Albrecht
Deborah Rojas De Leon

CRC Press
Taylor & Francis Group

GIS and Housing

GIS and Housing: Principles and Practices discusses one of the challenges that has not been addressed by Geographic Information Science thus far: how can we use GIS to deal with the complex issues underlying the housing crisis? This book provides GIS technicians and analysts with an overview of US housing challenges and examples of how to effectively integrate spatial thinking to address housing policy questions, while simultaneously introducing housing policy analysts to advanced GIS concepts and techniques to create livable neighborhoods that include housing alternatives beyond the single family. Through numerous examples, the authors advocate for a collaborative approach that encourages professionals, policymakers, and analysts, across different ideological and political perspectives, to confront the multifaceted housing crisis.

Features:

- Examines the historical aspects of housing provision, societal attitudes, demographic shifts, and government policies.
- Bridges the gaps between housing professionals and GIS experts, facilitating an interdisciplinary approach to address the housing crisis.
- Explores different challenges that are facing urban, suburban, and rural neighborhoods in different US regions.
- Provides professionals with the necessary tools for informed decision-making.
- Proposes solutions that leverage the integrative capacity of GIS to address established housing issues.
- Advocates for denser housing alternatives to address issues of affordability, supply shortages, and homelessness.

This book is intended for graduate students and professionals in housing, community development, urban planning, architecture, and GIS, and anyone curious about learning more about the American housing crisis.

GIS in Action

Series Editor

GIS and Housing: Principles and Practices
Laxmi Ramasubramanian, Jochen Albrecht, and Deborah Rojas De Leon

For more information about the series, please visit: https://www.routledge.com/GIS-in-Action/book-series/CRCGISINACTI

GIS and Housing
Principles and Practices

Laxmi Ramasubramanian, Jochen Albrecht,
and Deborah Rojas De Leon

CRC Press
Taylor & Francis Group
Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

Designed cover image: © The Authors

First edition published 2024
by CRC Press
2385 NW Executive Center Drive, Suite 320, Boca Raton FL 33431

and by CRC Press
4 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

CRC Press is an imprint of Taylor & Francis Group, LLC

Library of Congress Cataloging-in-Publication Data
Names: Ramasubramanian, Laxmi, author. | Albrecht, Jochen, author. |
De Leon, Deborah Rojas, author.
Title: GIS and Housing : principles and practices / Laxmi Ramasubramanian, Jochen Albrecht, and Deborah Rojas De Leon.
Description: 1 Edition. | Boca Raton, FL : CRC Press, [2024] | Series: GIS in action | Includes bibliographical references and index. | Summary: "This book discusses how GIS enhances our understanding of complex housing issues in the United States. It provides an overview of US housing issues and examples of how to effectively integrate spatial thinking to address housing policy questions, while simultaneously introducing housing policy analysts to advanced GIS concepts and techniques to create livable neighborhoods that include housing alternatives beyond the single family. Through numerous examples, the authors advocate for a collaborative approach that encourages professionals, policymakers, and analysts, across different ideological and political perspectives, to confront the multifaceted housing crisis"– Provided by publisher.
Identifiers: LCCN 2023036808 (print) | LCCN 2023036809 (ebook) |
ISBN 9780367197339 (hardback) | ISBN 9781032676562 (paperback) | ISBN 9780429243066 (ebook)
Subjects: LCSH: Housing. | Community development. | City planning. |
Geographic information systems.
Classification: LCC HD7287. R326 2024 (print) | LCC HD7287 (ebook) |
DDC 363.5–dc23/eng/20230911
LC record available at https://lccn.loc.gov/2023036808
LC ebook record available at https://lccn.loc.gov/2023036809

ISBN: 978-0-367-19733-9 (hbk)
ISBN: 978-1-032-67656-2 (pbk)
ISBN: 978-0-429-24306-6 (ebk)

DOI: 10.1201/9780429243066

Typeset in Times
by codeMantra

Contents

Preface

The three authors of this book are professionals in the realms of architecture, geospatial analysis, and urban planning. The publisher invited us to propose a book about GIS applications and left it up to us to choose the application area. In considering our different areas of expertise, we began to hone in on housing. Preliminary investigations revealed a glaring gap in recent GIS applications literature: we could not find a book-length treatment of GIS applications for housing. The reasons for the gap became gradually apparent as we conceptualized and framed this book. First, since housing production is largely left to the market, much of the data and analysis about that sector tend to be proprietary and not readily accessible to the public. Second, housing policy analysis is a highly specialized sub-genre that typically focuses on affordable housing, assessing the impacts of government policies and programs designed to improve housing affordability or the assessment of government policies that attempt to remove structural or institutional barriers to housing affordability. Lastly, the financing of housing production using federal and state-level data that dominate policy conversations, subsuming design and planning considerations that rely on local and sub-regional data.

The study of housing as a GIS application area has many opportunities and challenges. Undoubtedly, the study of housing is central to other fields such as economic development, transportation, and crime/public safety. As the field of GIS grew and matured in the 1980s and 1990s, GIS specialists, particularly those scholars interested in GIS applications, were actively involved in shaping GIS policies to increase access to spatially referenced data. For example, GIS specialists analyzed home lending data made publicly available through the Housing Mortgage Disclosure Act. These analyses and insights made discriminatory lending practices visible to the general public and to lawmakers. However, in the past two decades, GIS applications in housing appear to have not received much attention.

This book speaks to a new generation of GIS users and specialists who have grown up in a world where the early challenges of spatial data access have largely been resolved. In addition to Census data that is publicly available, a range of datasets generated for different purposes can be accessed and linked using a common spatial identifier. The advent and democratization of geospatial technologies provide us for the first time with the tools to deal with housing in the context of larger societal shifts. Current shortcomings in the provision of adequate shelter for everyone cannot be addressed without seeing its embeddedness in questions of demographic changes (immigration, aging societies, and homelessness), climate change, or the impact that information technology has on labor markets, transportation, and individualized services. Yet, data alone is not sufficient to prompt interesting and intelligent queries – a deep understanding of the phenomena being investigated is also necessary. Otherwise, GIS specialists can develop solutions to non-existent problems or worse, arrive at erroneous conclusions because they do not fully understand the social phenomena under scrutiny. GIS applications research requires that GIS specialists understand the world as it is, not the world that is accessible through the

GIS interfaces. The real world is far more complex than the comfortable vector GIS landscape that comprises points, lines, and polygons.

This book engages housing researchers, alerting them to how the GIS technology and data landscape have changed and encouraging them to go beyond simple mapping and overlays of phenomena. Asking, "where are all the public housing properties in the city located?", is a useful starting point, but GIS in the 2020s can be tasked to do much more. Complex queries and new lines of inquiry require that domain specialists (in this case, housing experts) and GIS specialists work in partnership to resolve pressing social problems such as homelessness.

Our diverse perspectives invite readers from various fields to delve into these pages, exploring the important and often missed interconnections between housing and broader societal shifts that impact people at the neighborhood level. We have written this book using accessible and jargon-free language with a wide range of examples from big- and medium-sized cities as well as small towns and rural areas. It is our fervent hope that elected officials and decision makers interested in pragmatic problem solving will read this book. We encourage readers to understand our perspectives – GIS tools and spatial thinking allow end users to swiftly move between and across spatial scales to identify actionable policy levers appropriate to solve the problem at hand. Private residential housing production and management is largely a local matter in the United States – and therefore conversations about densification should occur at the local level. National or state mandates about densification notwithstanding, the preferred housing type in America is a spacious, single family home. We encourage policymakers to focus on encouraging a diversity of housing alternatives, emphasizing new designs and new ownership models. We also encourage decision makers to use the integrative potential of geospatial technologies to explore the challenges that are coming toward us rapidly – demographic changes worldwide and the global climate change impact the housing situation in the United States and no enclave can be immune to these effects. In other words, housing insecurity and homelessness will continue to increase and it has to be confronted at the local/regional scale in order to have quick and meaningful impacts.

GIS and housing specialists are focused on numbers; this is unsurprising because quantification is essential to make a case for large investments of public dollars. In this book, we encourage architects, landscape architects, and urban designers to engage with housing and GIS specialists in order to co-create innovative design alternatives, for example, by investigating new living options for the 55+ and over residential market becomes critical as our national demographic trends shift.

We end this book with a note to students – future architects, planners, engineers, GIS specialists, and aspiring elected officials. We wrote this book with you in mind. As educators, each of us has worked with hundreds of individual students and we poured our collective knowledge, experience, and expertise into the pages of this book. We filled our pages with dozens of examples from all parts of the United States; so, you can find the context that relates to your circumstance and location. We have provided cross-referencing within the book as well as literally hundreds of references for further reading. We have developed a companion website (gisandhousing.com), where we plan to provide updates, errata, and further examples. In the long run, we plan to write a follow-up volume of GIS exercises that go beyond the limited amount

of how-to's that we could include in this volume. Please use our website to engage with us as we strive to keep the contents of this book current.

Housing is deceptively simple as it is complex. Consider "poor doors", "dorms without windows", restrictive housing covenants, or the power that homeowners' associations wield and it becomes quickly apparent that our own values shape and influence housing policy as well as our solutions to serve the most vulnerable among us. If we are going to tackle the housing crisis, developers and real estate professionals have to work in partnership with stakeholders in all levels of government, and the nonprofit sector. We encourage a geospatial perspective as a lens to tackle the housing crisis. Our diverse perspectives invite readers from various fields to delve into these pages, exploring the important and often missed interconnections between housing and broader societal shifts that impact people at the neighborhood level. Our aim is to empower readers to apply a geospatial framework to confront the housing crisis. We envision a future where housing becomes a right accessible to all, fostering a more just and inclusive world.

Foreword

As a planner, an advocate, an administrator, and a former political appointee I've stepped out in front of scores of boards, hearings, working groups, and meetings of many types to attempt to secure approvals in the service of getting more housing built. Often there is quick agreement amongst everyone that a home is essential to provide stability and safety, and that the barriers to housing, particularly the increasing cost to rent or own, need urgent attention and intervention. Together, we'll exchange analogous statements that making housing more accessible will strengthen the health, fiscal, and societal bonds of a community. But despite that common ground, it is not long before too many of these discussions can devolve into perplexing contentiousness. In these exchanges about whether housing should be allowed in the proposed location, designed as suggested, and serving the mix of people we're proposing to serve, it's critical that we leverage our most reliable and persuasive tools if there is any chance these proposals will be embraced.

The high bar is because the subject of housing – yours or someone else's – can be incredibly personal, the arguments as subjective and varied as the gamut of those, with their individualized experience and values, that present them. The debates that play out occur in exchanges equally driven by facts as they are by feeling. For many it's not simply a matter of public policy or rational planning, but a decision that represents the most consequential thing standing between themselves and protecting their prosperity. The potential of new housing can be seen as both an opportunity and a risk – this perspective sometimes shifts from support to opposition and vice versa when talking about different geographies where a proposal may be considered. In those moments, how the information is presented, how responsive it is to address broader concerns, and the credibility of that information can make or break a proposal.

The act of holding the discussion is not the problem, it remains part of the solution. It should occur through direct participation and elected representatives evaluating the complexities of broad regulatory and tax reforms or more discrete discretionary actions that can potentially unlock barriers to growing the housing supply. And depending on the scope of the changes proposed, conversations go beyond a decision about the buildings themselves, but instead drill into questions about local infrastructure, public transit, parks, roads, sustainability, and school seats which either through mandated environmental reviews or voluntarily offered research, bring to the surface some reasonable, and difficult, questions that need to be considered alongside the need for housing.

These forums are at their most effective when participants are supplied with data that is vetted and factual and not primarily driven by anecdotes or assumptions. This is not to say there isn't a role for qualitative techniques and descriptive input. Non-numerical information can be invaluable and needs to be integrated to fully grapple with the complex questions being considered. But it's the mixed methods approach, with dynamic analysis at its foundation, that can allow for a faster, fuller charting of where your stakeholders are now and where they want to be in the future. Especially

as the scope of the questions being considered grow beyond the housing and the additional subject matters at play become more specialized and exact, it's important to pivot to strategies of gathering, organizing, and presenting information so that participants and decision makers in the process are speaking from the same set of facts and sharing the same reality.

Geographic Information Systems (GIS) can do just that. It can facilitate a more unbiased platform for information to be studied, issues and trends scrutinized, permutations of various impact assessments to be played out. Alongside the qualitative data, you can then visually articulate and graphically render information in ways that illustrate the findings in the broadest possible terms promoting inclusive engagement and easy digestion of the factors at play.

As a facilitation tool, GIS allows housing discussions to become a collaborative and iterative process where users can draw on 21st- century spatial analysis made more reliable with an ever-growing set of data-rich and accredited inputs. In its simplest form, this is software for locating things on a map, but in the hands of trained professionals, it can set the stage for a proposal to advance more quickly past rudimentary steps and onto the technical and political landscape that needs more attention and nuance.

The possibility that the strategic use of GIS can contribute to affordable housing campaigns and organized movements is more important now than ever. Large cities, and more towns and villages typically untouched by what were considered "urban" problems, now face record numbers of homelessness, increased household overcrowding, and deepening rent burden. The accelerating cost of insurance and materials, rising interest rates, high land costs, and the challenges associated with maintaining quality housing has made conditions for adding new supply more unpredictable for even the most experienced builders. Unsurprisingly, the ramifications go further when you consider that housing shortages can stifle job growth; undermine tax revenue; curb spending on core public services like transit, waste removal, schools, and recreational spaces; exacerbate climate resiliency issues; and dilute fair housing goals and investments to reverse intrenched residential segregation that local, state, and national entities have made. The difficulties not only present issues for diversifying access to housing but it also stiffens obstacles that exist for diversifying the companies working in the sector itself. Emerging and BIPOC builders struggle to break in and overall prevents more firms constructing the housing to reflect some of the communities they are building in.

We are not helpless in this situation. In fact, there are many effective strategies we can deploy to create the housing we need. A suite of tools that include public – private partnerships; social housing strategies; flexible as-of-right and discretionary municipal financial incentives; rental subsidies; permissive and incentivize zoning; and regulatory, code, and administrative reform are among the primary instruments. Federal funding directed at lowering housing costs, expanding supply, improving affordable rental and homeownership options, supporting even deeper levels of affordability, and tackling homelessness creates energy at the highest levels of government that can help break through parochial roadblocks. But to secure these tools requires public support and the key to garnering public support relies on communicating clearly, authentically, and with exactitude – three things that GIS can help us all do.

The authors Ramasubramanian, Albrecht, and Rojas De Leon do a tremendous job working through the complexity of the history, the present, and the future of housing policy decisions at the core of this problem and expertly present the case for how comprehensive spatial analysis can diffuse noise to make room for lucidity in a combative space. My hope is the reader sees this not as a passive learning experience but a call-to-action where every able-bodied and skilled practitioner is compelled into service. The promise of "home" particularly for those with no or limited choice, and the future of our communities depends on it.

Ahmed Tigani
First Deputy Commissioner,
NYC Department of Housing Preservation and Development

Author Bios

Dr. Laxmi Ramasubramanian serves Hunter College as an associate professor of Urban Planning and Policy and the deputy director at the Institute for Sustainable Cities. She holds undergraduate and master's degrees in Architecture from the University of Madras, India, a master's degree in City Planning from the Massachusetts Institute of Technology, and a PhD in Architecture from the University of Wisconsin-Milwaukee. She is also a certified planner holding the AICP credential. She has been recognized as a leader in the geospatial community and has served as the elected president of the University Consortium for Geographic Information Science (2012–2014). In February 2016, she was appointed to a three-year term on the National Geospatial Advisory Committee, a federal advisory committee that provides guidance to the federal government on matters of national geospatial policy.

Dr. Jochen Albrecht, GISP, is a professor of Computational and Theoretical Geography at Hunter College and The Graduate Center of the City University of New York (CUNY). This is his third book and the second co-authored with Dr. Ramasubramanian. In addition, Dr. Albrecht published over 60 refereed articles and conference proceedings. He served on the Board of Directors of several professional organizations and is currently the president of the GIS Certification Institute (GISCI).

Deborah Rojas De Leon, RA, is a licensed architect in New York. She is the owner and founder of Rojas AP, an architecture and planning firm in Jamaica, Queens. Over the past decade, her work has been dedicated to enhancing the quality of neighborhoods through architecture and urban planning. She consistently seeks out opportunities to collaborate with local community organizations and stakeholders, ensuring that her projects reflect the unique needs and aspirations of the people she serves. Deborah continually works toward a more equitable and harmonious urban landscape for all. She teaches Graphic Communication at Hunter College in the Urban Planning and Policy master program where she empowers future planners to effectively share their spatial stories, enhancing their ability to communicate effectively.

1 Why Geography Matters in Housing

1.1 HOUSING IS A HUMAN RIGHT

Housing is rooted in the provision of shelter. Along with sustenance to nourish the body, shelter is a basic need. The United Nations Universal Declaration of Human Rights recognized adequate housing as a human right as early as 1948 (UNGA, 1948). According to the United Nations Committee on Economic, Social and Cultural Rights (UNCHR), the right to adequate housing cannot be equated with shelter alone, stating that for housing to be adequate, housing should be suitable for human habitation and include services such as clean drinking water, and sanitation, located away from health hazards or polluted areas, be accessible to everyday activities such as employment opportunities, educational and recreational opportunities, and essential services such as hospitals and health care facilities. Adequacy also includes affordability and security of tenure (Office of the UNCHR, 2009).

Some countries outside the United States as well as some individual communities and cities within the United States are also in the process of establishing policy language that emanates from the housing-is-a-human-right worldview (Fallon, 2021). These policies facilitate an increase in funding to build new or repurpose old infrastructure to produce new shelter options (places to live), in addition to funding support services that are essential to serve those who live in a constant state of housing precarity. While the UN declaration has been accepted by the United States in principle, no federal laws currently exist to protect a right to adequate housing. Recently, a bill called "Housing is a Human Right Act of 2021" (Jayapal et al., 2021) was introduced. While this legislation seems unlikely to receive traction in the US Congress, it calls attention to the need for a serious societal conversation about our national "housing crisis".

1.2 THREE HOUSING CRISES

Three distinct housing crises currently plague the United States: the housing supply crisis, the housing affordability crisis, and the homelessness crisis. The housing supply crisis is characterized by an acute shortage of housing units, a longstanding problem in the United States. The affordability crisis focuses on the rising costs of owning or renting a home, making it increasingly challenging for individuals and families to secure affordable housing. Lastly, the homelessness crisis highlights the growing number of people without secure housing, exacerbated by factors such as lack of affordable options and economic downturns. By examining these interconnected issues, we aim to shed light on the complexities of housing challenges. Moreover, it emphasizes the importance of using a geographical lens and utilizing

DOI: 10.1201/9780429243066-1

Geographic Information Systems (GIS) to facilitate conversations and inform policy decisions in the realm of housing.

As we emerge from the global pandemic, the media is drawing attention to a variety of housing challenges. The first framing is that there is an acute shortage of actual housing units for anyone who needs a permanent place to live, in other words, a *housing supply* crisis, see Figure 1.1 (data source, US Census, 2021b). For instance, in July 2022, a *NYTimes* article opened with the claim that "the United States has a deep, decades-old housing shortage" (Dougherty and Casselman, 2022). The claim in this particular article is an attention grabber, at best. How do we know there is a housing supply crisis? Where's the evidence? The rest of this article actually focuses on providing one explanation to address the lack of housing supply, namely, the private market's reluctance to create (build) actual housing units because private home builders remain concerned about their ability to sell homes to credible buyers.

This article and others like it reveal some of the challenges of making housing the subject of academic inquiry. The decision to buy a house is a deeply personal and therefore a very subjective choice and one that is imbued with complex layers of meaning about what it means to become a homeowner. The production of housing, on the other hand, is a business proposition – where a home is commodified, packaged, and sold as an aspirational ideal to millions of Americans who are often enticed to become "first-time home buyers" and hence first-time homeowners, see Figure 1.2 (data source, US Census, 2021b). From a home builder's perspective, the costs of housing production are very high (particularly on the West Coast, the Midwest, and in the Northeast, see Figures 1.1 and 1.4) and there is little room for error, and they typically proceed with caution. The private market does not want a repeat of what happened after the Great Recession of 2007–2009, when many homeowners defaulted on their mortgages and walked away, resulting in a glut of unsold housing. Thousands of units of built housing developments languished for years without occupants (Healy, 2016) as buyers could not qualify for mortgages. Of those who did, many were unable to keep up with the monthly payments, and their homes were repossessed by lenders. In addition, the US economy relies heavily on global and regional supply chains to provide the raw materials and finished products that are critical to housing construction. These supply chains were disrupted because of the global pandemic, another reason that is offered for slower-than-usual housing production in 2021 and 2022 (Goodman, 2022; Sisson, 2022).

The question of whether we have an adequate supply of housing is simultaneously a data-driven inquiry and a philosophical musing because adequacy can be qualified and interpreted in many different ways. In the United States, the dominant form of housing, about 2/3rd of all housing stock, is a detached single-family home, and the mean homeownership rate has hovered between 65% and 66% over the last six decades, see Figure 1.3 (data source, U.S. Census Bureau, 2014 and earlier).

The second framing is focused on the rising costs associated with owning or renting a home, the *housing affordability* crisis. Narratives about the affordability crisis usually focus on homeowners and their challenges of buying a new home. Unlike many parts of the global south, where homebuyers raise most of the purchase price over an extended period, making home ownership very challenging (e.g., Haub and

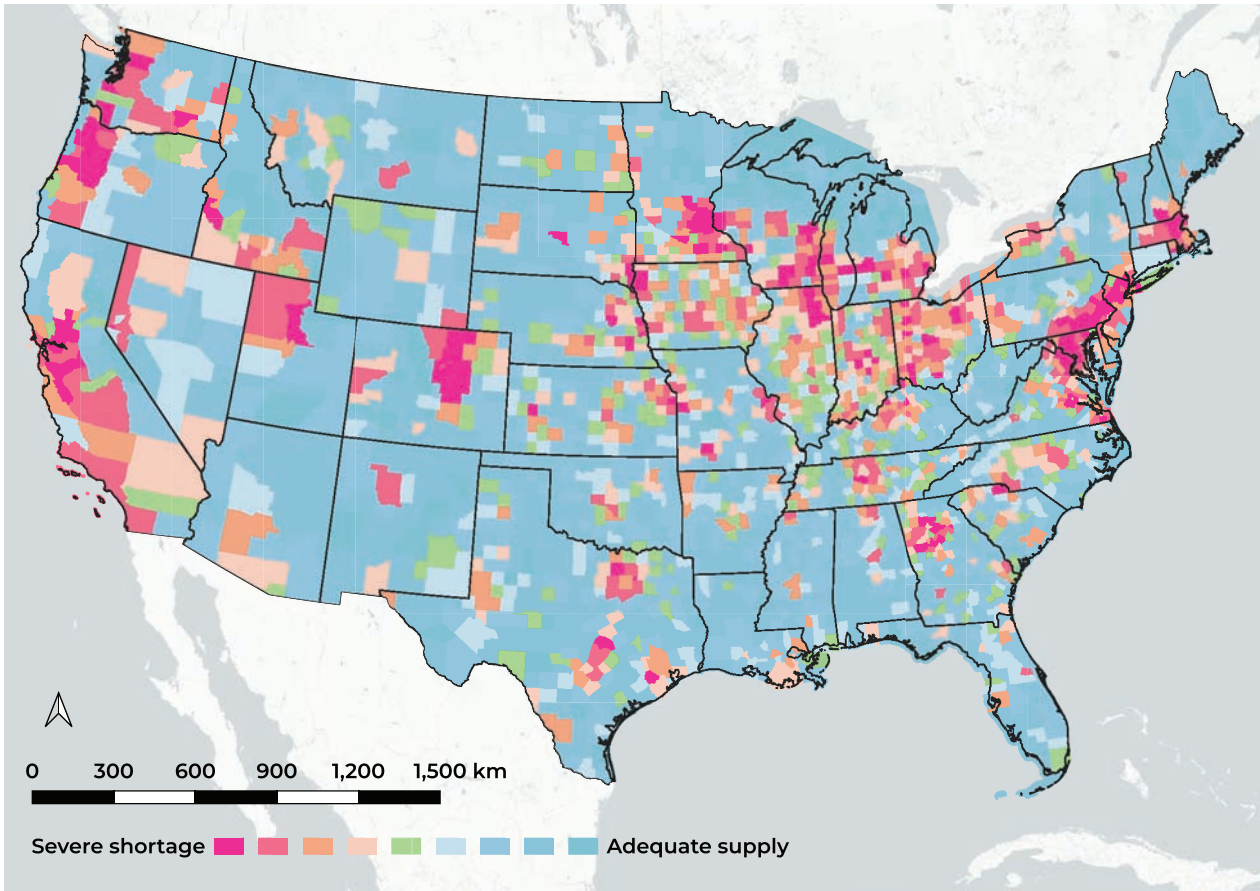


FIGURE 1.1 Housing supply crisis

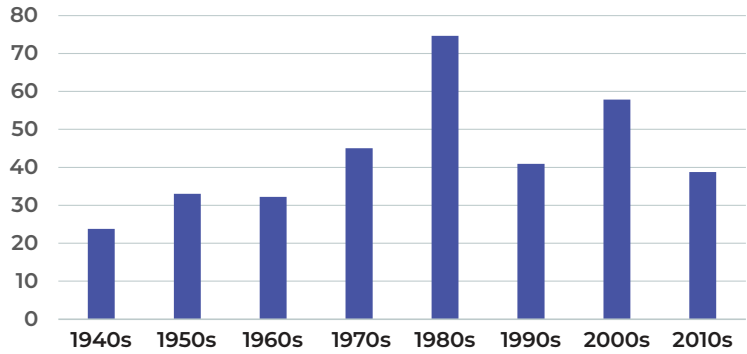


FIGURE 1.2 Housing built per 100 new residents

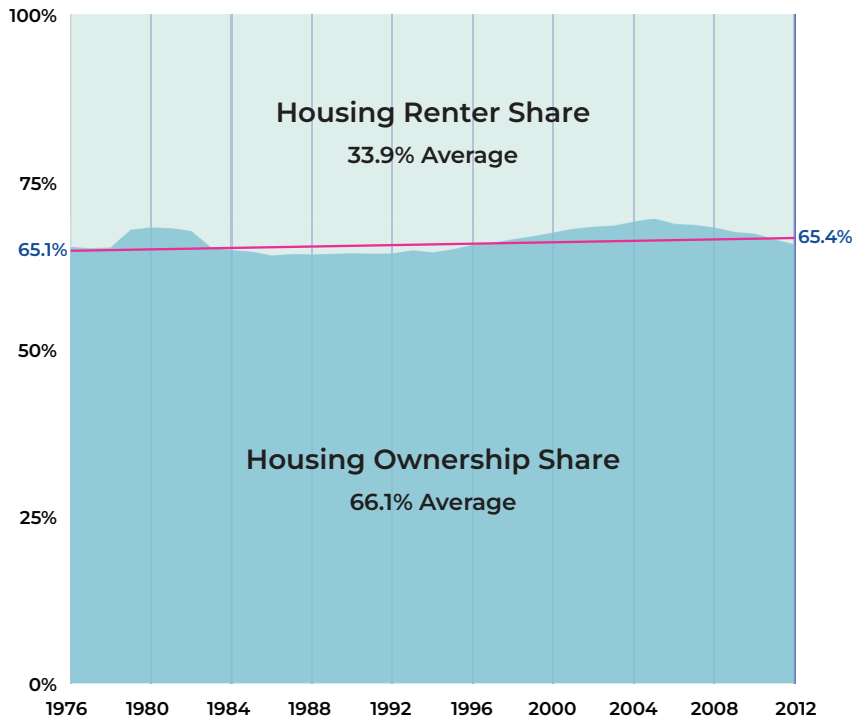


FIGURE 1.3 US Homeownership trends through the decades

Sharma, 2018), the United States is unique because of the sophisticated financing/lending mechanisms that allow individuals to typically purchase a home with only 20% of the purchase price in hand (Jones et al., 2017). The high reliance on borrowing creates additional instabilities because of the fluctuations in interest rates for home loans. For example, one perspective that is often offered to explain the sales slump in 2022 is that rising interest rates and economic instability make prospective first-time home buyers anxious – they decide to wait a little longer (Kaysen, 2023).

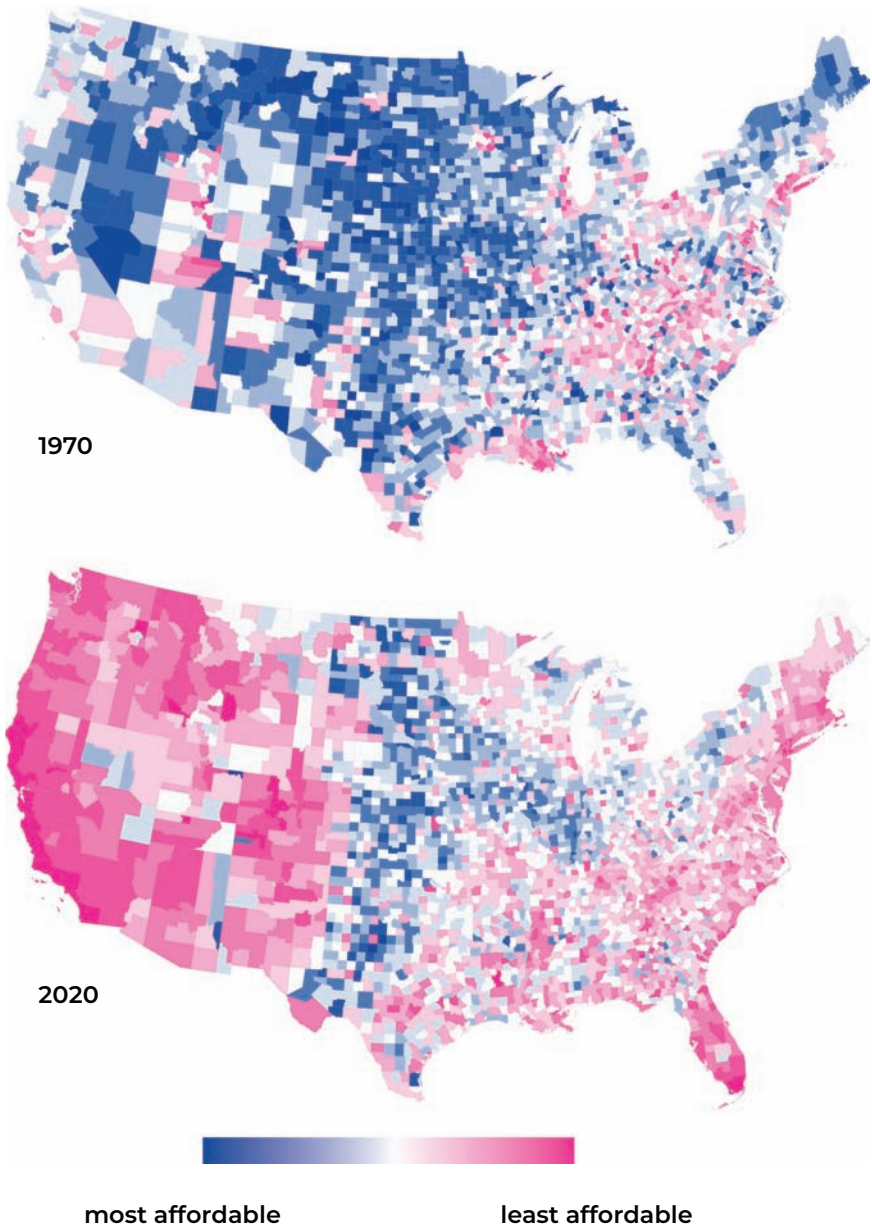


FIGURE 1.4 Comparison of housing affordability in the United States, 1970–2020

For existing homeowners, the received wisdom suggests that they use the money they have to make improvements on their existing home, rather than buying anew. In urban environments, policymakers and elected officials often discuss the challenges facing renters, another dimension of the affordability crisis. High rents are a source of frustration to many for whom owning a home is impossible, or at best an

elusive goal. Renters contend with a myriad of challenges, chief among them is the threat of rising rents that result in displacement. While economists advise individuals and households that they should spend 30% of their income on housing (rent), a typical renter in expensive housing markets like New York City or the Bay Area is more likely to spend between 40% and 45% of their income on finding a decent place to live (e.g., BLS, 2022) – and many renters spend more than 50% of their income on rent (as discussed in some detail in Chapter 6).

The affordability crisis results in *housing insecurity* – a state of instability caused by having to move constantly to find a place to live within a limited budget. Individuals and families on fixed incomes, including disabled individuals unable to work, elderly people relying primarily on social security payments, and workers in service-oriented occupations (schoolteachers, police officers, and firefighters for example), struggle to find stable and affordable housing alternatives whether they own or rent. Housing insecurity is an invisible problem because it can be very hard to assess how close an individual or household is to being evicted. Unstable housing creates new burdens and compounds existing problems being faced by members of the household – children's schooling is negatively impacted, elders may miss out on routine or necessary visits with health care providers, and individual's mental health challenges may be exacerbated because of constant change and anxiety.

The accepted understanding based on the federal government's definition of housing affordability means that a household spends under 30% of the monthly household income towards paying their mortgage (which is the conventional pathway to homeownership in the United States) or towards their rent (in the case of renters). Figure 1.4 (US Census, n.d. and NHGIS, n.d.) provides the stark visualization of the changes in housing affordability between 1970 and 2020 using counties as the unit of analysis. For reference, there are about 3,200 counties in the contiguous United States, excluding Alaska and Hawaii. The color ramp moves from dark blue to dark red, with the darkest blue color-shaded counties being the most affordable and the darkest red color-shaded counties being the most unaffordable. Counties that are color-shaded white did not experience any discernible changes. Even a cursory glance at the map reveals that housing affordability has decreased throughout the United States in the last five decades. At first glance, housing in several coastal states such as Massachusetts and Florida, in the east, and California, Oregon, and Washington has become more expensive (unaffordable).

While a state may be relatively affordable, regional and sub-regional differences influence an individual or household's experiences of finding affordable housing. In other words, examining housing affordability requires a fine-grained analysis, examining county-by-county variations. In examining changes over time (1970–2020), it may be useful to note that some counties that were relatively affordable in 1970 (dark blue) transitioned to relatively unaffordable. Figure 1.5 (US Census, n.d. and NHGIS, n.d.) shows the details of changes in affordability ranking for counties in California and Nevada between 1970 and 2020. Counties with relatively small populations such as Mariposa county (east of Merced, north of Fresno) show dramatic changes in housing affordability. Mariposa county grew almost 150% in population between 1970 and 2020, but the total population in 2020 was a little under 17,500 people. Housing affordability is a relative measure (the areas that were most affordable in 1970 are expected to show the greatest change in 2020). The value of using counties

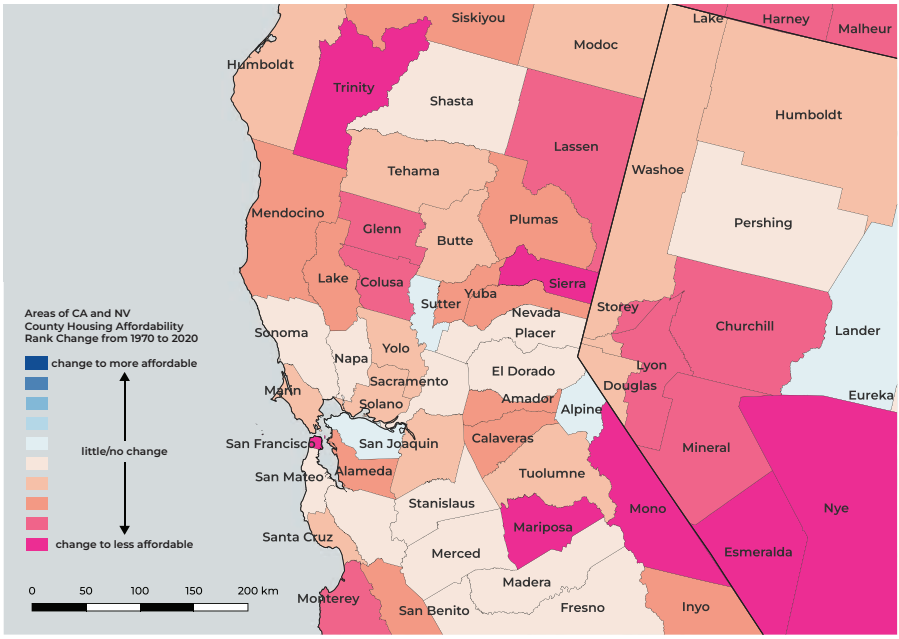


FIGURE 1.5 Change in housing affordability in California-Nevada 1970–2020

as the unit of analysis becomes more relevant as we see the inter-state dependencies with respect to settlement patterns. During the same time period (1970–2020), Washoe County in Nevada had a net gain in population of over 300%, creating housing unaffordability in that county. Washoe County, includes the city of Reno that has attracted and retained Californians who are able to commute to and from the Bay Area for work and leisure while enjoying the lower living costs in Washoe County, accounting for its rapid population growth. The population explosion places pressures on housing supply, increasing unaffordability.

The economic downturn and the burgeoning public health crises in the United States have resulted in the third and most poignant housing crisis, the *homelessness* crisis. Readers in other parts of the world may be surprised to read that about 0.2% of the US population (a little over 580,000 people) do not have a secure place to spend the night (Meyer et al., 2022). The authors posit that this number is a severe underestimation.

Counting the homeless population is fraught with challenges because of the transient nature of the population being counted. The US Department of Housing and Urban Development (HUD) uses a Point-In-Time count of unsheltered individuals experiencing homelessness in a single night in January every year. This data is combined with other data counts gathered from other non-institutional group quarters such as homeless shelters, domestic violence shelters, and group homes. Figure 1.6 (USHUD, 2022) shows the geography of homelessness in the United States.

One of the main drivers of the current homelessness crisis is related to the lack of affordable housing. According to the National Alliance to End Homelessness (2022), a nonpartisan advocacy organization that tracks and reports data about homelessness,

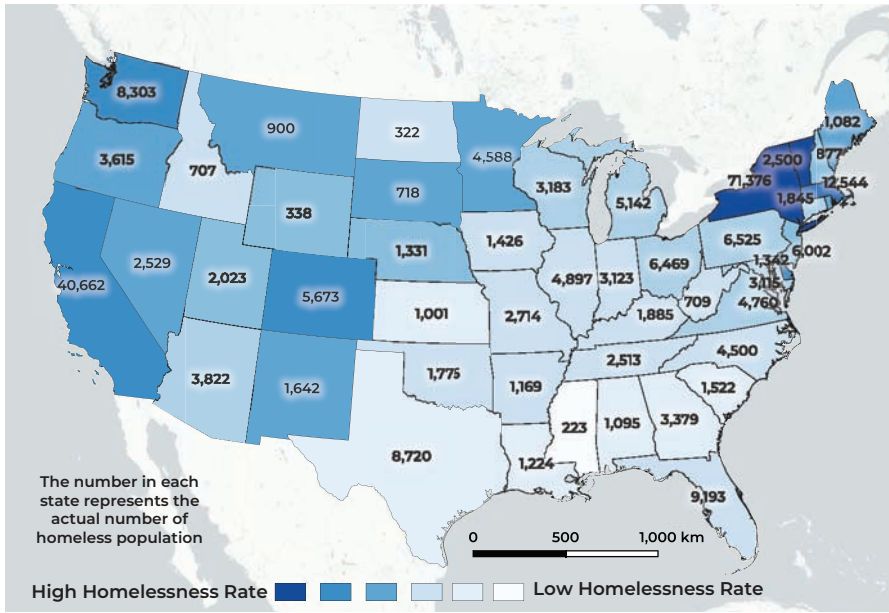


FIGURE 1.6 Geography of homelessness by state, 2022

unhoused individuals are more likely to be men, about 70% and about 30% of the homeless population comprise families with children. About 8% of the homeless adult population are veterans (Henry et al., 2021).

Unhoused individuals are very often likely to have mental health challenges (National Coalition for the Homeless, 2009). In recent years, young people identifying as LGBT are more likely to be unhoused, although official data is hard to come by since many organizations do not collect this data. Additionally, this information is likely to be volunteered or shared by the individual experiencing homelessness. However, as early as 2011, the National Gay and Lesbian Task Force and the National Center for Transgender Equality identified the challenges of transgender people to find access to safe shelter (Grant et al., 2011).

Once an individual or a household has moved from the ranks of the housed to the unhoused, it is a struggle to return them to their former living situation. This is especially true for those who were already in some form of subsidized housing provided by the state or the nonprofit sector. The visibility of the unhoused provokes a range of emotions in the general public. Although there are frequent demands for action, the problems of the unhoused have become an intractable problem, magnified by waves of asylum seekers fleeing persecution in their countries of origin gathered in southern border cities and towns awaiting formal entry into the United States.

Most scholars who study homelessness discuss the "definitional inconsistencies" as well as limitations of the data (Lee et al., 2010). There is widespread agreement that the numbers of homeless are heavily undercounted because of the invisibility of homeless people and the fact that housing insecure individuals (those who live in their car, couch-surf, or move in and out of the shelter system) often fall between the cracks and may not be accounted for during the single point-in-time count conducted

by HUD. For example, the Department of Education statistics is likely to have a more accurate count of school-aged children who live in shelters with a parent or guardian and attend a public school. In recent years, cities in states governed by Democrats have become sanctuaries for people without shelter. Thus, the numbers of homeless people in States such as New York and California with more humane social policies are much higher than states that have criminalized homelessness (Olivet, 2022).

Housing affordability is a social policy question. Authors Donald Schön and Martin Rein (1994) have previously argued that the way policy problems are framed can limit the solution spaces that can be created to address them. They suggested a more pragmatic approach, where attempts to resolve policy controversies are addressed in the context of policy implementation by those individuals or groups that must design and implement the policy decisions through the development of programs. According to Schön and Rein, policy innovations and breakthroughs are more likely to occur as a result of detailed conversations, where understanding different/conflicting policy positions can be fully explored as a part of a pragmatic attempt to solve problems within a specific situational context.

In the United States, the production of housing has largely been left to the market. Housing production, however, is intricately tied to its financing as well as to related infrastructure provision, and all levels of government are involved in creating supportive conditions to allow the housing industry to accomplish the goal of creating housing. Many individual and institutional intermediaries are involved in the supply and management of housing. Housing is a robust area of scholarly inquiry judging by a steady slew of books addressing historical narratives (e.g., Chey, 2017), case studies (e.g., Desmond, 2017), in addition to growth trends and policy critiques (e.g., Madden and Marcuse, 2016) to mention a few. Recently, academic scholars have drawn attention to alternative housing typologies (e.g., Parolek, 2020), as well as unpacking the complexities of creating shelter and rebuilding lives after natural disasters (e.g., Fitzpatrick and Spialek, 2020). Although strong academic linkages have been established between the fields of housing and community development, the academic study of housing continues to be very challenging, because of its central status within the economy, and because of the complex emotional overtones associated with homeownership. There is also a strand of research that links housing challenges within the land use and transportation planning literature (e.g., Jackson, 1985; Kunstler, 1993; Rothstein, 2018).

While data and statistical analysis have been used extensively in the study of housing, the multi-scalar dimensions of these analyses appear to have been curiously neglected by the housing policy studies. To address this disconnect, the authors of this book, representing the fields of architecture, geography, and urban planning strongly recommend the use of GIS tools and the use of a geographical/spatial lens to reframe housing policy debates. Ramasubramanian (2010) and Ramasubramanian and Albrecht (2018) have argued that GIS can make policy conflicts more visible to decision makers and facilitates the rapid testing of different scenarios and policy alternatives that can allow for new policy alternatives to emerge. In a special journal issue that assessed the state of housing scholarship between 1968 and 2008, Galster wrote that, "*academe and the practice of planning and policymaking are like two neighbors*, *sometimes quarreling*, *sometimes exchanging resources*, *always reacting*

to and stimulating the other" (Galster, 2008). Agreeing with Galster, we propose that both sides (academics and policymakers) include a geographical lens and use the advanced analytical and visualization capabilities of GIS to facilitate and mediate conversations between housing policy experts, elected officials, land use planners, and community residents to solve housing problems at the neighborhood and sub-regional level.

1.3 UNDERSTANDING HOUSING GEOGRAPHIES

Following our claim that housing studies can benefit from using a geographical world view, we draw on the words of Amos Rapoport, architect and author of an influential book *House Form and Culture*, who observed that "*the house is an institution, not just a structure, created for a complex set of purposes. Because building a house is a cultural phenomenon, its form and organization are greatly influenced by the cultural milieu to which it belongs*" (Rapoport, 1969, p. 46). Extending Rapoport's argument, we posit that the study of housing cannot be viewed merely as an assemblage of houses on a street or a neighborhood, housing morphologies and settlement patterns are likely to reflect a dominant cultural ethos that may be as significant or more significant than building with considerations of nature, weather, and climate in mind. Taking a conscious geographical (spatial) view can assist with deciphering those cultural variations and complexities while also helping to delineate unifying ideals.

1.3.1 Cultural Beginnings of Early 20th Century City Planning

The original inhabitants of what we now consider the United States of America, the Native American (American Indian) peoples' living environments and settlement patterns were influenced by their own indigenous cultural traditions which were severely harmed by the American settler colonialist project (Hixon, 2013). The earliest European settlers who came to America imposed their (own) cultural norms on the landscape because they considered the place as a tabula rasa upon which they could create their own imprint. The physical settlement patterns came from the cultural landscapes and memories they carried with them and the changes they hoped for as settlers. While the long trajectory of settler colonialism and its tragic impacts on the indigenous communities and landscapes are outside the scope of this book, we respectfully remind our readers that every wave of settlers has shaped and continues to reshape our communities since the beginning (Cavanaugh, 2020).

In our narrative, we fast forward to the City Beautiful movement, a progressive reform movement that began in the late 19th century is a good starting point to understand where the current cultural norms of residential settlement patterns in the United States were established (Hall, 2014). That movement reflects the dominant cultural ethos of the time – establishing the linkages between physical and moral order. The educated and upper classes of the 1890–1900s were concerned about the chaotic conditions in cities – American cities including Boston, New York, Chicago, and even smaller cities like Pittsburgh were overcrowded, dirty,

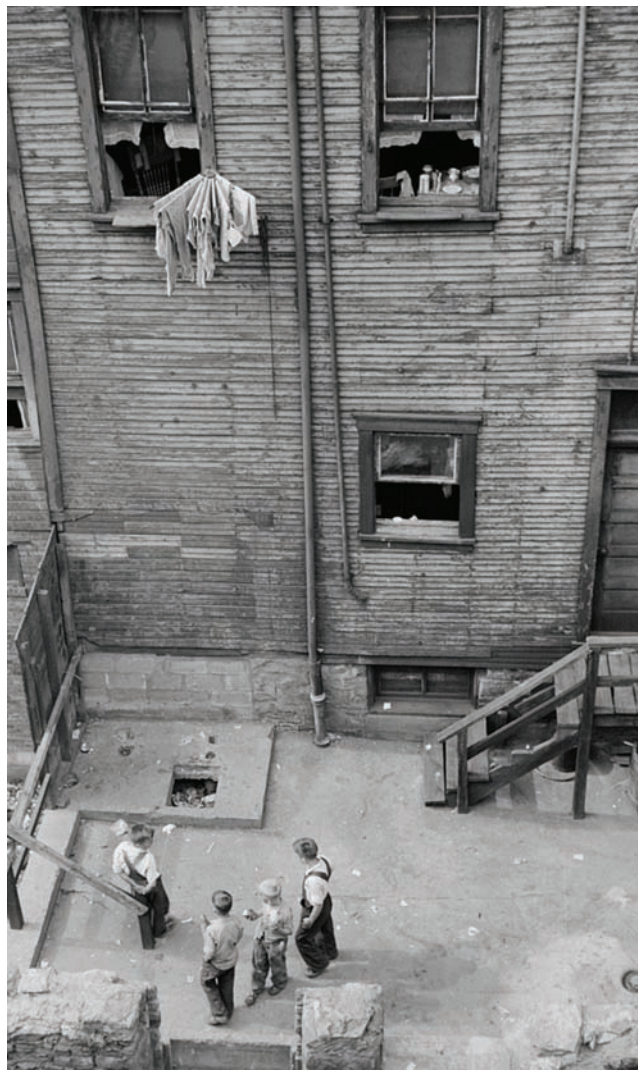


FIGURE 1.7 Unsanitary urban areas

and dangerous places. Housing was in short supply and sanitation systems were not well developed. In a bid to reduce congestion and manage overcrowding, the social reformers sought to transform physical places – through legislation and policy.

Figure 1.7 (Rothstein, 1938) is a photograph taken by Arthur Rothstein of a degraded urban environment showing trash, and generally run down building conditions in Pittsburgh in 1938. The actions of the reformers improved the quality of life of urban areas and created many positive outcomes during that time. The ethos of the time emphasized environmental determinism, where disorder in the built environment was correlated with disorder in the social environment. The

earliest building regulations were intended to reduce overcrowding and provide for well-ventilated and safe residential living conditions for the urban underclass (Hall, 2014).

The social reformers of the late 19th and early 20th century were not simply content with correcting wrongs and undoing harm caused by poorly constructed and laid out dwellings; they also articulated aspirational ideals for urban living and advocated for governmental and philanthropic experiments to develop new models (Hall, 2014). At the same time, these visions of the ideal city in the early 20th century can be conceptualized as a pragmatic response to the ills of the late 19th century (Ramasubramanian and Albrecht, 2018). One of the dominant visions that were imported to the United States included the Garden City concept advocated by Ebeneezer Howard in 1898 and 1902 (Howard, 1898/2010; 1902/1965). The concept was often described as accomplishing a balance between city and country living. The balance was partially accomplished by separating functions that did not belong with each other – places for living (residential areas) were consciously separated from places associated with work (industrial areas). Because the work at the time was often noisy, dusty, and sometimes dangerous, these arrangements seemed plausible. Figure 1.8 (Howard, 1898) shows the elements of the Garden City concept that relied on rail transportation to connect human settlements of modest scale/density surrounded by agricultural uses. The segregation of the sick and the elderly (convalescent homes), and people with physical disabilities (asylums for the blind and deaf) visualized indicate elements of the concept.

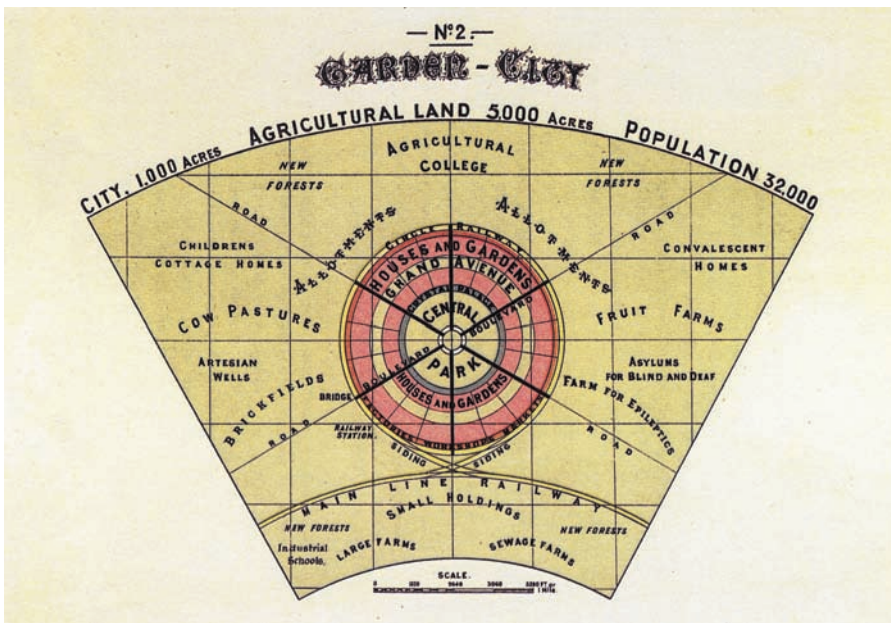


FIGURE 1.8 The garden city concept

1.3.2 Dominant Models of American Urbanization 1900–1945

Academic scholars aligned to explain the confusing and complex morass of American cities by beginning the process of codifying the internal structure of the city. Scholars such as Park and Burgess from the Chicago School began modeling city morphologies in abstract terms in the early 1920s. The dominant ethos of the time viewed the American city as a biological milieu (a social-ecological view) that used the language and reasoning of how natural environments thrived and evolved to social and community environments like neighborhoods. The sociologists of the Chicago School imposed their own cultural biases in describing, explaining, and later predicting how cities were growing and how they would grow in the future. In their conceptualization, see Figure 1.9 (adapted from LeGates and Stout, 2019), the business functions were better suited to be in the center (privileging commerce), surrounded by a transitional zone, followed by three rings of residential housing, moving from dense to less-dense development. Of note is the zone of better residences, which appears to be at a "reasonable distance" away from the business center but yet not so far away as

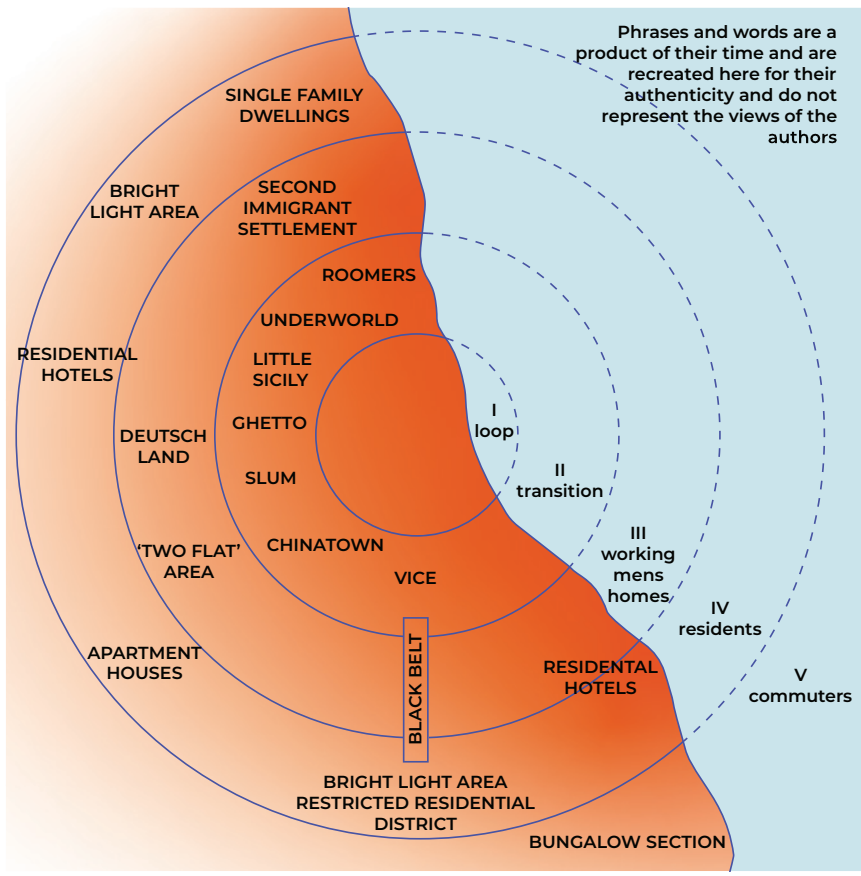


FIGURE 1.9 The structure of the city conceptual model by Park and Burgess. Adapted from LeGates and Stout (2019)

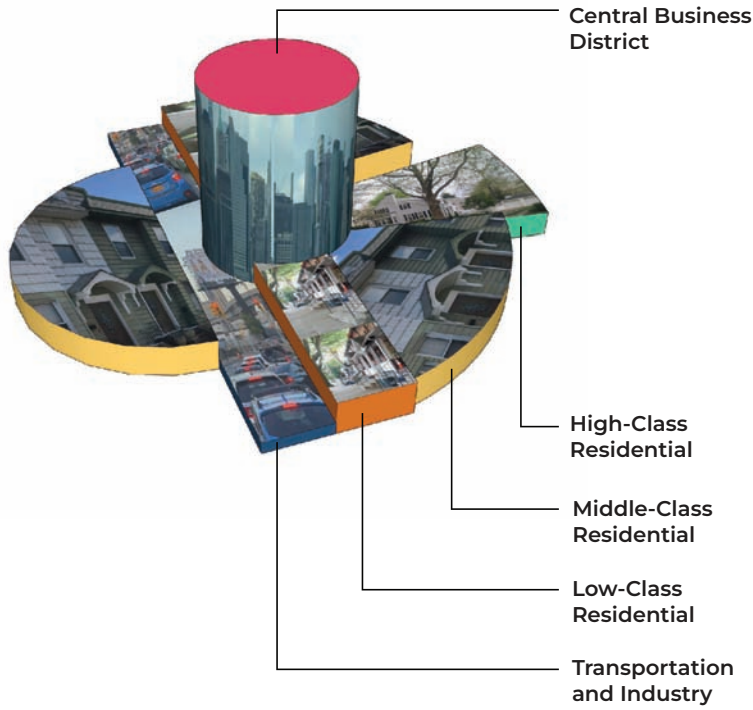


FIGURE 1.10 The structure of the city conceptual model by Hoyt. Adapted from Hoyt (1939)

to be a non-city dweller or commuter (Park et al., 1925/1967). The "concentric zone model" can be adapted to accommodate the realities of natural topographies and the constructed realities of accessibility corridors such as railroad routes.

Subsequently, additional models to explain city living were proposed, including by Hoyt (1939) who proposed that the cities evolved as sectors; here the high-end residential sector moved along a predetermined transportation corridor/routes such as a streetcar or train line whereas the lower-rent districts were more likely to be adjacent to industrial areas or freight corridors. In both models, preferred residential areas are likely to be segregated from "noxious" uses/activities, whatever those activities may be. Distancing and spatial segregation of uses as a way of commodifying and adding value to certain residential areas were established early on. Therefore, any discussion of housing geographies must be linked to a consideration of neighborhood geographies. See Figure 1.10 (adapted from Hoyt, 1939).

1.3.3 Neighborhoods and Urban Settlement Patterns

The reformist goals to reduce density and create safe and well-ventilated living spaces, combined with the availability of land, alongside the evolution of new transportation technologies (street cars, passenger trains, and private automobiles), encouraged

the move away from inner city living towards proto suburban environments away from the city center and the creation of predominantly residential neighborhoods within cities. The "neighborhood" as a spatial and social unit is a persistent idea that has occupied the geographical and social imagination for over a hundred years and remains curiously unchanged since its original conceptualizations. The identity of neighborhoods in these cities is deep and well developed since the 1920s. For example, Perry (1929) attempted to define a neighborhood unit, in part because architects and planners laying out new residential areas for the growing population needed a way to organize them – to provide services, to market the new areas to prospective buyers, and to facilitate and manage orderly development and growth. Perry specified areas with distinct boundaries so that residents could visualize it as a distinct entity to accommodate between 3,000 and 6,000 people (ref). Shared services included schools, playgrounds, and parks to be located within the neighborhood, while shops and commercial areas were located along the peripheries, see Figure 1.11 (adapted from Perry, "The Neighborhood Unit", 1929).

According to Glass, 1948, cf. Walmsley and Lewis (1993), a geographical neighborhood provides a means of translating social distance into geographical distance, affords a convenient unit for the provision of goods and services, and facilitates the formation of a territorial group, in which the members can meet on common ground for both spontaneous and organized social activities. Although the idea of neighborhood unit has been criticized since the 1950s for its superficial understandings of homogeneity and community formation (proximity does not always induce conviviality) and because of the tendency of developers and speculators to artificially shape homogeneity using restrictive and racist covenants, the neighborhood unit became the basis for planning and remains so, a hundred years later. In contemporary terms, a neighborhood is an imagined place, one that is a relatively homogeneous and cohesive agglomeration of residential living units that share some basic services and amenities but one that is simultaneously distinct and disconnected from other such agglomerations.

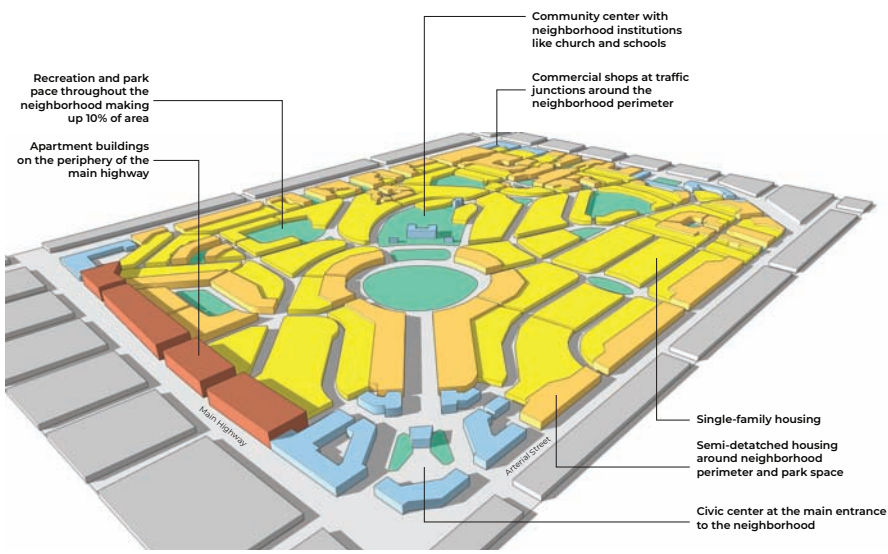


FIGURE 1.11 Clarence Perry's conceptualization of a neighborhood unit. Adapted from Perry, "The Neighborhood Unit" (1929)

As city planners began codifying activities/uses that could occur within neighborhood units, determining what amenities should be included in each neighborhood (for example, parks and playgrounds), and what amenities should be shared among neighborhoods (for example, shopping), they also began to formalize the separation of activities and uses. New York and San Francisco were among the first cities to establish zoning ordinances that created "districts" or "zones", designating large areas as "residential". Fisher (1962) reviewing the San Francisco experiments writes:

> Whereas a building code emphasizes considerations of structural and fire safety, and a housing code focuses upon those features of a dwelling unit that make it decently habitable, a zoning ordinance is more concerned with the integrity of a neighborhood as a desirable place in which to live or work. As such, it is an essential element of a city's program for the preservation of existing neighborhood values and the guidance of future development. The essence of a zoning ordinance is its designation of separate use districts for the three broad categories of residential, commercial and industrial uses.
>
> *(Fisher, 1962: 326)*

The gradual shift from legislating the form and function of individual buildings to legislating the form and functions of a neighborhood had a significant impact on Americans' cultural understandings of housing.

1.3.4 Suburbanization and Suburbs

Advances in transportation technologies, primarily the private automobile, are often credited with encouraging and stimulating the first waves of suburban development. In New York, for instance, Robert Moses established the scenic parkways that would lead affluent New Yorkers to northern and western suburbs as early as 1925 (Caro, 1974) away from a crowded and noisy New York City into the bucolic garden suburbs. The largest impetus of suburbanization occurred after 1945 when a confluence of public policy decisions supported the movement of newly returning War veterans with opportunities to create the American dream (e.g., Beuregard, 2006). Levittown, Long Island, often referred to as America's first suburb was a vast tract of mass-produced houses, only possible because of the deployment of Fordist models of assembly-line production, and the alliance between the private developers (Levitt and sons) and the federal government (housing loans and guarantees for purchasers). The design of the Levittown homes emphasized a specific kind of residential living centered on the nuclear family that lived in a private enclave, surrounded by the new wealth and luxury afforded by technology (Kelly, 1993). The Levittown single-family home used emerging labor-saving devices and a garage, the designated space to store the private automobile (Gans, 1967, 2017), see Figure 1.12 (Levittown, n.d.) to appreciate the new morphology.

The design of suburbs also gave rise to unique neighborhood morphologies. Suburban neighborhoods were created by subdividing a large parcel of land into a series of smaller lots or parcels to create residential neighborhoods. The older suburbs were created on land that was previously used for another purpose, and the land use designation was changed from its original use (for example, agriculture) to its new use (usually residential). Subdivision processes are regulated by state and local laws and subject to environmental review in some states. Because these are purpose-built allotments of land upon which new houses are built, all at the same time, considerable pre-planning occurs to

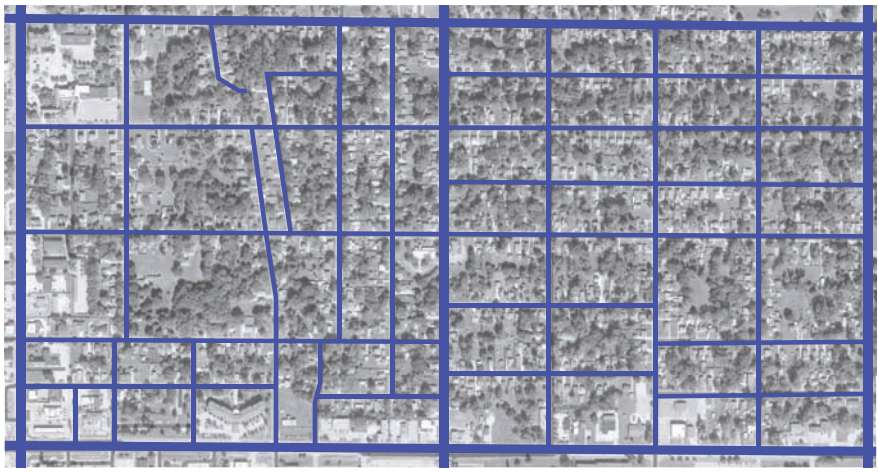
FIGURE 1.12 Levittown

create a pleasing and efficient road layout that links the individual lots, providing safe ingress and egress from the subdivision to the larger highways that will ultimately connect the subdivision to other parts of the urban network. The street layouts in subdivisions are intended for automobile travel and have unique interior street layouts – loops, cul de sacs and curvilinear driving paths, all intended to create a sense of enclosure and belonging for those who are fortunate enough to live there, see Figure 1.13.

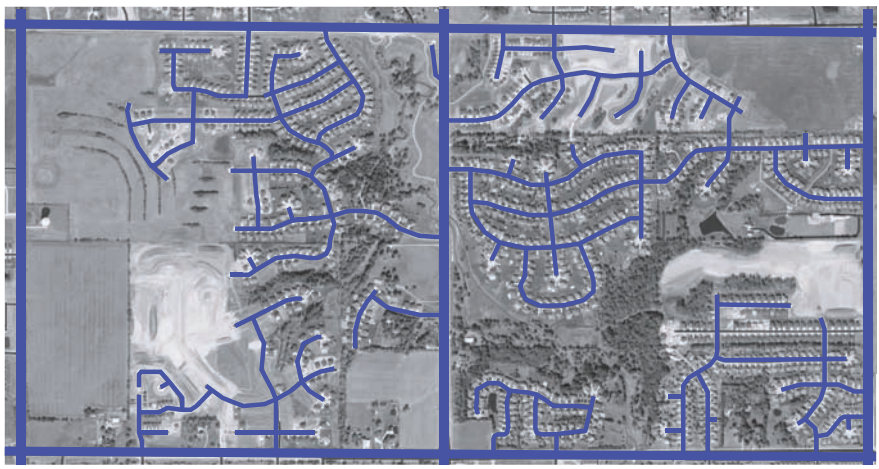
The design of the earliest suburbs harkens to Ebeneezer Howard's visions of a "garden city". Southworth and Ben Joseph (2003) discuss one of the unique street features of a suburban landscape – the cul de sac (a dead-end street) design. They argue that the cul de sac street has some benefits to residents because it creates safe streets for children and pedestrians, promotes social interactions among neighbors, and reduces infrastructure development costs for developers/subdivision planners.

Reviewing the literature, Ann Forsyth (2012) codified the dimensions across which a suburb may be recognizably identified, as distinct from a city, including its location within a metropolitan area, its built environment characteristics such as having low-density detached houses, transportation access (car reliant), activities (single uses such as residential only), and sociocultural characteristics of the residents and neighborhood.

Sprawl, the rapid growth of low-density, low-rise residential development in land that was formerly not designated for residential use is a direct result of federal policies that promoted the growth of suburbs after World War II (Hayden and Wark, 2005). The spatial segregation between residential and non-residential uses was only possible because of the



Traditional Developments: Des Moines, Iowa



Cul-De-Sac s Developments: Des Moines, Iowa

FIGURE 1.13 Traditional grid vs. cul-de-sacs in Suburbia

growth of private transportation and highway infrastructure that increased mobility and accessibility. It is also important to note that both the private sector and the government perpetuated racist policies and actions that have shaped the housing sector – Black veterans could not gain access to the favorable loans offered to Whites, and housing developers explicitly included restrictive covenants that barred Blacks and other minorities from owning a home in the newly emerging suburban developments (Rothstein, 2018).

Although the characteristics of the earliest suburbs are very different from the modern car-oriented suburbs that were built almost a hundred years later, suburbs established the single-family home as the dominant housing form in the United States (Jackson, 1985). While a critique of suburbanization and suburban housing are outside the scope of this book, we want to remind readers that the American suburb is a cultural idea, an imagined

FIGURE 1.14 Suburban dystopia

place immortalized as a beloved place to grow up on television series such as *The Wonder Years* (1998–1993), while simultaneously vilified as a dystopia in movies like the *Truman Show* (1998) and *American Beauty* (1999), see also Figure 1.14 (Flickr, 2009). It can be argued that suburbs emerged with the support and endorsement of federal, state, and local governments and the enthusiastic support of the real estate industry (Burchell et al., 2005).

1.3.5 Small Towns and Rural Settlements

In a discussion of housing in a highly urbanizing world, it is often easy to ignore small towns and rural settlements. There is a great diversity of small towns with a population between 5,000 and 25,000 people in the United States. Some of these towns thrive because of their location – in commuting proximity to job centers or because they have an anchor employer (e.g., a university) that supports the town. However, there are other towns and rural communities that have pressing housing needs because they do not have locational advantages, or they have lost their major employer. While stable housing can be an anchor to good education, healthcare, and employment, conversely, areas with substandard housing are associated with limited or no access to schools, hospitals, or work. Planning for the housing needs of vulnerable populations in sparsely populated small towns and rural areas requires different approaches than what is commonly done in dense urban areas. In the map of Texas, represented in Figure 1.15, there are 104 counties that have no urbanized area at all. The total number of residents in those

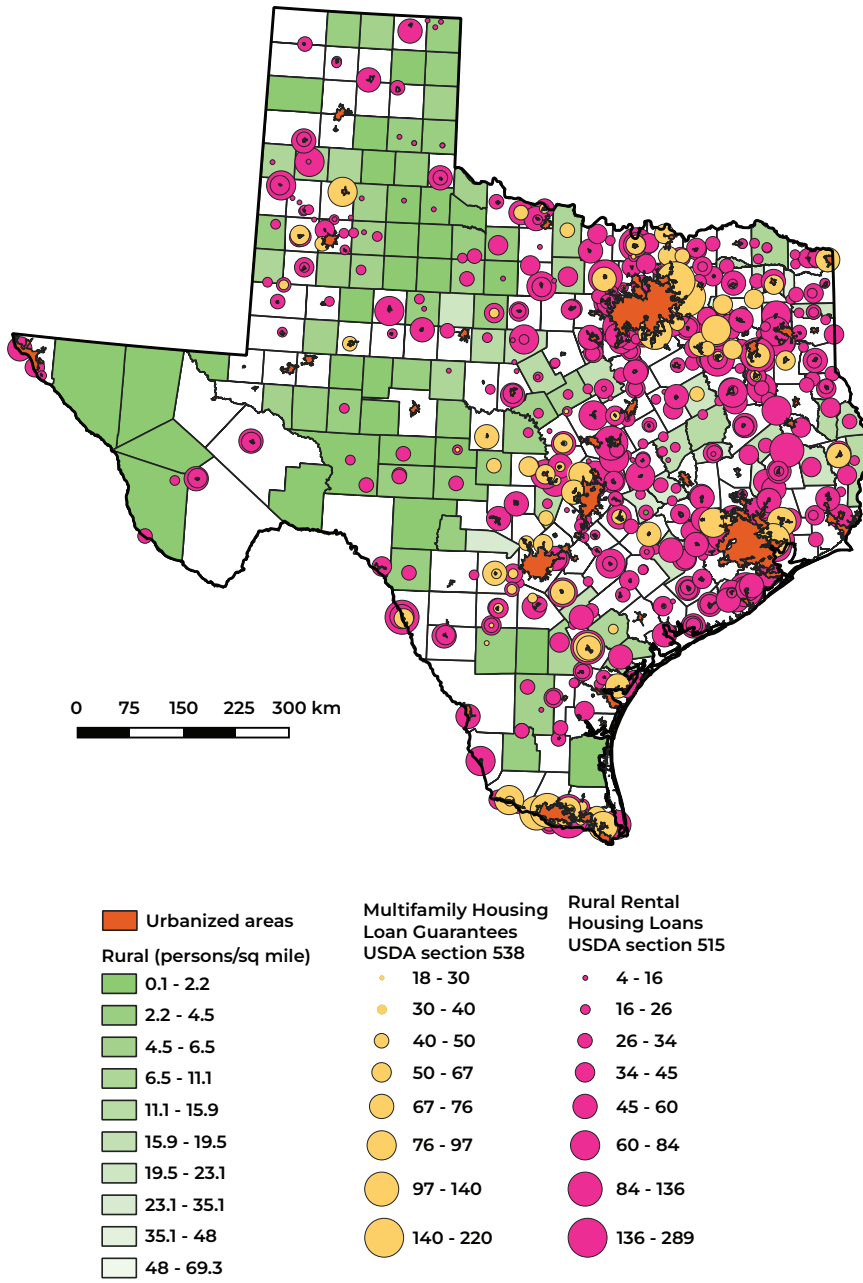


FIGURE 1.15 Rural vs. multi-family housing loans in Texas

counties is some 769,000; as a matter of fact, 66 of those counties have fewer than 10,000 residents. Compare this to Harris county (which includes the city of Houston), where we find 4.7 million residents in a single county. The rural/urban divide in Texas is massive: six counties each have more than a million people and the same six counties also have a population density of more than 1,000 per square mile.

The lack of density in rural counties is the main cause for the lack of infrastructure because it becomes expensive to extend sewer, water, and electrical lines to serve a relatively small number of people. Distances are larger and the tax basis is lower, which results in many counties not making allocations to provide subsidized rental housing, such as those provided by the USDA's section 538 and section 515 rural rental housing programs. As Figure 1.15 (USDA, 2022) shows, rural rental housing tends to be closer to the urbanized areas, leaving many rural counties without adequate rental housing and the poorest rural families such as migrant farm workers without access to adequate shelter, see Figures 1.16–1.18 (US Census, 2021) as a snapshot comparison between a Swisher county, a rural county on the western border and Dallas county.

One of the challenges of rural depopulation is that the vulnerable populations left behind are likely older, sicker, poorer, and less educated than those who left the area. The shortage of rental housing further exacerbates housing affordability and housing insecurity in rural areas (NRHC, 2014).

1.4 DEMOGRAPHIC TRENDS AND IMPLICATIONS FOR HOUSING

There is a close relationship between demographic trends and housing. It is well established that the population of the United States is growing steadily, even though the pace of growth has slowed since 2000. The 2020 population was listed as 331 million in 2020, a 7% increase since 2010. Most US states gained population with the exception of West Virginia which recorded a 3% decrease between 1950 and 2020. States like Utah and Texas gained the most people. New births are partially responsible for population

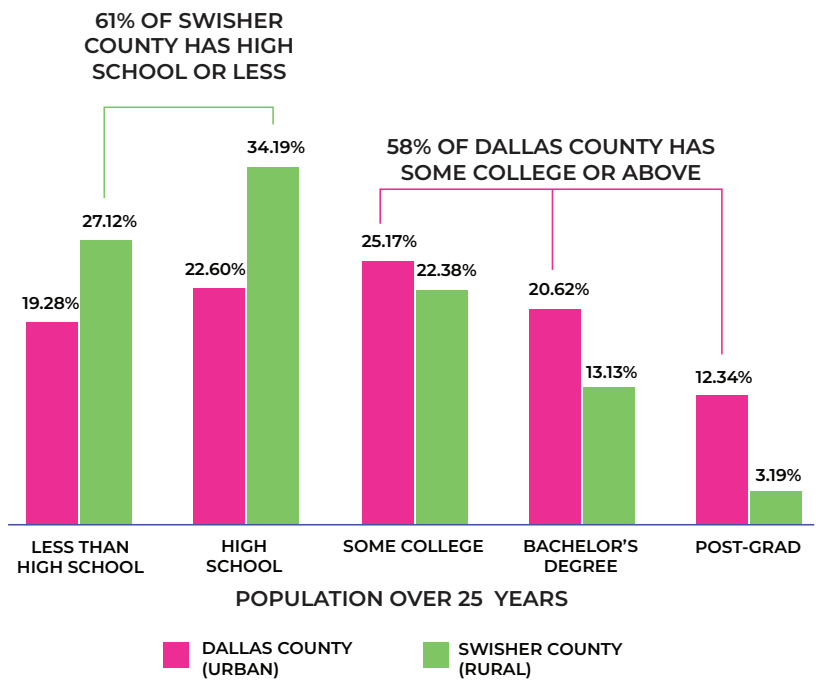


FIGURE 1.16 Comparison of education level, rural vs. urban in two Texas counties

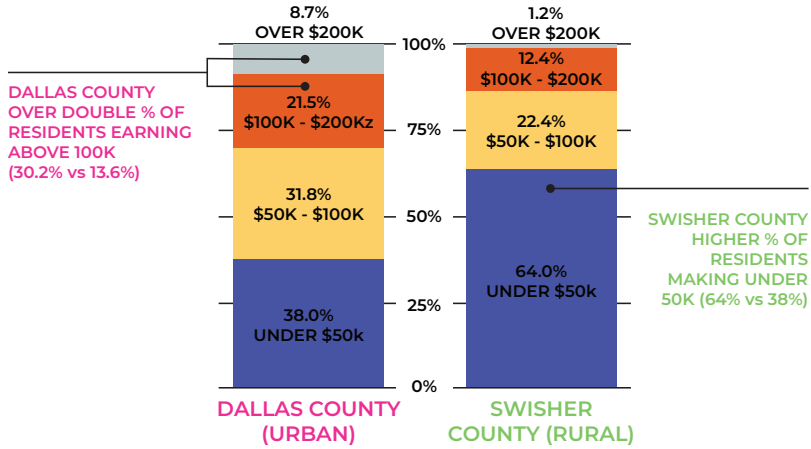


FIGURE 1.17 Comparison of income level, rural vs. urban in two Texas counties

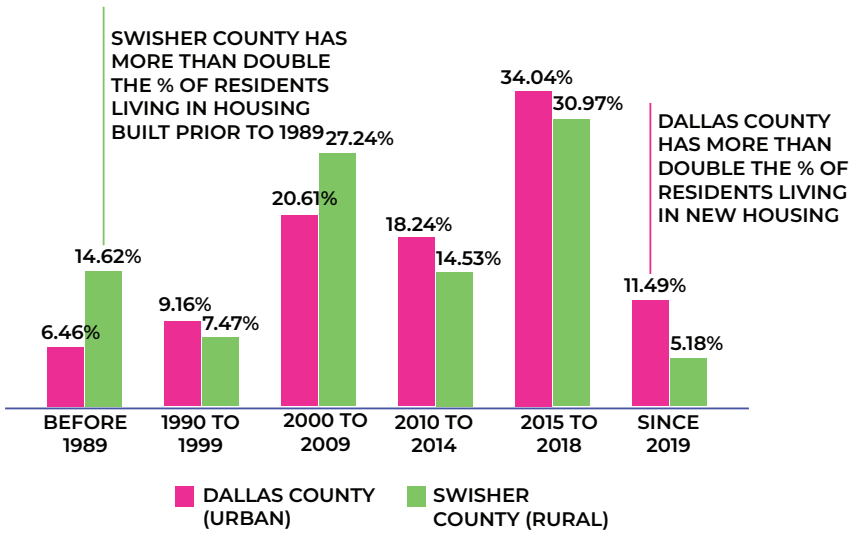


FIGURE 1.18 Comparison of age, rural vs. urban in two Texas counties

growth, but immigration is another factor contributing to the growth of the US population, projected to closer to 370 million by 2051 (Congressional Budget Office, 2022). See Figure 1.19 (US Census, n.d.; NHGIS, n.d.) for a geographic representation of the percentage of population change in the United States from 1950 to 2020.

1.4.1 Housing an Aging Society

While immigrants to the United States tend to be younger and more likely to have children (Frey, 2019), the population in America is aging, see Figure 1.20 (data source, US Census, 2021). Starting in 2030, older Americans (*aged 65 and older*)

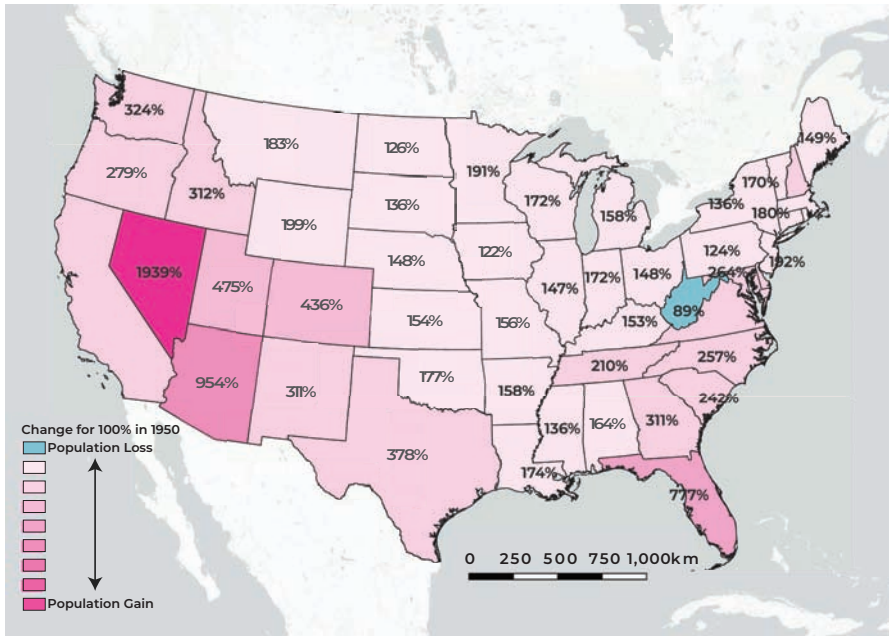


FIGURE 1.19 US population change between 1960 and 2020 by state

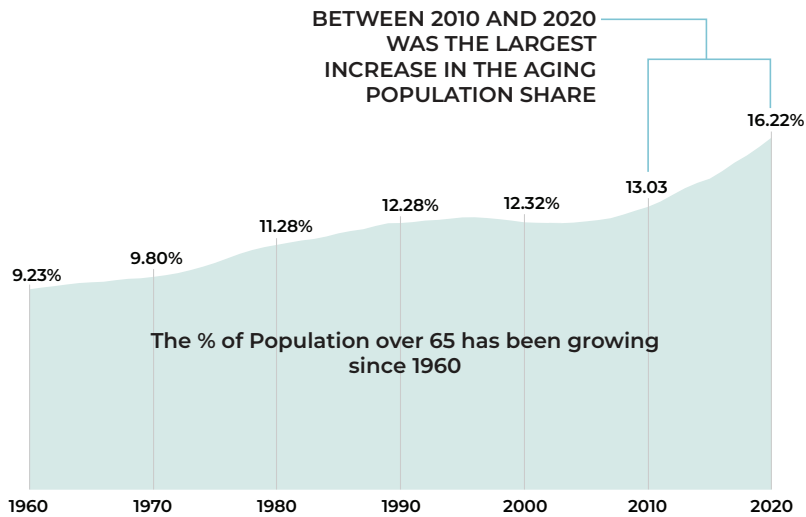


FIGURE 1.20 US aging population, 1960–2020

will make up over 20% of the total population, increasing to about 25% by 2060. Presently, more than half of all seniors above the age of 65 live in nine states led by California (5.8 million) and Florida (4.8 million), see Figure 1.21 (US Census, 2022).

The American family structure has long segregated its elders – older adults seldom live as part of a multi-generational household. Most Americans express a desire to age-in-place, holding onto their established patterns of living, surrounded by their social

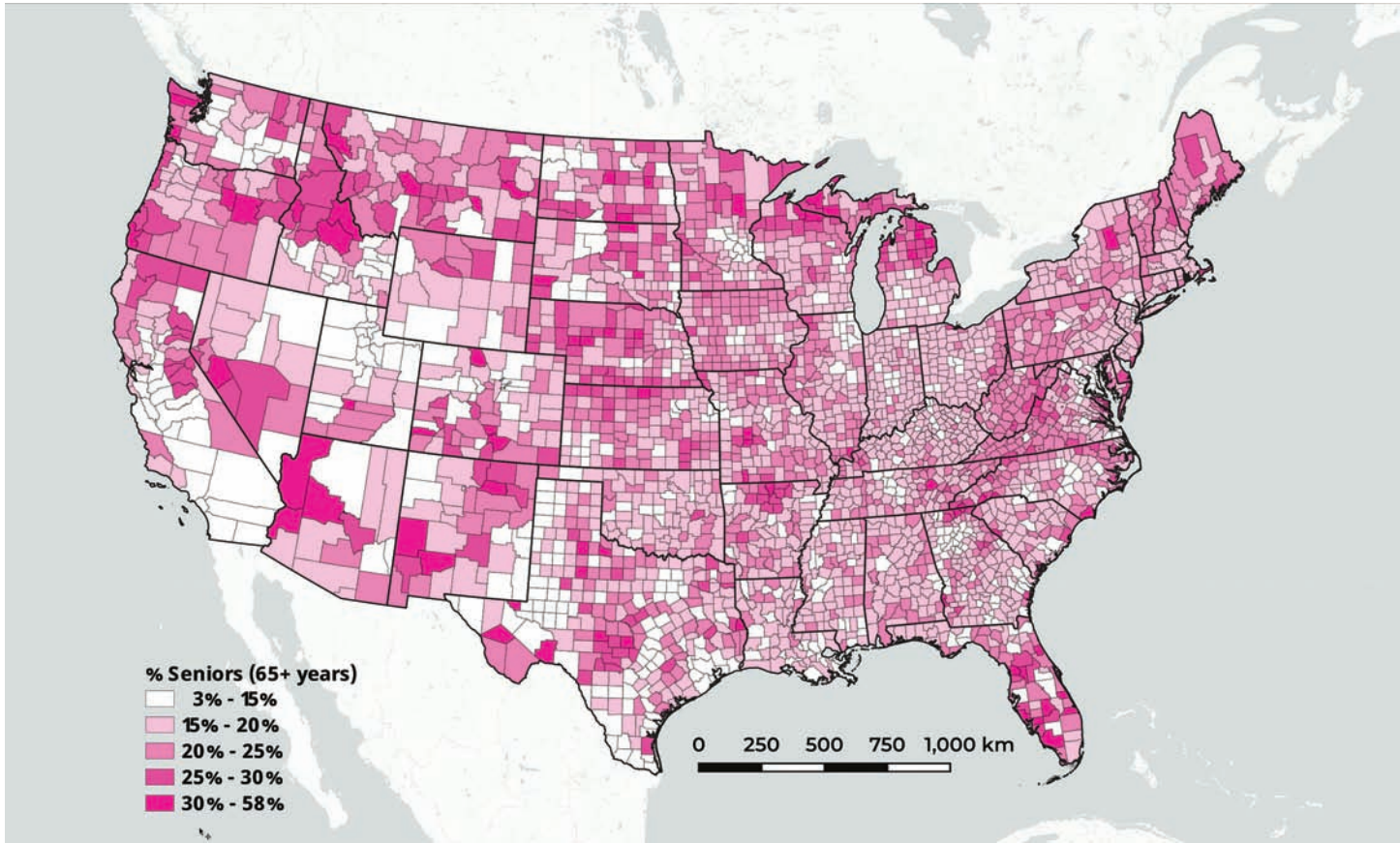


FIGURE 1.21 US counties showing the presence of seniors

and cultural networks, an aspirational ideal accepted in policy and practice (Means, 2007; AARP Research, 2018). However, as they age, older adults seek alternative living arrangements that accommodate their financial means and their physical capabilities, likely opting to move away from their suburban home. The first step along a continuum of care is usually a retirement (55+) community, also referred to as an age-restricted community. These retirement communities can include a range of housing options, including modified single-family homes, town houses, or apartments. Most retirement communities include a range of support services necessary for successful aging. Age restricted communities can include detached single-family homes, semi-detached residential units with 2–4 units per building, or apartments/condominiums that include 5+ units per building (Foundation for Community Association Research, 2017).

Environmental gerontologists have long argued that the "fit" between an older individual's individual capabilities and their living environment is central to their sense of wellbeing and a contributor to successful aging (Lawton and Nahemow, 1973). Although elderly residents may not be fully employed in paid work, successful aging models can include both paid and volunteer work, and opportunities to engage in social and recreational activities alone or in the company of others. The presence of "third places" (Oldenburg, 1989) that support opportunities for social engagement appears critical to the wellbeing of older adults (Sugiyama et al., 2022).

Creating and maintaining affordable senior housing is expensive – it is often supported by HUD Section 202 grants or the Low-Income Housing Tax Credit (LIHTC) allocations (Congressional Research Service, 2023). For older adults who have experienced traumatic situations earlier in life, such as homelessness or housing discrimination, researchers (Canham et al., 2022) argue that protections against displacement may be critical to their sense of wellbeing. There is some preliminary evidence suggesting a correlation between housing unit type and perceived social isolation among senior housing community residents, based on a sample of 1,160 individuals living in HUD Section 202 communities in metro Detroit, Michigan. The research found that "*individuals living in townhome-style dedicated senior housing were at lower risk of experiencing social isolation than their counterparts who lived in apartment style buildings*" (Carbone et al., 2022, p. 897).

When we combine geographic (Section 1.3) and demographic (this section) trends, we find that there is a huge difference between elderly populations in rural vs. urban areas. Some inner cities have reversed the late 20th century trend of depopulation and are attracting empty nesters, who cherish the high levels of accessibility, be it to health care or cultural amenities. This contrasts with the classic hinterlands of upstate NY, Appalachia where senior citizens are bereft of services (see also our discussion of NORCs in Chapter 6). Senior residents play an outsized role in rural areas. Table 1.1 is based on a comparison of the 104 Texas rural counties that we presented in Section 1.3.5 with the top six urbanized counties (Dallas, Harris, Tarrant, Bexar, Travis, and Collin).

1.4.2 The Challenges of Housing Immigrants

While the desire to move to the United States and become a citizen has remained generally consistent (the United States is still seen as a desirable place to live permanently),

TABLE 1.1
Characteristics of Senior Populations in Rural vs. Urban Counties in Texas

Variable	Rural	Urban
Share of area population	18.6%	22.2%
Disability	41.5%	32.3%
Own their place	86.1%	75.6%
Rent their place	13.9%	24.4
Still pay mortgage	14.2%	35.7%
Without phone	1.8%	1.3%
In poverty	9.2%	7.5%
Local for >30 years	36.6%	26.5%
Veteran	15.1%	15.6%
Share of area wealth	36.2%	29.0%

the number of immigrant visas issued (legal pathways to permanent residency and eventual citizenship) fluctuates as part of American foreign policy. At the time of writing (2023), immigration from Mexico tops the list with over 40,000 immigrant visas issued in 2021 (Koop, 2022). Legal immigrants to the United States are more likely to arrive at gateway cities such as New York and Los Angeles. Many of them have limited resources and struggle to navigate life in expensive housing markets. Immigrants arrive in the United States for a variety of reasons, some in search of economic opportunity while others flee oppression and persecution. However, it is a truism that all immigrants seek work. Legal immigrants often seek skilled work and regardless of where they arrive, they move to places where they can find meaningful employment. Looking at data between 1970 and 2020, there are no discernable settlement patterns; legal immigrants are found in all 50 states, although the majority are found in Texas, California, and Florida, see Figure 1.22 (US Census, n.d. and NHGIS, n.d.).

We can speculate that immigrants are more likely to become homeowners because they view the pursuit of homeownership as a legitimate pathway to wealth creation. Myers and Pitkin (2013) argue that the share of new homeowners who are foreign born is nearly eight times greater than what it was during the 1970s. It seems reasonable to conclude that as American society ages, adults 65 and over are likely to sell their suburban single-family homes to new immigrants who are younger and are active in the workforce. However, not all immigrants will become homeowners, and even those that aspire to become homeowners will be renters when they arrive in the United States. Salz (2007) investigated the question of how immigrants affect the housing market and observed that there is a local economic impact of immigration, pushing up demand for housing in destination areas, resulting in increased rents. His findings reinforce earlier research by Muller and Espenhade (1985) who observed that rents went up in Los Angeles, more than other metro areas in the period 1967–1983, a phenomenon attributed to the arrival of new immigrants. A similar correlation was observed in Toronto, Canada, by Ley and Tuchener (1999).

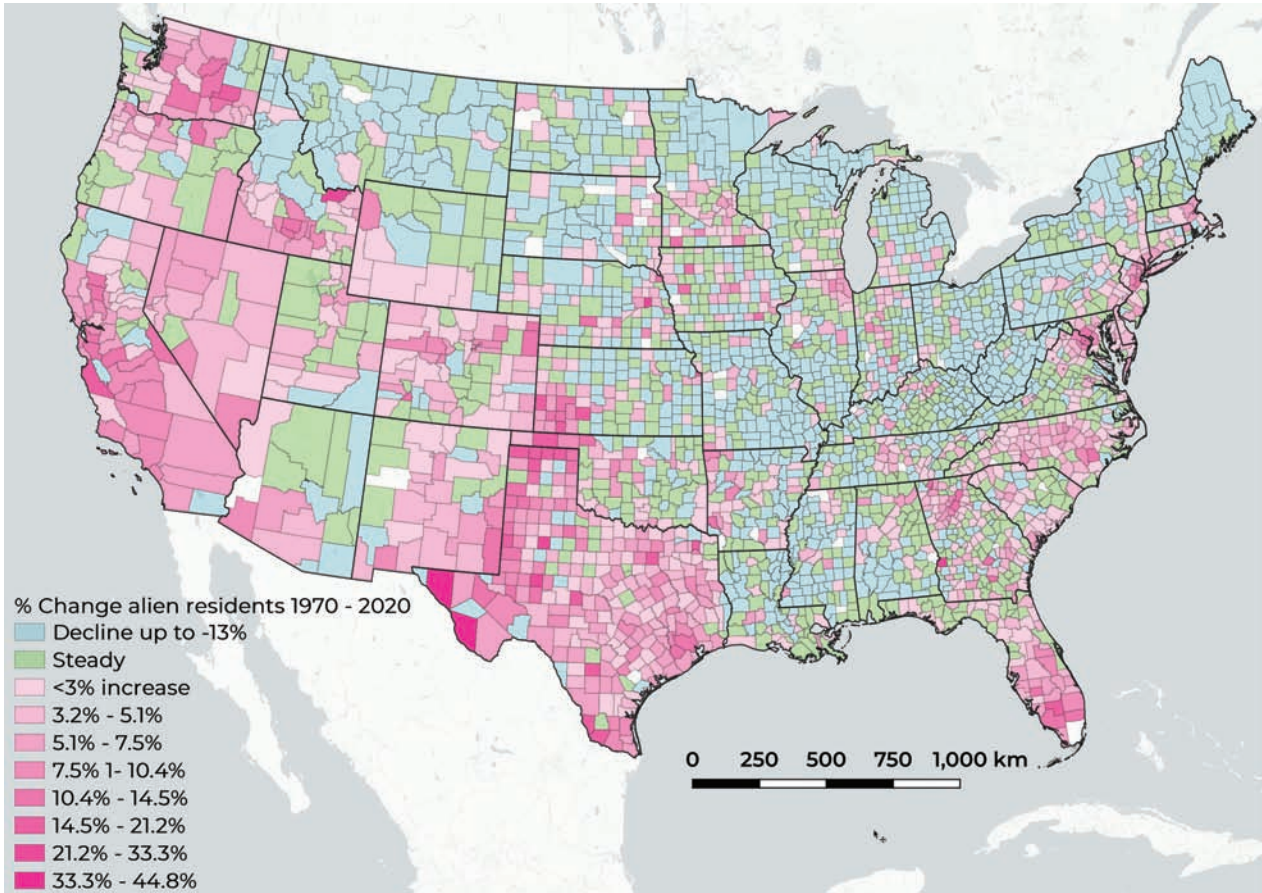


FIGURE 1.22 Change in immigration, 1970 and 2020

There are other cultural variables to be considered. Many larger US cities have ethnic enclaves, with quaint references to Chinatown, little India or little Saigon. These enclaves are often the beating heart of the immigrant community. While outsiders may consider these enclaves as restaurant districts, for poor immigrants, especially those without formal education, these neighborhoods are live-work spaces, providing much needed shelter in addition to a robust social support system until they can establish themselves. Thus, phenomena such as illegal subletting of apartment units and overcrowding may attract the attention of both the planning authorities and law enforcement. We must recognize that the new immigrants, predominantly people of color, are challenged in the same ways as the predominantly European immigrants who experienced discrimination in the pursuit of jobs and housing in the 1900s. The challenges of securing housing forces immigrants to consume less housing, although we can speculate that over a period of time, their housing needs (in terms of space usage) become comparable to the locals.

Migrants who have arrived in gateway cities illegally are being subjected to extreme hardships by law enforcement. While conditions for asylum seekers and refugees are marginally better, these individuals and their families including young children are pushed into overcrowded shelter systems without much support. Migrants' access to safe and adequate housing is proving to be a major challenge.

1.4.3 A Tale of Two Cities

Our visualizations of change over time tell a story of how changes in housing are related to accompanying urbanization and suburbanization trends, demographic shifts, technological advances, economic fluctuations, and politics all affecting housing geographies as discussed in Section 1.3. While it may be easy to label cities and regions as "winners or losers", we point out that change is a dynamic process. Next, we examine Phoenix, AZ and Detroit, MI in further detail.

Phoenix, Arizona is a "sun belt" city that was shaped by 20th century technological innovations that resulted in a demographic shift that has made it a boomtown. Founded in the 1880s, Phoenix was a small settlement in a desert that could not grow because of the lack of water. The relative accessibility and affordability of indoor air conditioning systems after World War II allowed people to consider Phoenix for year-round living rather than a winter escape for a few short months. The housing and settlement patterns in the 1950s favored automobile travel, suburban single-family housing typologies, and encouraged urban sprawl, see Figure 1.23 (US Census, n.d. and OSM). Government investments created a reliable, affordable water supply for the new city. In sum, technological innovations, laissez-faire capitalism, and voluntary migration encouraged new settlements to develop in areas that were previously not considered desirable, see Figure 1.24 (US Census, n.d.; NHGIS, n.d.), making Phoenix the fifth largest city in the United States. Despite its successes, Phoenix now struggles with the challenges of human-induced climate change, including hotter temperatures in summer, the challenges of maintaining a sustainable supply of water, and a growing homeless population that struggles to cope with rising costs of affordable housing.

Detroit, Michigan is a rust-belt city. In the first half of the twentieth century, Detroit grew in prominence as a result of the great migration of southern Blacks, as well as

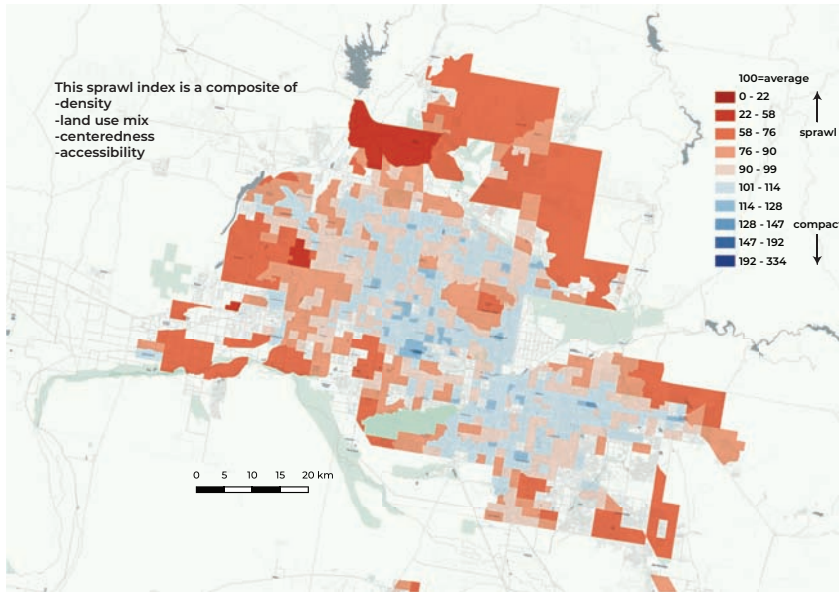


FIGURE 1.23 Phoenix urban sprawl index

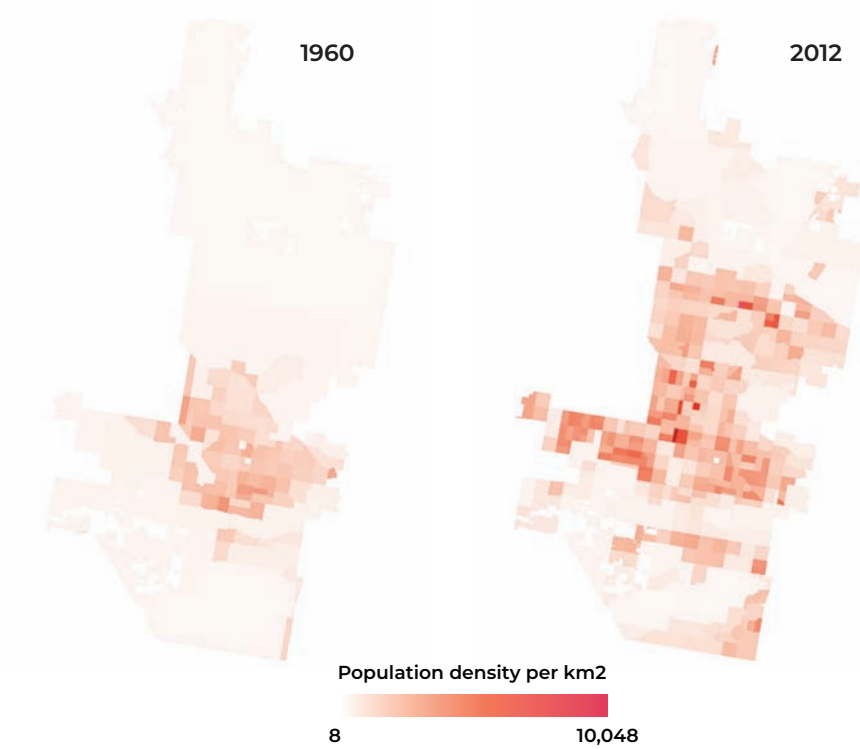


FIGURE 1.24 Phoenix population growth, 1960–2012

immigrants from eastern and central Europe. The auto industry pioneered by Henry Ford established the principles of automation and mass production. The principles emphasized efficiency and also allowed low-skilled workers to become gainfully employed and part of a growing middle class. Workers in auto plants were able to have relatively clean and safe work and made a living wage, creating wealth across race and class lines. However, the auto industry's growth also contributed to de-densification and urban sprawl. As car culture evolved, cities like Detroit built networks of freeways to move people away from the city to residential suburbs, creating a host of negative consequences, chief among them being the destruction of thriving neighborhoods where Black people lived. Racial tensions caused urban riots, cementing segregation. The city of Detroit was crippled by white flight to the suburbs and the destruction of thriving Black neighborhoods through transportation policies that favored the car.

The current Metro-Detroit area map that includes Wayne, Macomb, and Oakland counties shows the stark contrast between inner city Detroit that shows serious population decline and areas of population growth in the outer suburbs. The effects of the decline of the automotive industry that began in the 1970s and 1980s have not been repaired. The consequences of population decline result in depressed home values, deterioration of housing stock, increase in number of vacant lots, and urban blight, see Figure 1.25 (US Census, n.d.; NHGIS, n.d.).

Historians, geographers, and urban scholars studying Detroit have documented the interlocking forces of private market decisions that privileged and advanced particular policy positions that were adopted by government planners and decision makers. In

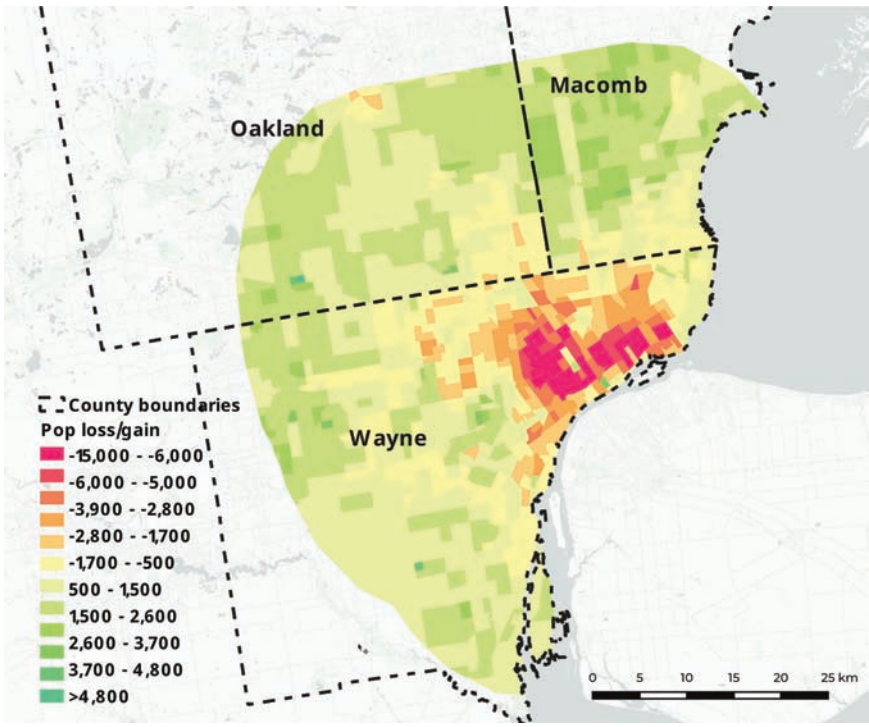


FIGURE 1.25 Detroit population gain and loss

retrospect, the choices made in the 1950s have made it difficult to solve the depopulation crisis that remains a persistent challenge to present-day planners and city managers.

1.5 WHY SCALE MATTERS FOR HOUSING RESEARCH, PRACTICE, AND POLICY

Scale is one of the central anchors in geography, architecture, and spatial urban planning, yet it is a concept that is not well-understood by non-experts. Scale, in its everyday understanding, allows us to consider the relative size or complexity of an object, an event, or a process. Scale is also a useful concept to consider in representing real world objects, or processes on a map. Architects, for instance, can generate scaled drawings of their projects at a spatial scale of 1:10 or at a scale of 1:200. Each drawing serves a different purpose; for instance, a 1:4 scaled drawing may show the detail of an individual room, including the spatial relationship between the doors and windows of that room, whereas a drawing at 1:200 may better represent the building in relation to its site and setting.

Geographers and planners examining phenomena such as urbanization or environmental pollution represent processes. Processes are dynamic (change over time). Housing production, management, financing, and every other aspect of the housing enterprise occur across multiple spatial scales. Housing is inextricably linked to livability and quality of life. Thus, housing can and should be understood across different spatial scales, especially at the community and regional levels, rather than at a national level alone. It is only by understanding housing phenomena at the sub-regional and local levels can we understand geographic disparities in access to housing, for example, or assess whether national housing policies are having their intended effect in all regions, or whether one demographic group is being underserved or discriminated against in receiving financing to purchase homes. For example, housing starts (events) and urbanization (processes) are scale dependent and only understood by shifting/moving between spatial scales. While temporality also matters, understanding changes over space and across time requires consciously scaling up or down. Every aspect of housing can be examined at national, regional, and neighborhood levels. Using different scales to understand the same phenomenon can create a better understanding of the issue.

Another way to think about the value of thinking across spatial scales is to realize that humans experience the impacts of processes or events at different scales to arrive at different conclusions – for example, a walkable neighborhood may be appreciated at a local scale and be useful in creating a "walk score" (https://walkscore.com) for that neighborhood, while examining walkability at the scale of a city can be used to identify where new pedestrian paths must be laid to create equitable access. The only way to think across scales is to encourage spatial thinking, supported by available tools and methods. As a caveat, we note that because scale is linked to representation, there is a potential of manipulation/lying by adjusting the scale. Thus, a thorough understanding of scale is critical before deploying it to study housing phenomena (Albrecht, 2007; Ramasubramanian and Albrecht, 2018).

1.6 THE ROLE OF GIS IN ADDRESSING HOUSING CHALLENGES

This book's primary focus is to understand and explain housing challenges in the United States using geographically referenced data and analyses. We are confident

that our approaches can be used in different countries and cultural contexts by local experts who are familiar with the unique housing challenges in their country. The rest of the chapters in this book use a geographical lens to articulate our approach to examining housing challenges using Geographic Information Science (GIS) techniques. These techniques facilitate the (i) acquisition of data from diverse sources, (ii) specific analytical processes to query the data, and (iii) interesting ways to map and visualize results. Collectively, GIS assists in *communicating complex information* to diverse audiences, see Figure 1.26 from Perch Design Studio. We posit that GIS has not been effectively deployed in housing policy conversations at any scale and we hope that our contributions will be a step in the right direction.

As the authors of this book, we argue that this is an opportune time to use GIS to create new and compelling visual narratives that are anchored by data to understand housing in the context of neighborhood development. Housing (places of residence) seldom emerges/exists in isolation – where we live is closely related to where we work, socialize, shop, and worship. Examining housing as a single site (be it a single-family home or an affordable housing development) is pointless. Conversely examining housing policies such as whether a state policy supports the development of multi-family housing offers a simplistic and a non-spatial understanding of an inherently spatial phenomenon. The realtor's mantra, location, location, location, is relevant here. When realtors celebrate or talk up a location as a selling point, what they are trying to accomplish is to describe the non-monetary

FIGURE 1.26 GIS as a communication device

value of the location relative to the neighborhood's amenities. Neighborhood matters! GIS enables end users to understand housing and neighborhoods.

In addition, GIS provides a working framework to allow experts and non-experts to collaborate easily and creatively. It is not about collecting data – different departments can remain the custodians of their own data. GIS makes it possible to combine data, to drive insights, and to change the way people make decisions. Most datasets, even those that were collected without any GIS in mind, have some locational reference. This is the unifying aspect about all GIS data that allows us to combine the data by location (see Chapter 4 for details) and visualize it in the form of a map. Geospatial visualizations increase engagement with internal and external stakeholders. Internally, GIS is used to answer questions such as "How are you making investments in communities, and what are the demographics of those communities?" Externally, GIS maps can demonstrate why the city is investing in certain areas and what progress they have made in achieving stated goals. GIS tools help create narratives that increase an understanding with all stakeholders. Envision Utah is one of many examples where GIS has been at the core of raising and responding to complex social policy questions.

One example for its ability to communicate complex housing policy information to diverse audiences is Envision Utah (https://envisionutah.org), a non-for-profit organization that aims to facilitate the rapid population growth of Utah in general and the northern part of the metro Salt Lake City region in particular. While in general, this is a good problem to have, the pains associated with such growth have to be addressed by planning efforts which are politically fraught as housing and transportation needs clash with environmental interests. Envision Utah uses GIS extensively to develop and discuss a range of regional growth scenarios ranging from car-oriented low-density to transit-oriented high-density alternatives with high levels of infill and redevelopment.

The visual nature of GIS enhances public outreach efforts. Envision Utah conducted over 30 public meetings and received input from some 3,500 online participants, in addition to the collaboration of over 60 stakeholder organizations. GIS provides the unique ability to be data-driven, while also visually communicating the consequences of one policy decision or the other. And whereas policy is usually equitable in its intent, the effects are often not because of different starting conditions at different locations. The spatial differentiation inherent in GIS inputs helps stakeholders to understand the pathways of a decision-making process in a complex context. As such, GIS serves both the planning expert and the proverbial Jane Q Public who does not want to be bothered with numbers but is presented with instantaneous cause and effects of tweaking one factor or the other.

1.7 OVERVIEW OF UPCOMING CHAPTERS

The book is intended to introduce contemporary housing issues to non-specialist audiences and to encourage housing policy professionals and housing experts to use GIS concepts, methods, and techniques to investigate housing-related policy and implementation questions. As authors, we are clear that the context and the application domain (housing) and the questions posed to understand, explain, and shape housing policy must determine the use of the methods – in this case, the use of GIS mapping and spatial analysis. Therefore, we begin by framing the first chapter in contextualizing housing in the United States. In Chapter 1, we propose that housing, understood to be a basic human need in all societies, is much more than the provision of shelter

from the elements. Housing is a cultural phenomenon, in that housing morphologies and settlement patterns are as likely to reflect a society's dominant cultural ethos which may be as significant or more significant than building with considerations about suitability of materials, methods of construction, or costs. American urbanization and housing settlement patterns were influenced by the City Beautiful movement and societal considerations that sought to reduce density and overcrowding in urban areas. The chapter proposes that the application of a geographical lens can create a robust understanding of housing related issues at the neighborhood/human scale and advocates for the use of Geographic Information Science concepts, methods, and techniques to formalize geographical analyses of housing questions. Maps and data are used to explain housing geographies and highlight how the use of geographically referenced, publicly available information can be used to support policymaking.

Chapter 2 addresses the demographic shifts in the United States since the early 20th century to establish that demographic realities, regardless of their cause, influence housing production. At the same time, housing production innovations were made possible because of technological advances. Just as in the late 19th century, indoor plumbing and sanitary sewer systems allowed changes in the layout of individual houses and apartment buildings, the invention of indoor air conditioning systems allowed large-scale settlements to develop in previously inhospitable climatic zones. Likewise, advances in refrigerated trucking, and the development and growth of an automobile-oriented culture influenced American urbanization since the 1920s, trends that accelerated after 1945 as a result of the post war baby boom. Suburbia was "invented" to advance an ideal of a nuclear family (with a working father and a stay-at-home mom), who lived in "safe" suburban residential environments spatially separated from unhealthy and unsafe urban workplace environments. This cultural ideal has prevailed for over 60 years and shows no signs of abating. Land use policies and practices supported and advanced these cultural ideals. Zoning imposed a pseudo-order on the landscape and was established using racist and exclusionary practices that created segregated neighborhoods. The chapter also discusses the rise and decline in investments to create public housing and ends with a brief discussion of gentrification.

Chapter 3 expands the readers' understanding about housing typologies. Non-specialists hearing the word "housing" typically use their own personal understandings of housing establishing a rudimentary binary classification that distinguishes between owner-occupied housing and renter-occupied housing. While this is an important distinction, there are additional architectural distinctions that become significant in the production and management of housing. The range of housing typologies discussed in this chapter creates distinctions by function: (i) single-family housing, (ii) multi-family housing, and (iii) institutional living quarters. From a planning and design perspective, each of these types of housing typologies can be further broken down based on sub-categories such as (i) architectural styles (e.g., a single-family detached house), allowable height/volume (e.g., a non-elevator, walk-up building in a residential zone), number of individuals or households accommodated (e.g., group quarters such as college dorms), and ownership (e.g., condominiums). The chapter also discusses newer physical planning innovations in the housing sector such as the use of manufactured homes to address the housing shortage among low-wage workers, the legal and illegal conversions of homes to add space for expanding families such as a mother-in-law unit, or a rental unit to generate income for the house owner. The chapter also discusses policy innovations such as

the Rental Assistance Demonstration (RAD) program developed by the US Department of Housing and Urban Development (HUD) that attempts to preserve affordable housing. The chapter concludes with a discussion about geographical data and the use of geospatial indicators that can be used to understand the land use planning implications associated with housing. Housing specialists eager to learn about the use of GIS to support their work should begin with a careful reading of Section 3.5.

Chapter 4 shifts the focus from housing issues to a consideration of GIS. Geographic Information Science concepts require a preliminary understanding of data sources, databases, database organization principles, and data quality. The chapter begins with a discussion of different types of data sources. The primary data source for housing research comes from the US Census. Additionally, historical census data has been compiled and organized in formats suitable for research and analysis through the National Historical GIS. In order to take advantage of GIS, data needs to be locationally referenced, creating a unique spatial identifier – such as a street address to which other information can be linked. Chapter 4 also discusses how to create and use derived housing variables (that are computed or estimated), and the challenges of working in data poor environments. A discussion of data quality includes the Modifiable Areal Unit Problem (MAUP), which is the cause of ecological fallacies in analyzing and reporting GIS data. The chapter concludes with a reminder to readers to be creative in identifying non-conventional data sources and engaging citizens in conducting housing research to solve the problem of "lack of data" at the neighborhood level. The chapter does not claim to be an introduction to GIS (whole textbooks have been written about how to use GIS) but it gets housing specialists prepared to have conversations and collaborations with GIS professionals.

Chapter 5 builds on the previous chapter and prepares housing researchers to understand the principles of spatial coordinate systems that allow geo-referenced data points to be displayed correctly on a map. It also explains the geo-relational principle wherein a unique location reference in one database or data table is linked to the same unique reference in another dataset. Using a locational reference to link different sets of data lies at the basis of GIS. Data *about* a location (in GIS terms, called attributes) gathered from different sources can be linked and analyzed. For planners and housing researchers, this means that population data about a neighborhood (ZIP code) can be linked to housing prices in the same area and can also be linked to education characteristics at the same location. The chapter continues with a discussion of basic GIS operations that are used in GIS-based analyses and touches upon advanced methods such as spatial regression.

Chapter 6 is the most technical chapter in this book. GIS novices are urged to use a companion GIS textbook such as Albrecht (2007) and a planning methods book e.g., Ramasubramanian and Albrecht (2018) to extract value from this chapter. Chapter 6 moves from the realm of using GIS to understand housing issues to considering the complex policy questions that preoccupy housing specialists and urban planners. Progressive housing activists and policymakers are consumed by addressing the housing supply crisis discussed in Chapter 1 by increasing residential densities. The authors discuss how GIS can support framing these policy conversations. Each section tackles complex challenges where multiple layers of data and evidence are linked to produce a coherent narrative to advocate for a particular set of policies. In this chapter, GIS maps are recognized as services that create just-in-time analyses for end users. GIS is also more robustly integrated with 3-D modeling and visualization, requiring advanced technical skills. The latest investments in GIS for housing use digital twins – where

digital models of the urban environment are created in great detail to allow the testing of different scenarios or options. These technological advances push the boundaries of what is possible using GIS, and support future-oriented planning and decision making.

Throughout this book, we have discussed the power and potential of using a geographical lens to examine housing issues at different spatial scales. In Chapter 7, which concludes this book, we remind readers that GI technologies and applications facilitate academic inquiry but more importantly allow for a range of stakeholders to examine housing questions in relation to other city development challenges such as addressing infrastructure or transportation needs. Since housing is central to the lives of everyday people and housing challenges are experienced at the neighborhood scale, we have argued about the value and need for housing analyses to be conducted and communicated at the neighborhood/sub-city scale. We encourage educators in the design and planning professions to integrate policy and planning conversations – to further encourage professionals working in the built environment sector to work collaboratively to address housing production/supply challenges. We encourage bold thinking and forward-looking solutions to address the enduring housing crises in America to create sustainable and humane living alternatives for future generations.

REFERENCES

AARP Research, 2018. *2018 Home and Community Preferences: A National Survey of Adults Ages 18-Plus*. Washington, DC: American Association of Retired Persons. https://www.aarp.org/content/dam/aarp/research/surveys_statistics/liv-com/2018/home-community-preferences-survey. doi:10.26419-2Fres.00231.001.pdf, last accessed 6 March 2023.

Albrecht, J, 2007. *Key Concepts and Techniques in GIS*. London: Sage Publications.

Beauregard, R A, 2006. *When America Became Suburban*. Minneapolis: University of Minnesota Press.

BLS, 2022. *Consumer Expenditures for the San Francisco Metropolitan Area, 2020–2021*. Washington, DC: Bureau of Labor Statistics. https://www.bls.gov/regions/west/news-release/consumerexpenditures_sanfrancisco.htm#:~:text=Housing%20accounted%20for%2041.9%20percent,higher%20than%20the%20national%20average, last accessed 6 March 2023.

Burchell, R, Downs, A, McCann, B, and Mukheerjee, S, 2005. *Sprawl Costs: Economic Costs of Unchecked Development*. Washington, DC: Island Press.

Carbone, J, Clift, J, Wyllie, T, and Smyth, A, 2022. "Housing Unit Type and Perceived Social Isolation Among Senior Housing Community Residents". *The Gerontologist*, 62(6): 889–899.

Caro, R, 1974. *The Power Broker: Robert Moses and the Fall of New York*. New York: Vintage Books.

Cavanaugh, E, 2020. *The Routledge Handbook of the History of Settler Colonialism*. Philadelphia, PA: Routledge.

Chey, K, 2017. *Multi-Unit Housing in Urban Cities: From 1800 to Present Day*. Philadelphia, PA: Routledge.

Congressional Budget Office, 2022. *The Demographic Outlook: 2022–2052*. https://www.cbo.gov/system/files/2022-07/57975-demographic-outlook.pdf, last accessed 2 July 2023.

Congressional Research Service, 2023. *An Introduction to the Low Income Housing Tax Credit. RS22389*. Washington, DC: Congressional Research Service. https://crsreports.congress.gov/, last accessed 30 April 2023.

Desmond, M, 2017. *Evicted: Poverty and Profit in the American City*. New York: Crown.

Doughterty, C, and Casselman, B, 2022. "We Need to Keep Building Houses Even If No One Wants to Buy". *New York Times*, July 23. https://www.nytimes.com/2022/07/23/business/housing-market-crisis-supply.html, last accessed 6 March 2023.

Fallon, K, 2021. *Naming Housing as a Human Right Is the First Step to Solving the Housing Crisis*, *Housing Matters*. Washington, DC: Urban Institute. https://housingmatters.urban.org/articles/naming-housing-human-right-first-step-solving-housing-crisis, last accessed 6 March 2023.

Fisher, C, 1962. "Land Use Control Through Zoning: The San Francisco Experience". *Hastings Law Journal*, 13: 3. https://repository.uchastings.edu/hastings_law_journal/vol13/iss3/3, last accessed 6 March 2023.

Fitzpatrick, K, and Spialek, M, 2020. *Hurricane Harvey's Aftermath: Place*, *Race*, *and Inequality in Disaster Recovery*. New York: NYU Press.

Forsyth, A, 2012. "Defining Suburbs". *Journal of Planning Literature*, 27(3): 270–281. doi:10.1177/0885412212448101.

Foundation for Community Association Research, 2017. 2016 *Community Association Fact Book Part Six: Comparison of Condominium and Non-Condominium Residents Age 55 and Over*. Falls Church, VA: Foundation for Community Association Research. https://foundation.caionline.org/, last accessed 2 July 2023.

Frey, W H, 2019. *America Is Not Full. Its Future Rests With Young Immigrants*. https://www.brookings.edu/articles/america-is-not-full-its-future-rests-with-young-immigrants/, last accessed 2 July 2023.

Galster, G, 2008. "United States Housing Scholarship since 1968". *Journal of the American Planning Association*, 74: 1. doi:10.1080/01944360701792231

Gans, H, 1967, 2017. *The Levittowners: Ways of Life and Politics in a New Suburban Community*. New York: Columbia University Press.

Goodman, P, 2022. "A Normal Supply Chain? Its 'Unlikely'". *New York Times*, February 6. https://www.nytimes.com/2022/02/01/business/supply-chain-disruption.html, last accessed March 6, 2023.

Grant, J, Mottet, L, Tanis, J, Harrison, J, Herman, J, and Keisling, M, 2011. *Injustice at Every Turn: A Report of the National Transgender Discrimination Survey*. Washington, DC: National Center for Transgender Equality and National Gay and Lesbian Task Force.

Hall, P, 2014. *Cities of Tomorrow: An Intellectual History of Urban Planning and Design since 1880*. West Sussex: Wiley Blackwell.

Haub, C, and Sharma, O, 2018. *How People in India "Really" Live*. Population Reference Bureau Report. https://www.prb.org/resources/how-people-in-india-really-live/, last accessed 6 March 2023.

Hayden, D, and Wark, J, 2005. *A Field Guide to Sprawl*. New York: Norton.

Healy, J, 2016. "Underwater in the Las Vegas Desert, Years after the Housing Crash". *New York Times*, August 2. https://www.nytimes.com/2016/08/03/us/las-vegas-2008-housing-crash.html, last accessed 6 March 2023.

Henry, M, de Sousa, T, Roddey, C, Gayen, S, and Bednar, T, 2021. *The 2020 Annual Homeless Assessment Report (AHAR) to Congress*, *Part 1: Point-In-Time Estimates of Homelessness*. https://www.huduser.gov/portal/sites/default/files/pdf/2020-AHAR-Part-1.pdf, last accessed 6 March 2023.

Hixon, W, 2013. *American Settler Colonialism: A History*. New York: Palgrave Macmillan.

Howard, E, 1898. *Tomorrow: A Peaceful Path to Real Reform*. London: Swan Sonnenschein & Co., Ltd.

Howard, E, 1902 (reissued 1965). *Garden Cities of Tomorrow*. Cambridge, MS: MIT Press.

Hoyt, H, 1939. *The Structure and Growth of Residential Neighborhoods in American Cities*. Washington, DC: Federal Housing Administration.

Jackson, K, 1985. *Crabgrass Frontier: The Suburbanization of the United States*. London: Oxford University Press.

Jayapal, P, and Meng, G, 2021. *Housing is a Human Right Act of 2021*. https://jayapal.house.gov/wp-content/uploads/2021/06/Housing-is-a-Human-Right_Jayapal.pdf, last accessed 6 March 2023.

Jones, K, Getter, D, and Scott, A, 2017. *An Overview of the Housing Finance System in the United States*. Congressional Research Service Report, R 42995. https://crsreports.congress.gov/, last accessed 6 March 2023.

Kaysen, R, 2023. "A Housing Market Hangover". *New York Times*, January 3. https://www.nytimes.com/2022/12/30/realestate/housing-market-prices-interest-rates.html, last accessed 6 March 2023.

Kelly, B, 1993. *Expanding the American Dream: Building and Rebuilding Levittown*. Albany, NY: State University of New York Press.

Koop, A, 2022. *Ranked: The 25 Countries receiving the most US Immigration Visas*. https://www.visualcapitalist.com/countries-receiving-most-us-immigration-visas/, last accessed 1 June 2023.

Kunstler, J, 1994. *The Geography of Nowhere: The rise and decline of America's Man-Made Landscape*. New York: The Free Press.

Lawton, M, and Nahemow, L, 1973. "Ecology and the Aging Process". In Eisdorfer, C, and Lawton, M (Eds.), *The Psychology of Adult Development and Aging*, pp. 619–674. Washington, DC: American Psychological Association. doi:10.1037/10044-020.

Lee, B, Tyler, K, and Wright, J, 2010. "The New Homelessness Revisited". *Annual Review of Sociology*, 36(1): 501–521.

LeGates, R T, and Stout, F (Eds.), 2019. *The City Reader*, 6th edition. Philadelphia, PA: Routledge.

Levittown, P A. Wikimedia Commons, n.d., https://commons.wikimedia.org/wiki/File:LevittownPA.jpg.

Ley, D, and Tuchener, J, 1999. "Immigration and Metropolitan House Prices in Canada". *Research on Immigration and Integration in the Metropolis: Working Paper #*99-09. Vancouver, BC: Vancouver Center of Excellence.

Madden, D, and Marcuse, P, 2016. *In Defense of Housing: The Politics of Crisis*. New York: Verso.

Means, R, 2007. "Safe as Houses? Ageing in Place and Vulnerable Older People in the UK". *Social Policy & Administration*, 41(1): 65–85. doi:10.1111/j.1467-9515.2007.00539.x.

Meyer, B, Wyse, A, and Corinth, K, 2022. *The Size and Census Coverage of the U.S. Homeless Population: Working Paper No*. 2022-78. Chicago, IL: Becker Friedman Institute for Economics at the University of Chicago. https://bfi.uchicago.edu/working-paper/the-size-and-census-coverage-of-the-u-s-homeless-population/, last accessed 6 March 2023.

Muller, T, and Espenshade, T, 1985. *The Fourth Wave: California's Newest Immigrants*. Washington, DC: The Urban Institute Press.

Myers, D, and Pitkin, J, 2013. *Immigrant Contributions to Housing Demand in the United States: A comparison of Recent Decades and Projections to 2020 for the States and the Nation*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2239077, last accessed 2 June 2023.

National Alliance to End Homelessness, 2022. *State of Homelessness Report*, 2022. https://endhomelessness.org/homelessness-in-america/homelessness-statistics/state-of-homelessness/, last accessed 6 March 2023.

National Coalition for the Homeless, 2009. "Mental Illness and Homelessness". *Fact Sheet*, July 2009. https://www.nationalhomeless.org/factsheets/Mental_Illness.html, last accessed 6 March 2023.

National Rural Housing Coalition (NRHC), 2014. *Federal Strategies to Preserve Access to Affordable Rental Housing in Rural Communities*. Washington, DC: NRHC

NHGIS, n.d. *Generic historical US Census data archived by National Historical GIS*. Online resource, available at nhgis.org.

Office of the United Nations High Commissioner of Human Rights (OHCHR), 2009. "The Human Right to Adequate Housing". *Fact Sheet*, 21. https://www.refworld.org/docid/479477400.html, last accessed 6 March 2023.

Oldenburg, R. 1989. *The Great Good Place: Cafes*, *Coffee Shops*, *Community Centers*, *Beauty Parlors*, *General Stores*, *Bars*, *Hangouts*, *and How They Get You Through the Day*. New York: Paragon House.

Olivet, J, 2022. *Collaborate, Don't Criminalize: How Communities Can Effectively and Humanely Address Homelessness*. Washington, DC: U.S. Interagency Council on Homelessness. https://www.usich.gov/news/collaborate-dont-criminalize-how-communities-can-effectively-and-humanely-address-homelessness/, last accessed 30 May 2023.

Park, R, Burgess, E, and McKenzie, R, 1925 (reissued 1967). *The City*. Chicago, IL: The University of Chicago Press.

Parolek, D, 2020. *Missing Middle Housing: Thinking Big and Building Small to Respond to Today's Housing Crisis*. Washington, DC: New York Island Press.

Perch Design Studio. *Interactive Map Table*. https://perchmade.com/experience/interactive-map-table/, last accessed 13 July 2023.

Perry, C, 1929. "The Neighborhood Unit". In LeGates, R, and Stout, F (Eds.), *The City Reader*, 5th edition, pp. 488–498. Philadelphia, PA: Routledge.

Ramasubramanian, L, 2010. *Geographic Information Science and Public Participation*. Heidelberg, Germany: Springer.

Ramasubramanian, L, and Albrecht, J, 2018. *Essential Methods for Planning Practitioners: Skills and Techniques for Data Analysis, Visualization, and Communication*. New York: Springer.

Rapoport, A, 1969. *House Form and Culture*. New York: Pearson.

Rothstein, A, 1938. "Slums, Pittsburgh, Pennsylvania [Graphic]: 1938 July (1 Negative: Nitrate; 35 mm)". *The Hill*. Library of Congress, Prints and Photographs Division. https://lccn.loc.gov/2017723699.

Rothstein, R, 2018. *The Color of Law: A Forgotten History of How Our Government Segregated America*. New York: Norton Publishing.

Saiz, A, 2007. "Immigration and Housing Rents in American Cities". *Journal of Urban Economics*, 61(2): 345–371. doi:10.1016/j.jue.2006.07.004.

Schön, D, and Rein, M, 1994. *Frame Reflection: Toward the Resolution of Intractable Policy Controversies*. New York: Basic Books.

Sisson, P, 2022. "For Want of an Insulation Screw". *New York Times*, November 22. https://www.nytimes.com/2022/11/15/business/construction-costs.html, last accessed 6 March 2023.

Southworth, M, and Joseph, E B, 2003. *Streets and the Shaping of Towns and Cities*. Washington, DC: Island Press.

Sugiyama, M, Chau, H, Takumi, A, Yusuke K, Jamei, E, Veeorja, P, Mori, K, and Sugiyama, T, 2023. "Third Places for Older Adults Social Engagement: A Scoping Review and Research Agenda". *Gerontology*, 63: 1149–1161, doi:10.1093/geront/gnac180.

US Census, n.d. *Generic American Community Survey (ACS) data*. Online resource, available at census.gov/programs-surveys/acs/.

U.S. Census Bureau, 2014. *Current Population Survey: March and Annual Social and Economic Supplements*. Washington, DC: U.S. Census Bureau.

U.S. Census Bureau, 2021. *American Community Survey, 2021: American Community Survey 5-Year Estimates*. Washington, DC: U.S. Census Bureau.

US Census, 2021b. *Historical Population Change Data (1910–2020)*. https://www.census.gov/data/tables/time-series/dec/popchange-data-text.html, last accessed 24 May 2023.

USDA, 2022. *US Department of Agriculture*. Online resource available at sc.egov.usda.gov/data/files/MFH/, last accessed 14 April 2023.

USHUD, 2022. *Point-in-Time Count and Housing Inventory Count, Homelessness Data Exchange (HDX)*, Washington, DC: U.S. Department of Housing and Urban Development. Online resource. https://www.hudexchange.info/programs/hdx/pit-hic/, last accessed 12 February 2023.

United Nations General Assembly (UNGA), 1948. *The Universal Declaration of Human Rights, UDHR*. New York: United Nations General Assembly. https://www.un.org/en/about-us/universal-declaration-of-human-rights, last accessed 6 March 2023.

Walmsley, D, and Lewis, G, 1993. *People and Environment: Behavioral Approaches in Human Geography*, vol. 2. Philadelphia, PA: Routledge.

2 Social, Demographic, and Technological Shifts and Their Impacts on Housing

2.1 20TH CENTURY DEMOGRAPHIC SHIFTS

According to the US Census, the population of the United States in 1901 was a little under 78 million people, and throughout the 20th century, the population grew gradually, at an average rate of growth of between 1% and 2% every year (US Census, 2000, 2021a). There were some years when the growth rate declined, for instance during the war years, but in general the US population has continued to grow in overall numbers. In 2020, the population of the United States was recorded as "331,449,281 as of April 1, 2020, an increase of 7.4% since the 2010 Census" (US Census, 2021b). Demographers further explore the composition of the population, in terms of age and gender, consider birth and death rates, and track different factors that can explain population fluctuations. In Chapter 1, Section 1.4 we noted that housing is directly and indirectly affected by demographic shifts. The first factor is how many new people are born – that is related to the fertility rate. The fertility rate in the United States has been declining since 1960. However, immigration has bolstered population growth. Immigration fueled growth has been shaped by American foreign policy and immigration policy, thereby impacting the composition and household structure of foreign-born populations (Pew Research Center, 2015). For example, the change in American immigration policy after the passage of Immigration and Nationality Act of 1965 is credited with the rapid growth of Asian populations who were artificially prevented from entering the United States legally during the previous decade (Lee, 2016). The actual numbers, the population characteristics, and the motivation for immigration influenced regional variations in settlement patterns as well as the type of housing that was needed, see Figure 2.1 (data source, US Census, 2021a).

2.1.1 Settlement Patterns and Segregation

Settlement patterns in the United States in the 20th century co-evolved alongside and because of technological and political shifts. The transformations were non-linear and violent. By 1900, the United States was already making a shift from a largely rural and agrarian society to an early industrial society supported by waves of immigrants. In the late 1800s, most of the immigrants arrived in New York and traveled

DOI: 10.1201/9780429243066-2

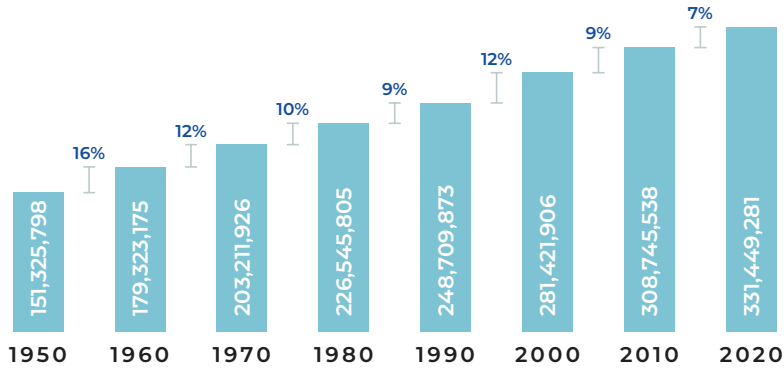


FIGURE 2.1 US population change from 1950 to 2020

to other cities along the eastern seaboard and further inland to Chicago and points west. Figure 2.2 (US Census, n.d.; NHGIS, n.d.) shows on a state-by-state basis, during which year over the past 150 years each state had its highest percentage of the total US population. Growth and expansion were encouraged and endorsed by the government. The government also created laws severely repressing Blacks, putting in place the early frameworks of segregated settlement patterns (Cavanaugh, 2020) Figure 2.3 (US Census, n.d.; NHGIS, n.d.) shows the date in which each state crossed the threshold to majority urban.

2.1.2 The Great Migration

Both in the industrial North and the agricultural South, segregation was a persistent challenge in the late 1800s. Southern Blacks began migrating to northern cities like Detroit and Chicago in search of work in factories, experiencing two major push factors: (i) the lack of viable economic opportunities in farming and (ii) the climate of fear caused by the violent actions of hate groups like the Klan. Black migrants to the North found work, although that work was often dirty and dangerous. Segregation of African Americans was sanctioned by law and many cities passed laws that actively discriminated against Blacks. In the larger cities, new immigrants found themselves clustered into ethnic enclaves because of discriminatory housing policies. Even when they did not have to confront racist laws, they experienced de-facto segregation because of limited access to housing, resulting in over-crowded living conditions in many American cities including New York City and Chicago. In NYC, Blacks settled in Harlem which became a city within a city – the cultural and economic heart of a Black metropolis – and in Chicago around Hyde Park (Wilkerson, 2011).

The population of the United Students has grown steadily, and Figure 2.4 (data source, US Census, 2021a) exemplifies how the Hispanic population has grown since the 1980s. Figure 2.5 (data source, US Census, 2021a) further identifies how different states absorbed this growth, with California, Texas, Florida (states along

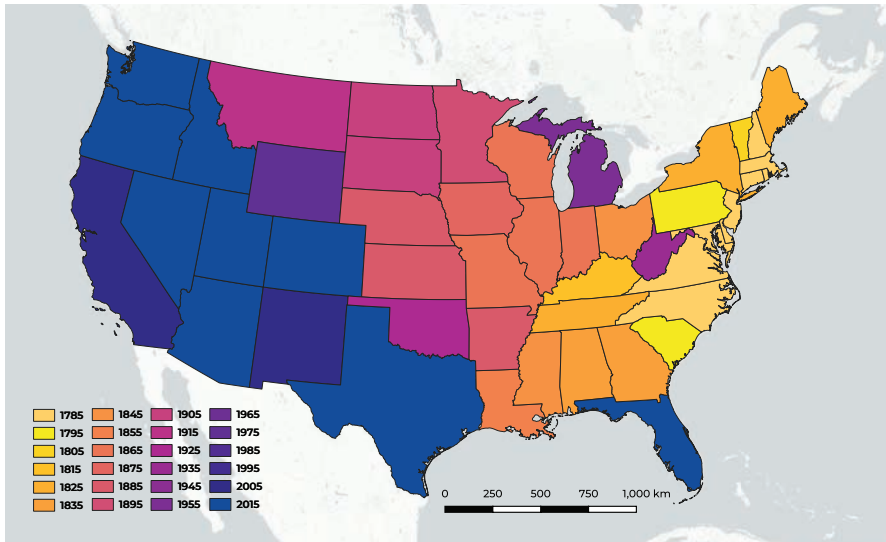


FIGURE 2.2 US states heyday

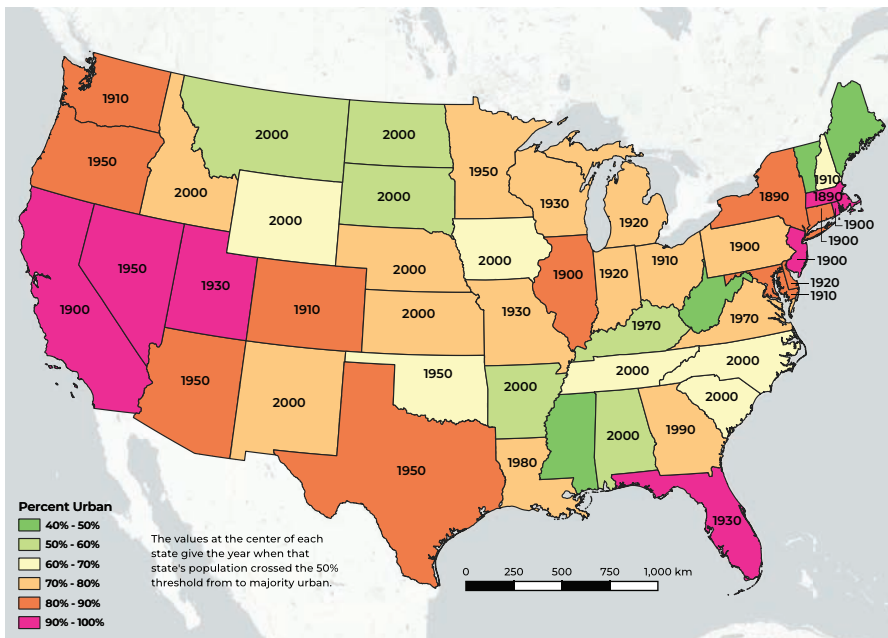


FIGURE 2.3 US percent urban

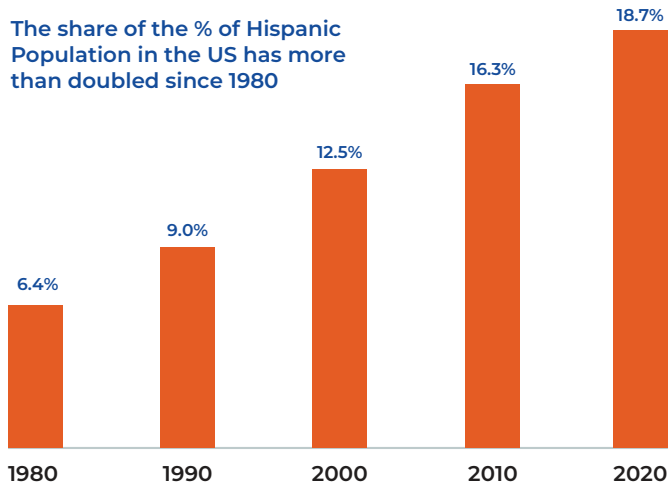


FIGURE 2.4 Percent of Hispanic population 1980–2020

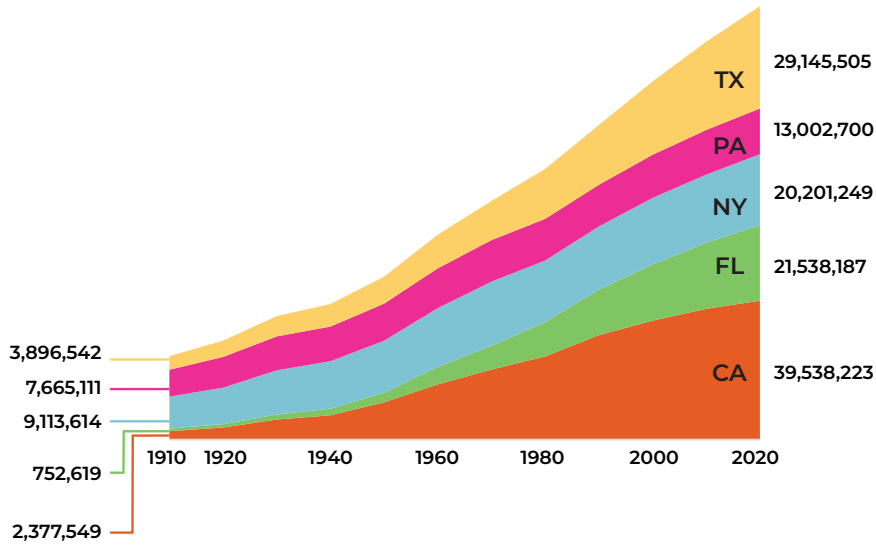


FIGURE 2.5 Population change from 1910 to 2020 of the five most populous states

the country's southern border) and the three most populous states in 2020 with New York and Pennsylvania rounding out the top five in terms of total population. However, it is useful to note that the numbers in New York have been shrinking since 2016 and Pennsylvania's population has stopped growing since 2019. The growth in the Hispanic (Latino) population has influenced the overall population growth. Figure 2.4 shows that the percentage of the Hispanic population as a share of the total population grew from 6.4% in 1980 to 18.7% in 2020. The Hispanic population is

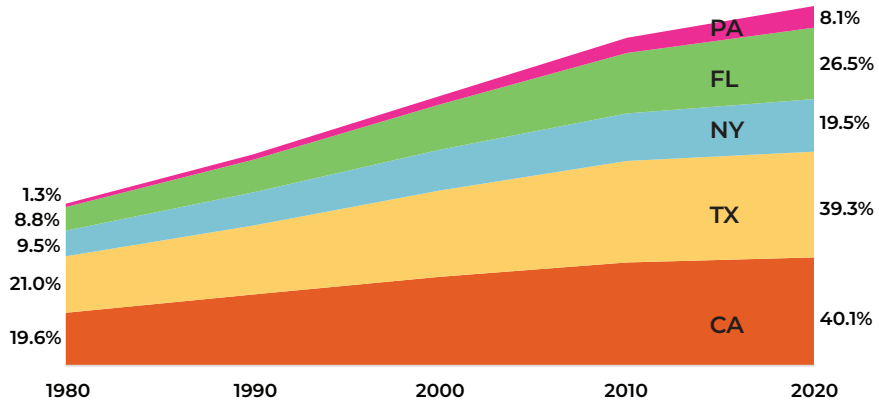


FIGURE 2.6 Percent Hispanic change from 1980 to 2020 of the five most populous states

projected to grow further in the coming decade. One of the challenges in considering the Hispanic population is that the category "Hispanic" is a cultural/ethnic category that can be interpreted differently and cannot be easily combined with existing racial categories such as White/Caucasian and Black/African American. In states such as California with high Hispanic populations, as seen in Figure 2.6 (data source, US Census, 2021a), these distinctions can become blurred. In both Texas and California, Hispanics comprise nearly 40% of the population, and their choices and preferences are likely to directly influence housing and urban development.

The Census has changed the way it asks questions about race over decades. In order to make our visualizations easy to understand, we made the decision to examine data in two categories, White and Non-White. Figure 2.7 (NHGIS) shows the movement of non-White populations in a series of six county-level maps for the years 1900, 1920, 1950, 1970, 2000, and 2020. Non-White populations were always present throughout the United States although these populations were more concentrated in the south and southeast between 1900 and 1920. The post-war years, 1950 and 1970, show more dispersion and a movement westward. The 2020 map offers the clearest evidence that other than counties in rural areas, Non-White populations are found in every county in the United States. Figure 2.8 (data source, US Census, 2021a) quantifies the percentage of Non-White populations which grew from 10.5% of the total population in 1950 to 38.4% in 2020.

2.1.3 Public Housing

Housing those who do not have the private means to develop and house themselves either through home ownership or through the private rental market has been a challenge for government policymakers in the United States throughout the last century. According to Vale and Freemark (2012, p. 382),

> American public housing is a) a 25-year series of efforts to accommodate the upwardly mobile working class between 1935 and 1960, and thereafter the worthy elderly; b) a 30-year consolidation of the poorest into welfare housing between 1960 and the mid 1980s, coupled by efforts to introduce direct private-sector involvement in public

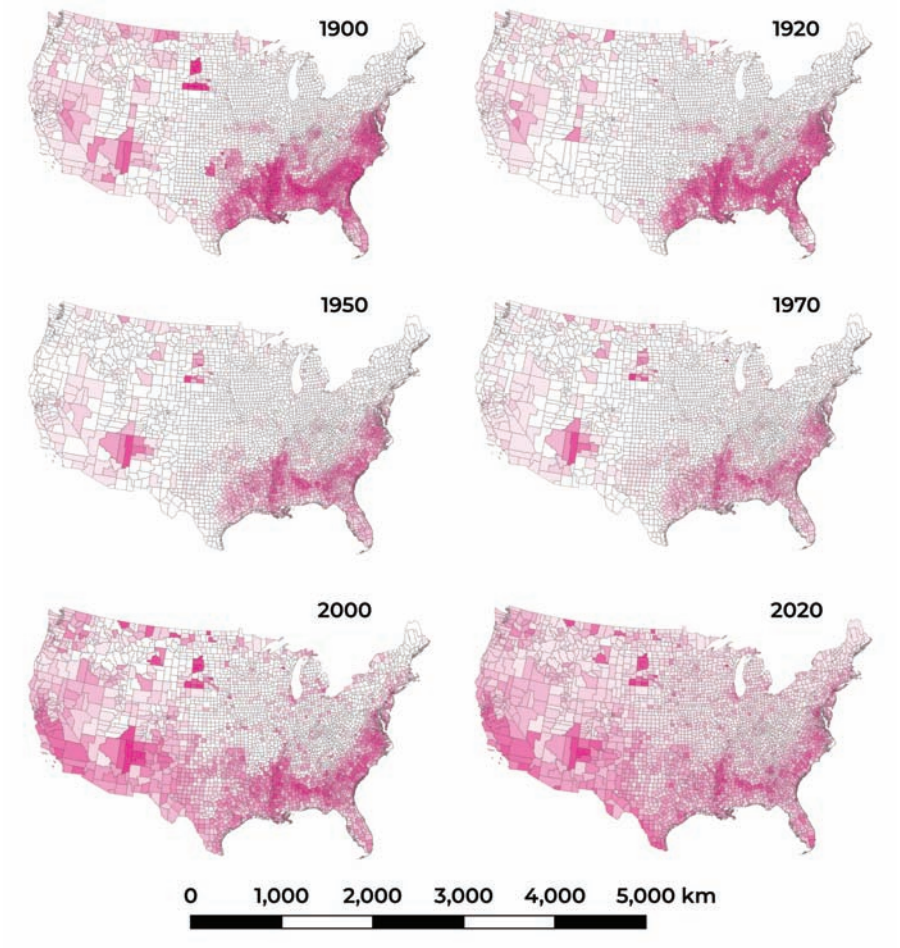


FIGURE 2.7 Settlement patterns by race. Non-White populations across the United States over time

housing and other programs; and c) a series of programs and policies since the mid-1980s to return more of public housing to a less-poor constituency, while furthering growth in other kinds of both deep and shallow subsidy programs through mixed-finance projects and tax-code intervention.

When mention is made of public housing, most Americans immediately think about "the projects", high-rise apartment complexes in big cities like New York and Chicago. The negative connotations about public housing relate to real and stereotypical concerns about crime, safety, and social disorder. The planned demolition of the Pruitt Igoe complex of public housing developments in St. Louis symbolized the governmental and societal disenchantment with public housing. Pruitt Igoe, built in the 1950s, was torn down in the early 1970s. It is important to note that

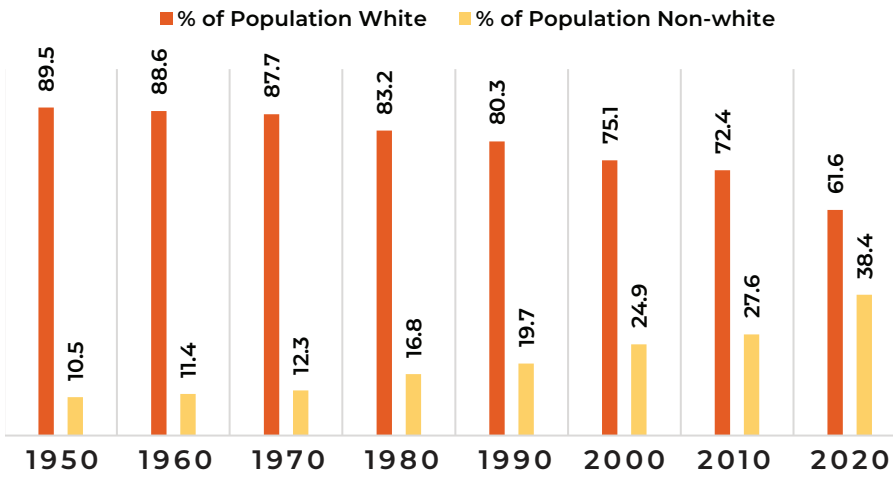


FIGURE 2.8 US population: share of minority populations from 1950 to 2020

the production, supply, and even the location of public housing are closely linked with national values about how to serve disadvantaged populations using public dollars. Thus, public housing developments were austere, imposed social sanctions about "appropriate behavior", concentrated poverty by being situated in low-income neighborhoods, were allowed to deteriorate through a pattern of deferred maintenance, and prevented individual agency by rigid adherence to formal rules (Bloom et al., 2015; Schwartz, 2021).

Outside the United States, Vienna's "Social Housing" is known for its high quality and affordable housing for low-income residents, as well as its innovative urban design and architecture. The city has a long history of investing in social housing, dating back to the early 20th century, and has become a model for other cities around the world. More than 60% of the city's 1.8 million residents live in social housing. Additionally, the city places a strong emphasis on sustainability, with many of the housing developments featuring green spaces and energy-efficient design elements (Holzner and Huberman, 2022).

Even by European standards, Vienna is an outlier in that its municipal government has continually made the preservation of its social housing stock a central aspect of its political identity at the same times as other European cities privatized social housing in the 1980s and 1990s. Buildings built nearly a century ago continue to provide comfortable and well-maintained housing for the city's residents. Vienna's other housing policies, such as rent control,[1] undergird the city's ability to maintain and expand its social housing stock. In sharp contrast to the United States, public attitudes towards subsidized housing are very different (it helps that a majority of Viennese benefit from these subsidies). Housing is seen as a public benefit rather than as alms for the poor with the city spending about 11% of its municipal budget on social housing (Holzner and Huberman, 2022). In consequence, the social housing estates are full of middle-class amenities that are cherished by the tenants and imbue pride and ownership that are very different from what tenants in US projects experience. The individual economic security afforded by social housing

results in active participation on local housing councils that support comprehensive neighborhood development from car-free streets to kindergartens and social clubs, which in turn help to keep crime rates low. While the city of Vienna has a formidable GIS program with an impressive amount of open-source data that advances evidence-based decisions, Vienna's successes are also a result of a commitment to keep housing generally affordable that spans left-right party ideologies. In addition, the high degree of community participation ensures that diverse perspectives influence decision-making in all sectors related to community quality-of-life, i.e., beyond a narrow focus on affordable housing policy.

The "heat map" in Figure 2.9 (USHUD, 2023) depicting concentrations of people in public housing shows robust concentrations in the Bos-Wash corridor, in Pittsburgh, Cincinnati, and Chicago a little further to the west, and in Raleigh, Memphis, and Birmingham in the South. The United States never had a robust supply of public housing units, when compared with the population's needs. Furthermore, there has been a steady decline in the production and availability of public housing units over time resulting in fewer numbers of people in public housing (see Figure 2.10 (Office of Policy Debelopment and Research. *HUD User*, n.d.)).

2.2 TECHNOLOGICAL SHIFTS

Natural and human-induced disasters prompted city planners to alter building form and implement zoning regulations in an effort to uphold societal ideals by zoning for light and air to create better living conditions for the urban poor who lived in close quarters in squalid settlements (tenements). The availability of new materials, new methods of construction, and the use of new technologies shaped housing production.

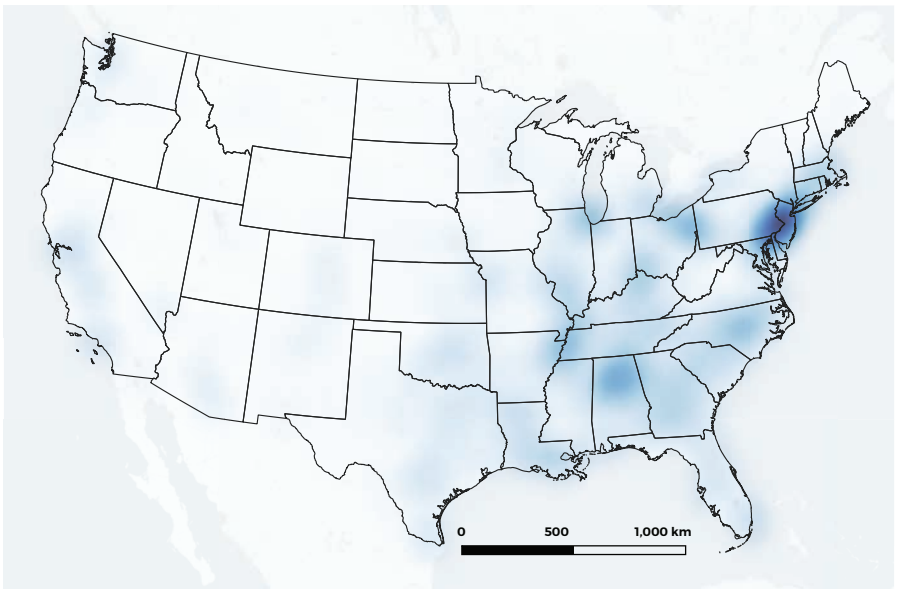


FIGURE 2.9 Heatmap of people living in public housing

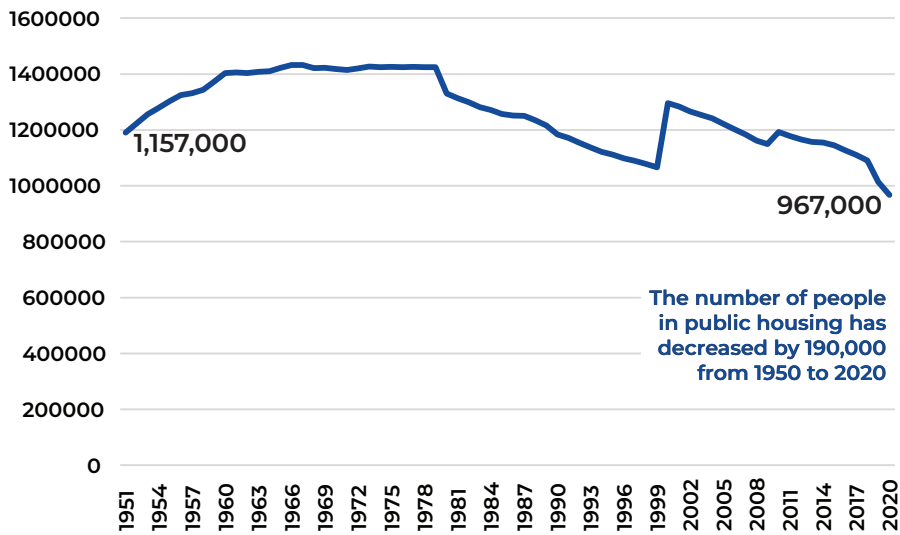


FIGURE 2.10 Number of people in public housing over time

2.2.1 Fire

In October 1871, the Great Chicago fire ripped through downtown Chicago killing 300 people and left one-third of the population homeless. The fire burned for 24 hours and destroyed 17,500 buildings (National Geographic, 2022). At this time, the construction of most buildings in Chicago and other cities such as New York and Boston used wood-frame construction. After the fire, laws were put in place to construct buildings with fireproof materials, but many could not afford the materials and simply did not follow the new laws. In 1874 another fire destroyed 800 buildings in Chicago and finally new buildings began to follow the regulations for construction with fireproof materials. The buildings that were constructed of cast-iron were just as vulnerable as the wood constructed buildings. After this latter fire and the discovery that terracotta could protect cast iron construction in fire, the regulations for fire protection in construction began to be followed. This pushed out residents from downtown Chicago that could not afford to build in these new materials and methods, changing settlement patterns for those with lower economic standing.

Similarly, in New York City tenement housing, housing with three or more dwelling units, was built to house immigrants coming to the United States. Housing advocates became very concerned about the conditions of these types of homes as early as the 1860s. Conditions inside each dwelling unit were such that only one room had direct access to light and air while all other rooms were windowless. The response to these conditions was the Tenement House Act of 1879. Jacob Riis photographed many of the conditions (Riis et al., 1890, see Figure 2.11). The act required windows in all rooms. Adherence to the requirement led to what is known as the dumbbell style tenement building (White and Willensky, 2000). As well as light and air, fire escapes and fireproof balconies and stairwells were required to prevent human loss during a fire. These changes did not address all the problems in tenement housing design. New York State Tenement House Act of 1901 was enacted to further improve housing conditions in tenements.

The 1901 Tenement House act incorporated requirements for light in rear yards as well as minimum separations for courts and requirements of bathroom facilities.

This law also retroactively imposed restrictions on old law tenements for bathroom facilities and increased lighting. The 1901 act also required new and old tenement buildings to install fire escapes. This regulation was strictly enforced, and the visual landscape of NYC began to change. The tenement houses of this period take the shape of letters, typically I, H and C, formed by the required courts between the buildings. This act sparked a spurt of development right before the law was passed because developers rushed to build before the new law went into place in order to skirt the new regulations. It also prompted developers to increase the number of building floors from 4–5 stories to 6 or 7 stories (without elevators).

Fire was always a major challenge. The Sanborn Map company made detailed and large-scale maps of major US cities that provided a great deal of information to assist insurance providers in assessing risk. These maps were created beginning in the late 19th

FIGURE 2.11 Jacob Riis, 'Bandits Roost'

century. Although they were created to assess the risk of fire for insurance purposes, over time their significance extended beyond this use. They became a resource for urban planning and development because they provided, as seen in Figure 2.12 (Sanborn Fire Insurance Map, 1898), comprehensive information about buildings, structures, streets, and infrastructure. The maps depicted the layout of cities and towns in great detail. Data included building materials, property widths, and the location of fire hydrants and were updated on a regular basis, generally every 2–5 years. These maps were meant to provide accurate and up-to-date information; therefore, urban planners were able to use them to gain insight into the past and analyze urban growth patterns.

If the Sanborn maps were accidentally deployed to serve planning purposes, the Public Land Survey System (PLS) was established in the United States with the explicit purpose of managing land with an intent to promote orderly growth. The PLS was used to

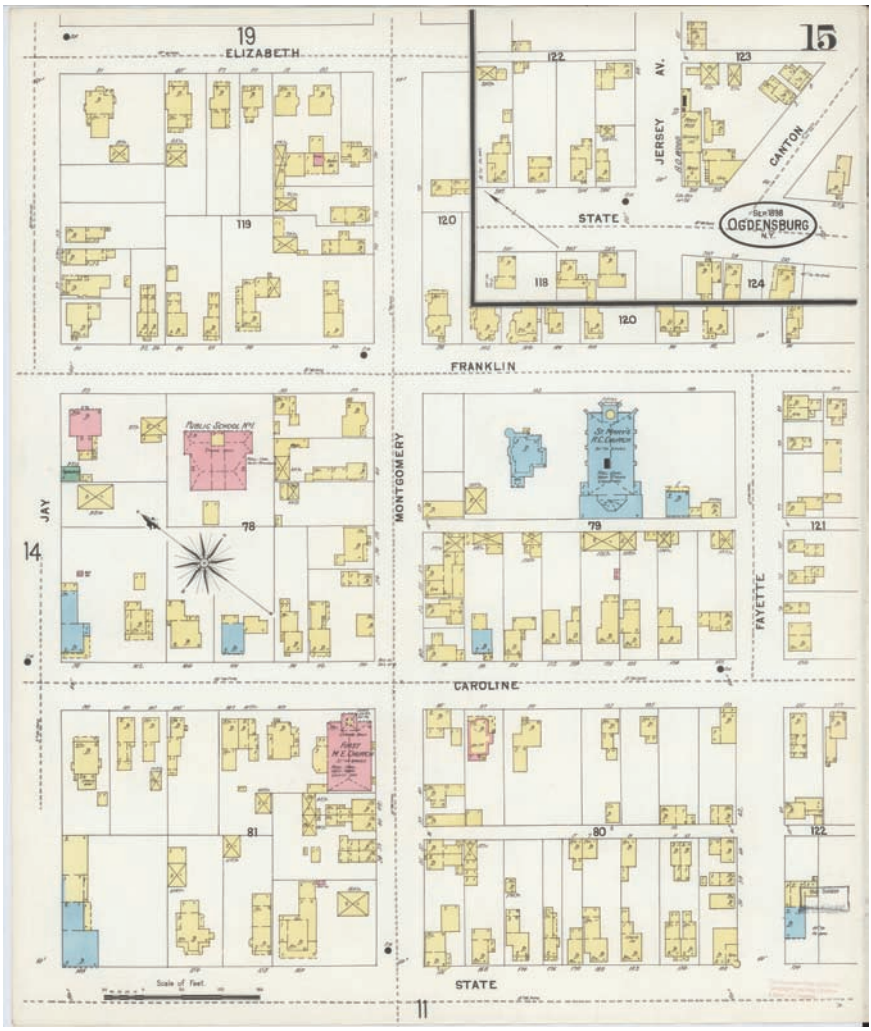


FIGURE 2.12 Example of a Sanborn fire map

survey and divide land in the western territories (more detail about the PLS can be found in Section 2.3). Using cadastral maps, detailed representations with land ownership, land use, and property boundary data were created. The maps included surrounding features such as roads, water bodies, and neighboring properties. Cadastral maps illustrate the spatial arrangement of land ownership, which had a significant impact on urban planning, providing spatial information that helps guide and inform planning decisions. The maps offer urban planners an understanding of existing land use patterns, identifying available land for development, and assessing the potential for urban expansion. By analyzing cadastral maps, planners can determine the suitability of different areas for specific land uses, such as residential, commercial, or industrial zones, see Figure 2.13. These maps also aid in identifying infrastructure needs, including road networks, utilities, and public amenities, by highlighting the spatial relationships between parcels and infrastructure.

2.2.2 Elevators

As new buildings rose in the late 1800s in cities like Chicago and New York, their heights were limited to how many stories a person could reasonably climb, typically around six-stories. In 1857, the Otis Elevator Company began manufacturing passenger elevators for tall buildings in New York City. These elevators first found a place in commercial buildings. Commercial buildings began to rise taller and taller with the elevator, and eventually became an issue because of the shadows they created below/around them. In 1916, the NYC Zoning Resolution addressed these issues of bulk for growing skyscrapers to mandate for light to penetrate the streets below.

At the time of the 1916 zoning resolution, wealthy New Yorkers were still living in townhouses consisting of only a few stories and adjusting to the idea of apartment

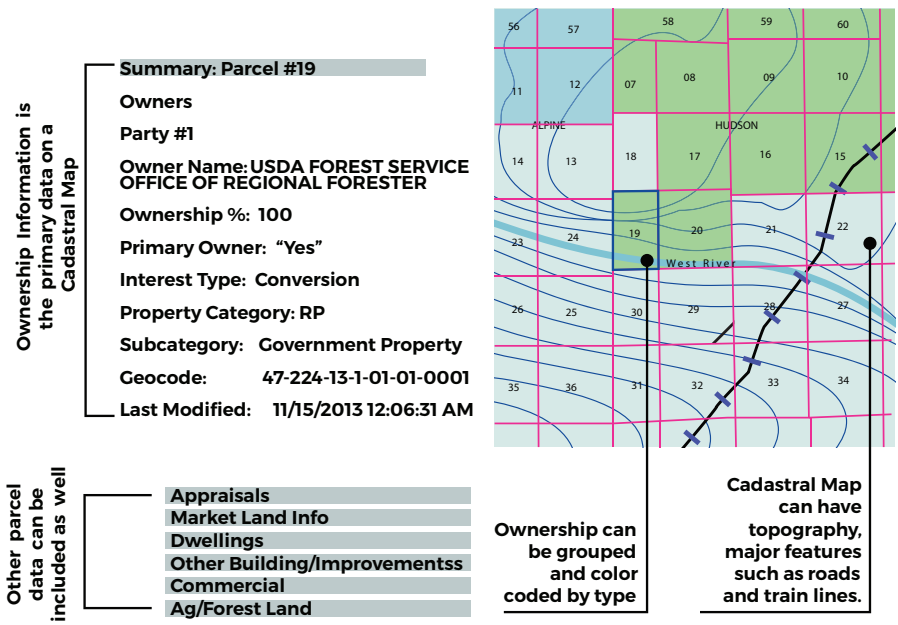


FIGURE 2.13 Example of a cadastral map

living, but by the 1920s the idea of living on a higher floor began to emerge as a status symbol and many high-end apartment buildings were built from then onward (see Figure 2.14 (data source, MapPLUTO, n.d.) and Figure 2.15 (data source, NYC Open Data Portal, 2022).

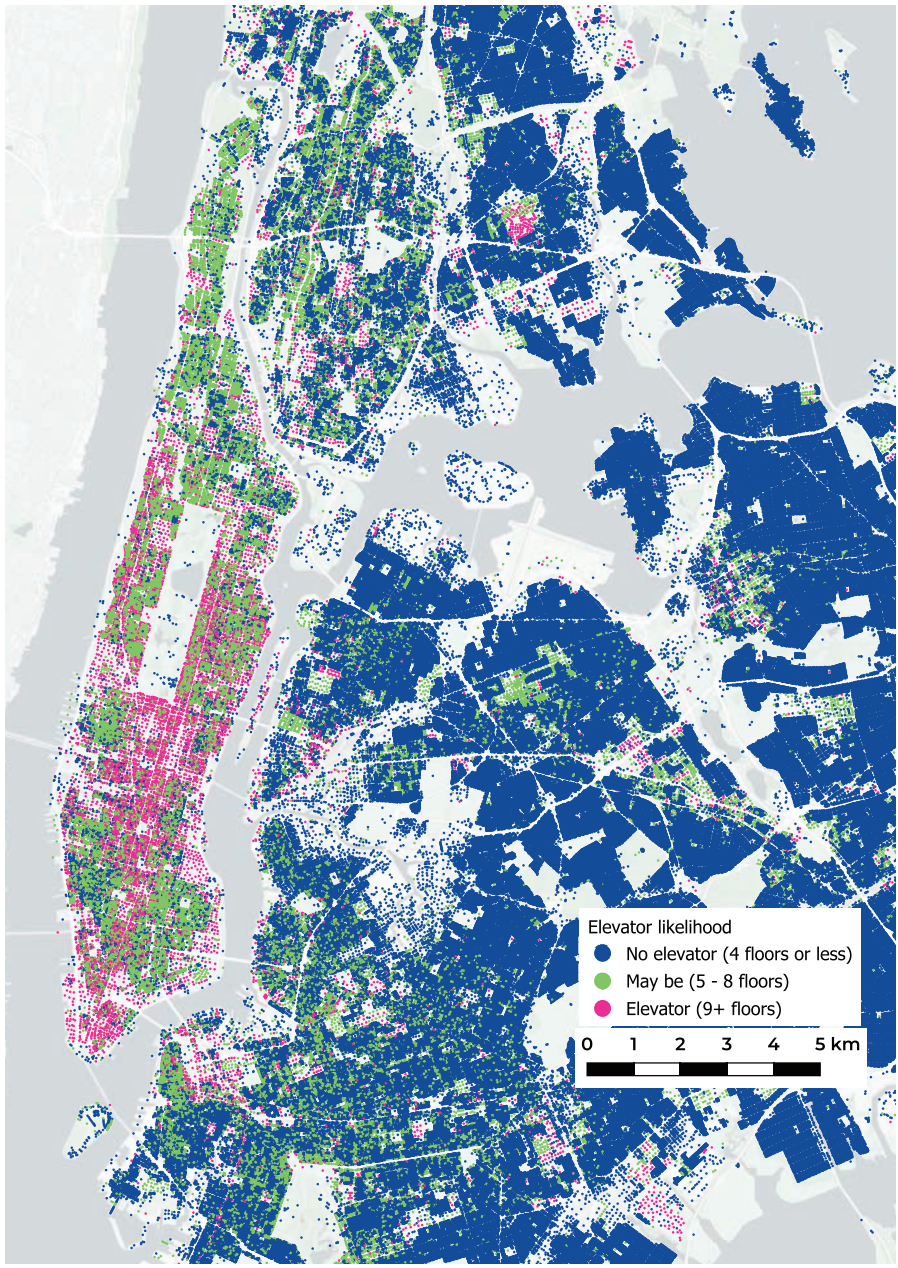


FIGURE 2.14 Vertical exploration: mapping Manhattan's elevator distribution

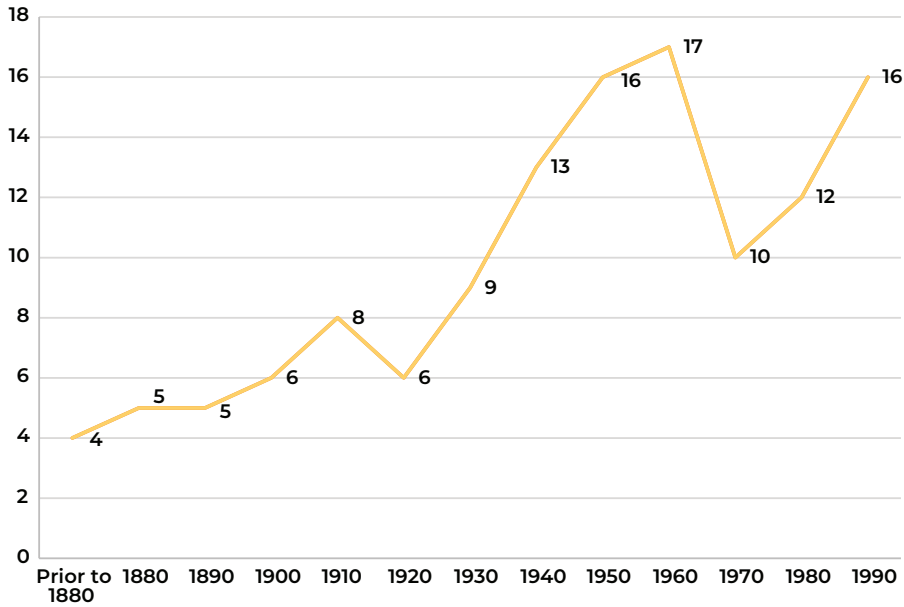


FIGURE 2.15 Decadal analysis of Manhattan's average building height

It wasn't until the late 1940s during urban renewal that middle- and low-income housing began to take advantage of elevator buildings. The forms of the low-income housing projects that were built were also a product of the zoning resolution that allowed buildings to build vertically as long as open space on a lot was maintained. These "towers in the park" were developed not only in NYC, but in almost all US cities during this time period.

2.2.3 Air Conditioning

Air conditioning also made the rise of the skyscraper possible. Once a building reaches greater heights, operable windows are not reasonable because of high winds at those elevations. With the implementation of air conditioning in tall commercial buildings, windows were no longer needed for air, and could always remain fixed in place. Air conditioning and elevators allowed for skyscrapers to rise as tall as the structural system would allow. The 36-story Philadelphia Saving Fund Society (PSFS) building, built in 1932 in Philadelphia, PA was the first international style skyscraper in the United States that used air conditioning for ventilation and comfort for the commercial tenants in lieu of operable windows (see Figure 2.16 (en.wikipedia, 2023)).

Air conditioning was introduced to Americans in commercial settings in the early 1900s. The company Carrier, a maker of fans at the time, developed air conditioning to lower humidity in printing factories during hot summer months in New York. There was great success, and the technology quickly became a standard in factories of that time. In the South, textile mills and tobacco processing plants also employed the use of air conditioning, not so much for the workers, who did benefit from its use, but for the manufacturing of the product. It wasn't until the 1950s that air conditioning

FIGURE 2.16 Philadelphia Saving Fund Society (PSFS) building on Market Street

became affordable enough to be marketed to the general population. Residential air conditioning had a great impact in hot areas of the South and Southwest United States (see the discussion about the growth of Phoenix in Section 1.4.3).

In addition to the growth of industry, people were able to live in these areas because of the increased comfort that came with air conditioning. As of 2015, all new housing in the South has central air conditioning, emphasizing the importance of conditioned air for comfort in this region. Air conditioning is now a standard in most new homes, but the flipside of that indoor comfort means that these regions

now spend as much energy on cooling as more northern climes spend on heating during the winter, thereby contributing to global warming (see Figure 2.17 (USGCRP, n.d.)). New technologies are being developed to make air conditioning systems more

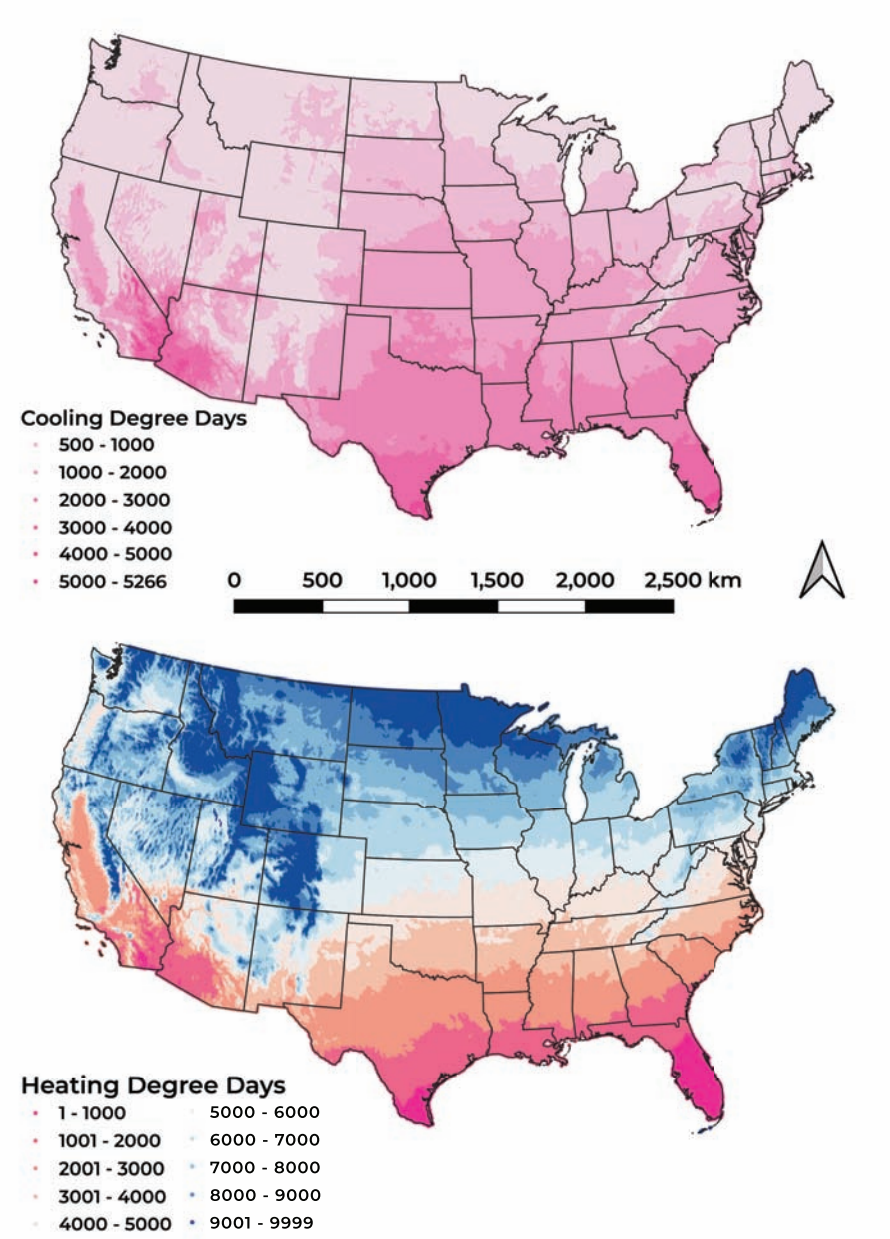


FIGURE 2.17 Cooling and heating degree days

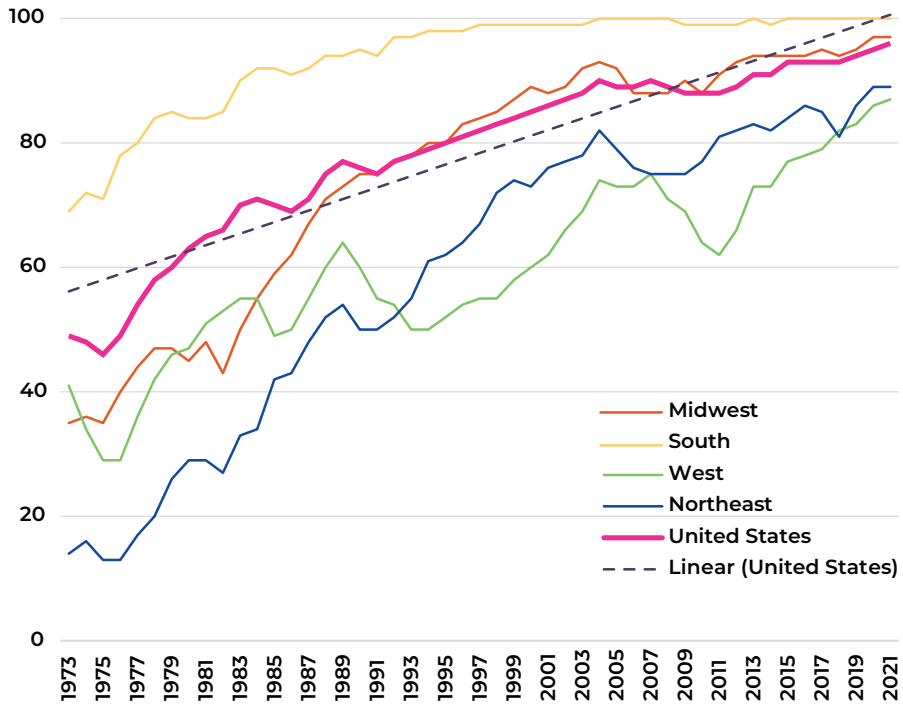


FIGURE 2.18 Cooling the nation: Comparative regional analysis of air conditioning adoption in new single-family homes from 1973 to 2021

efficient overall. Over time the use of air conditioning has increased and now there is a strong push for architects and designers to design buildings for thermal comfort using passive methods to reduce cooling or heating loads on a building (see Figure 2.18 (data source, US Census Construction, 2023)).

2.2.4 Transportation

The early stages of the American industrial revolution created innovations in transportation technologies, specifically a shift away from water-based transportation from the East Coast through the Great Lakes towards the development of rail-based transportation. Regionally, the expansion of the railroads opened up the western United States creating opportunities for settlements to emerge along these newly established train routes.

Subsequently, the development of the automobile to support private transportation changed the form of our cities. The "walking city" of the late 1800s gradually gave way to the "streetcar city" of the early 1900s (Schiller and Kenworthy, 2017). By the 1920s, American cities began to expand to accommodate the private automobile, which could move people of affluent means away from the congested and unsanitary city to the bucolic countryside. In New York, master planner Robert Moses created scenic

"parkways" to create a pleasurable experience for those who traversed in automobiles, creating opportunities for the journey to be as pleasurable as the destination (Caro, 1975).

This system of parkways played a significant role in shaping The Bronx, initially because most of the parkways ran in a north-south direction from the wealthy suburbs in the north to Manhattan in the south (see Figure 2.19, Nelson, 2023). In the undulating geographic terrain of The Bronx, the roads were like rivers that run along

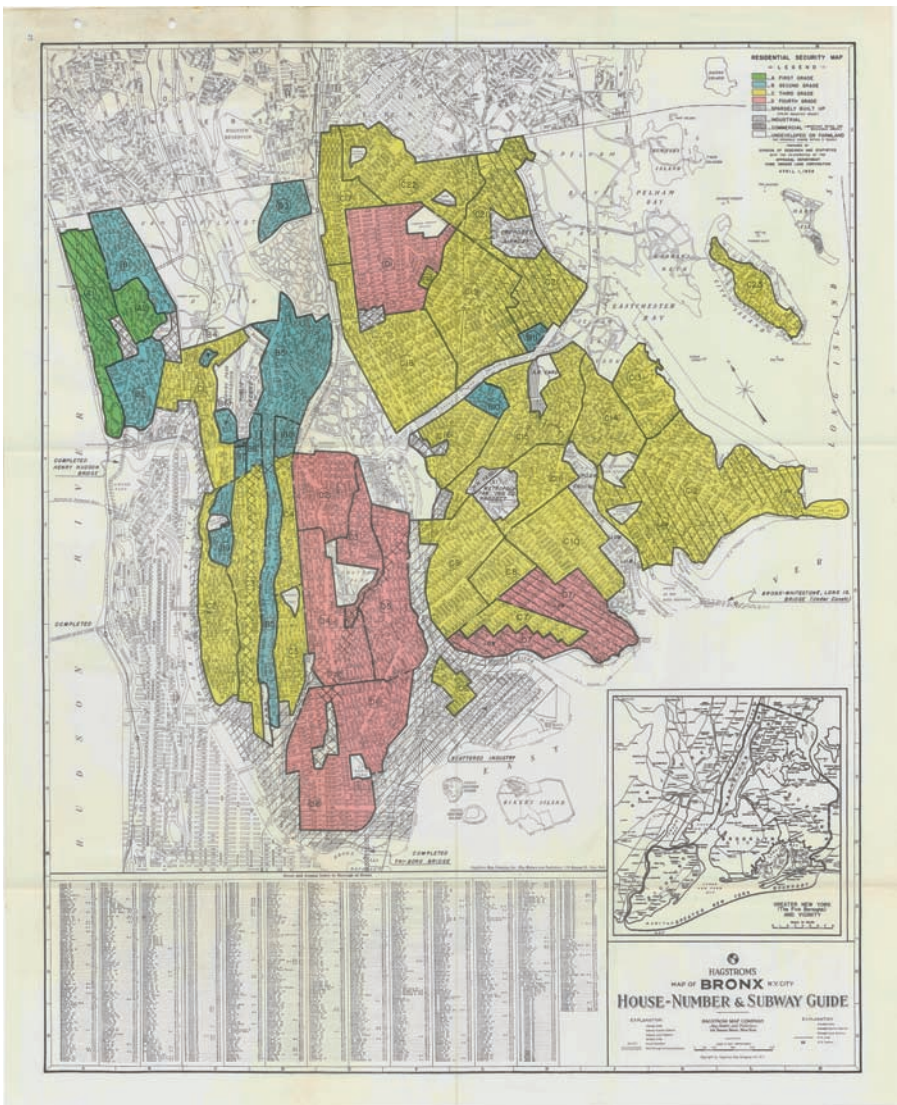


FIGURE 2.19 Bronx HOLC map

the valleys. Likewise, the commuter rail lines were designed to move commuters from Westchester and south-eastern Connecticut directly into Manhattan, then considered the nerve center of the metropolis. These rail connections largely bypassed The Bronx, just as the parkways did.

In addition to the rail and road transportation developments, another 20th century federal government supported intervention was also influential in creating and establishing patterns of neighborhood settlement and displacement. A New Deal program called the Home Owner's Loan Corporation (HOLC) attempted to assess and ameliorate the problems faced by homeowners in the wave of the Great Depression. Real estate professionals created "residential security" maps to classify neighborhoods where examiners systematically graded neighborhoods based on criteria related to the age and condition of housing, transportation access, closeness to amenities such as parks or disamenities like polluting industries, the economic class and employment status of residents, and their ethnic and racial composition. Neighborhoods were color-coded on maps: green for the "best", blue for "still desirable", yellow for "definitely declining", and red for "hazardous". Figure 2.19 (Nelson, 2023) is an example of a HOLC map from that era.

In the post-war era, freeway placements and expansions in urban areas typically occurred where land prices were depressed, which frequently corresponded with the residential neighborhoods of low-income and minority households.[2] Such neighborhoods generally had low levels of political power resulting from institutional discrimination over time. In some respects, freeway locations in cities are the philosophical progeny of "Negro removal" or "urban renewal" programs that were thought to cure "urban blight" by tearing down minorities' homes (Powell and Graham, 2002). More than 200,000 people have lost their homes nationwide to federal road projects over the last three decades, according to a Los Angeles Times analysis of federal transportation data (Dillon and Poston, 2021).

Figure 2.20 (Google Earth, 2022) shows an aerial view of Link Road in the Independence Heights neighborhood of Houston where a mural was painted to highlight the uniqueness of Independence Heights, one of the oldest Black communities in Texas (Hennes, 2020).

2.3 LAND USE PLANNING

Land planning in the United States began as the country became settled and several governmental entities were actively involved in land surveying and classification. The first major survey of public lands was initiated in 1785, see Figure 2.21 (Bechler et al., 1856). The Public Land Survey system, also known as the rectangular survey system, was first proposed to commodify "public lands" to build a new nation. American land surveyors divided the land into sections of one square mile containing 640 acres. Townships consisted of 36 sections on a rectangular grid (Bureau of Land Management, 1991).

While the Bureau of Land Management is responsible for the management of public lands, the surveying procedures adopted over two centuries ago continue to shape how land is measured and mapped even today.

FIGURE 2.20 Houston Black community aerial perspective

The term "land use" sometimes written as "land use" can be interpreted as a simple descriptor that explains how the land around us is being used. However, many professions including surveying, architecture, urban planning, and engineering define land use through the lens of commodifying and classifying land in order to shape development and growth. The main considerations in discussing land use patterns are the concept of land value, and inherent in the assessment of land use is the belief that land should be used to its highest and best potential.

The American Planning Association describes the national land use classification schema that is used in the United States. Land Based Classification Standards consider different variables that describe a land parcel – including observable activity (e.g., farming or manufacturing), economic function (e.g., agricultural, commercial, or industrial), structure (e.g., single-family home or office building), site (physical characteristics that can help to assess whether the land has development potential or not), and ownership (identifying who has the rights to develop the land). The LBCS also includes a detailed color-based classification that is deployed across all land use maps although local variations may exist. In general, residential activities are coded yellow, commercial activities are coded red, institutional activities are coded blue, agricultural activities are coded green, and unclassified land is coded white.

Contemporary land use maps are created by taking data that describes the use of a parcel or piece of land. The use is classified into categories. The scale and type of land being examined determine the categories that will be shown on a land use map. A regional land use map may show built-up urban land use and agricultural or forest land. Land use maps that are at a city level can show open space or parks

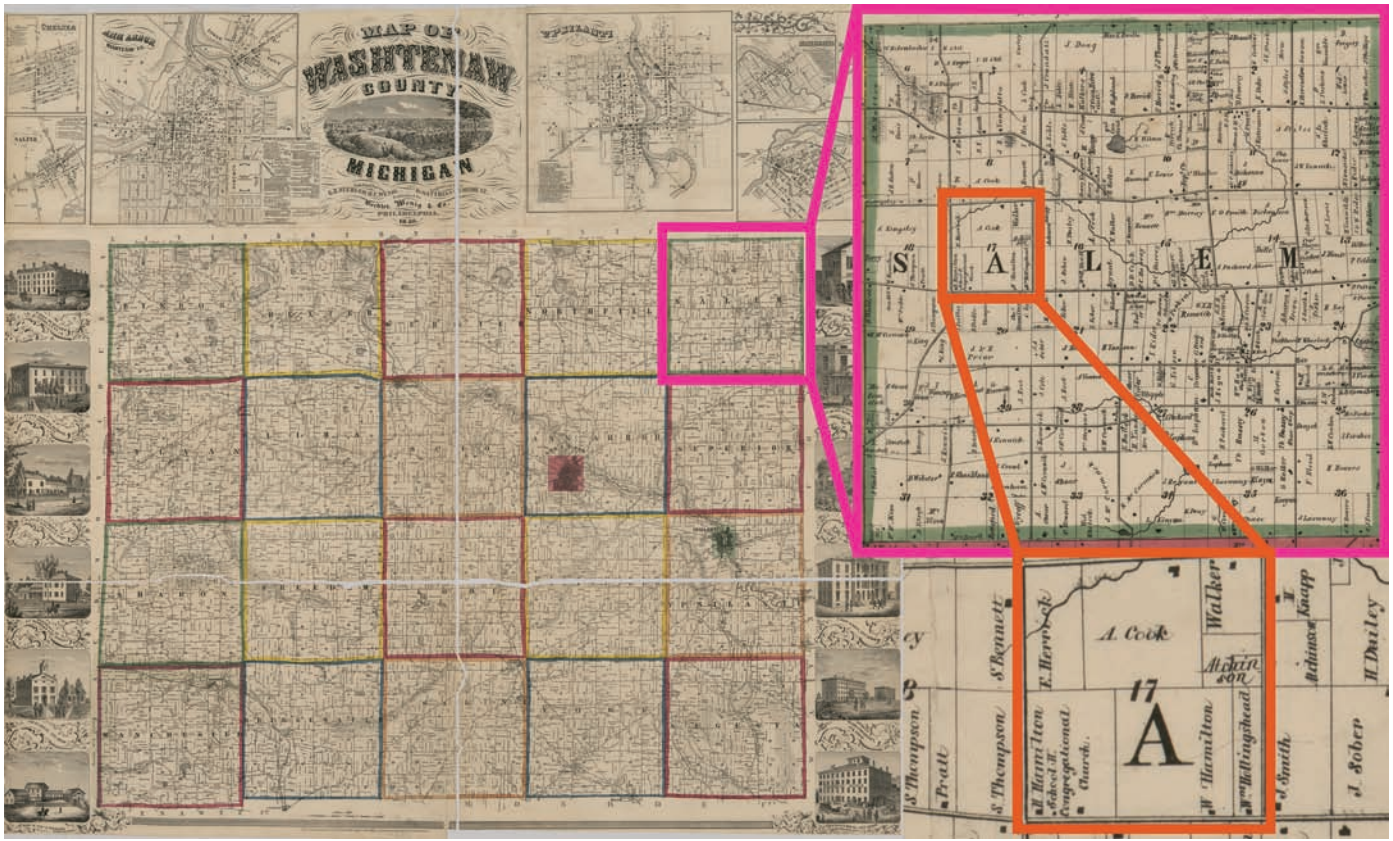


FIGURE 2.21 Public land survey system: historical map of 1856 Washtenaw County, Michigan

FIGURE 2.22 NYC ZoLa land use map

and recreation areas, residential areas, commercial areas, and manufacturing areas. Maps that are at a neighborhood or block level will give further details into the land use, for example, showing detailed information about residential land use, such as multi-family use vs. single-family housing (see Figure 2.22 (NYC Planning, 2023)).

Such land use maps help us to observe patterns like higher concentrations of multi-family housing near transit, or manufacturing near a waterway. This type of analysis can help housing professionals understand the spatial patterns of housing and the past and potential impacts of the policies created on spatial makeup of a place.

2.3.1 Land Use and Zoning

Land use maps describe the characteristics of the land in its present state, whereas a zoning map codifies present land uses, considering societal needs and aspirations. While an expanded discussion of the history of zoning in the United States and around the world is beyond the scope of this book, zoning, in its simplest form, is the creation of single-purpose districts or "zones" where one particular type of land use/activity can occur (Hirt, 2014). Traditional zoning formalizes present and future land use, regardless of ownership. Zoning considers public health (access to light and air), safety (avoiding overcrowding), pollution (the separation of heavy industrial activities away from residential living areas), as well the need to provision space for desirable uses such as parks and playgrounds. The concept of a rigid separation of uses is a vestige of the City Beautiful movement (Hall, 2014).

In the United States, planning is highly localized (Hoch et al., 2000). Zoning supports planning and is a powerful instrument that transforms a local government's political visions into reality. For example, a local government that wants to increase its property tax revenues may zone a higher proportion of available land for

single-family housing than for multi-family residential housing (rental apartments or condominiums).

The earliest reforms of housing focused on the design of individual multi-family dwelling units, the tenements discussed in Section 2.2.1. The 1901 Tenement Law required an interior courtyard for ventilation and garbage removal, rather than relying on interior air shafts that could not be cleaned. Additional requirements and improvements focused on indoor plumbing and removing waste and connecting tenements to a sanitary sewer system. By the early 1900s, the City Beautiful movement was growing in western societies including America, and well-meaning elites advocated for a benevolent way to manage the housing needs of the masses.

Zoning is a set of regulations and restrictions that municipalities impose onto private properties. These laws began with Los Angeles in 1904 and New York City in 1916, in a continuation of the efforts to improve sanitary conditions described in Chapter 1, Section 1.3.1. At this time, it was a new idea that private owners could have restrictions on what they could build on their land, not only in size but in use. In 1926, a case against zoning was brought to the Supreme Court in the Village of Euclid v. Ambler Realty Company (see Figure 2.23 (Kull, 2023)). This case cemented a local government's right to impose zoning restrictions upon land based on the notion that there was a right to maintaining the character of a neighborhood. After this ruling, there was an increase of zoning regulations implemented in the United States, see Figure 2.24 (data source, APA, 2023), which shows the year of implementation of zoning regulations for the largest city in each state, most of which fall between 1920 and 1930.

New York City passed its first zoning regulation in 1916. This document was among the first of its kind and regulated the height, use, and lot coverage of buildings. They addressed issues such as undesirable shading of neighboring streets as well as the desire from wealthy residents to keep the encroaching manufacturing uses away from Ladies Mile, which at that time was a posh shopping district. The second zoning resolution in NYC was passed in 1961 to include the separation of all buildings into three use zones, commercial, manufacturing, and residential.

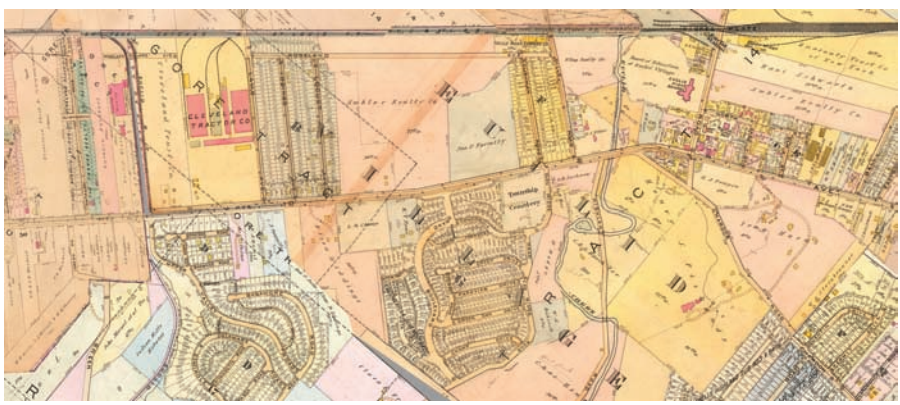


FIGURE 2.23 Euclid vs. Ambler – eminent domain

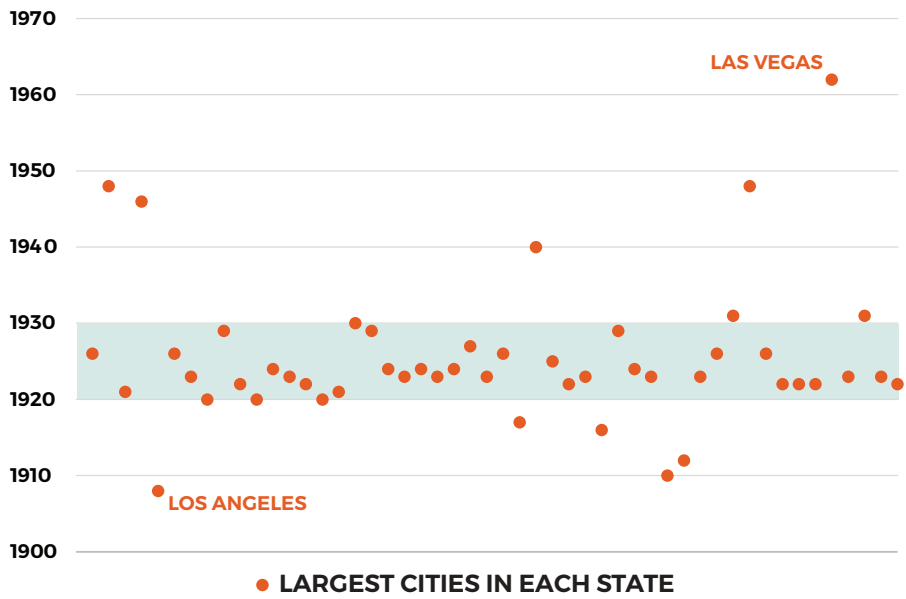


FIGURE 2.24 Urban regulatory evolution: chronology of zoning code enactment in major US cities

2.3.2 Redlining

Redlining can be defined as a discriminatory practice that consists of the systematic denial of services such as mortgages, insurance loans, and other financial services to residents of certain areas, based on their race or ethnicity. The term redlining finds its origins in the HOLC program previously described in Section 2.2.4. These maps were color-coded, each color corresponding to the loan worthiness of the neighborhoods in the United States and the color red was attributed to the neighborhoods that were deemed not worthy of inclusion in the homeownership programs. Most of the neighborhoods marked in red were predominantly inhabited by Black residents. The consequences of this were that Black residents were denied government-insured loans.

The University of Richmond's Mapping Inequality project digitized scans of an example of such redlining maps developed by the Home Owners' Loan Corporation (HOLC), which it is important to note did not engage in redlining (Gomby, 2022). Nowadays, about 11 million Americans live in those formerly red-zoned areas. This population is now majority-minority but not majority-Black, nor do Black residents form a plurality in these areas overall. The Black population share is approximately 28%, ranking third among the racial groups who live in formerly redlined areas, behind White and Hispanic residents. The approximately 3 million Black residents in redlined areas account for just 8% of all Black Americans.

As discussed in Section 1.3, there are great regional differences in the effect of redlining today, which would be better characterized as the persistence of sustained

racism. Only 7% of the population in formerly redlined areas in Denver are Black, while some 85% of the 80,000 redlined residents in Birmingham, AL, are. As many inner cities are gentrifying, Black-majority suburbs are on the rise (Saunders, 2019), which were underrepresented in HOLC maps due to their focus on urban centers.

In the 1990s, another form of redlining became apparent as homeowners who lived and owned properties in certain "redlined" census tracts that were dominated by Blacks or people of color did not receive the same homeowners' insurance products as those who lived in predominantly white census tracts. Although Milwaukee in the 1990s was a spatially segregated city, the segregation can be masked if the data is analyzed at the level of zip codes (a larger area) that can mask intentionally discriminatory practices. Figure 2.25 shows a finer resolution that begins to show the spatial correlation between insurance policies and African American communities. In Milwaukee, the work of nonprofit groups and legal activism fostered a settlement with a large insurance company who systematically discriminated against African Americans (Ramasubramanian, 1995).

Zoning has been criticized by the political right for creating a vast array of rules and regulations that contravene private property rights and by the political left for serving powerful interests by zoning out "undesirable" (less profitable) uses (Angotti and Morse, 2023). More recently, zoning has come under rigorous scrutiny and withering criticism as analysis of historical zoning maps has revealed a more deliberate attempt to create racial segregation than previously thought (Rothstein, 2018).

Larger cities like New York have "rezoned" land, to create new opportunities as traditional land uses have ceased to exist. Formerly industrial areas have been rezoned to allow a range of uses including residential and commercial uses. In New York City, prized industrial waterfront land has been made available to developers who have created market-rate residential living units or other kinds of luxury commercial ventures that cater to tourists and the elite.

New York City has been at the forefront of planning since the area was first settled in 1609 (Sanderson, 2009). As the city and region grew rapidly from the 1600s to the 1900s, the city's leaders encountered challenges related to managing the built environment. The naturally occurring geographies of the settlement patterns meant that while social classes lived next to each other, their lives and lived experiences were anything but similar. In addition, self-selection based on ethnicity, country of origin, and/or mother tongues prompted the emergence of distinct residential enclaves that have persisted over decades. Yet, Little Italy in NYC remains a distinct enclave in name only, a physical vestige and a landmark reminding us about the complexities of neighborhood change and assimilation.

2.4 SUBURBANIZATION AND URBAN SPRAWL

Suburbanization refers to the socio-spatial process whereby cities expand outwards beyond their original central areas via the formation of suburbs. Suburbs are peripheral areas lying beyond a city's boundaries, but which are interconnected to the city economically and socially, for example, via commuting. Suburbanization typically involves building new homes for either sale or rent, combined with residential mobility whereby people leave the city in order to live in non-urban settings.

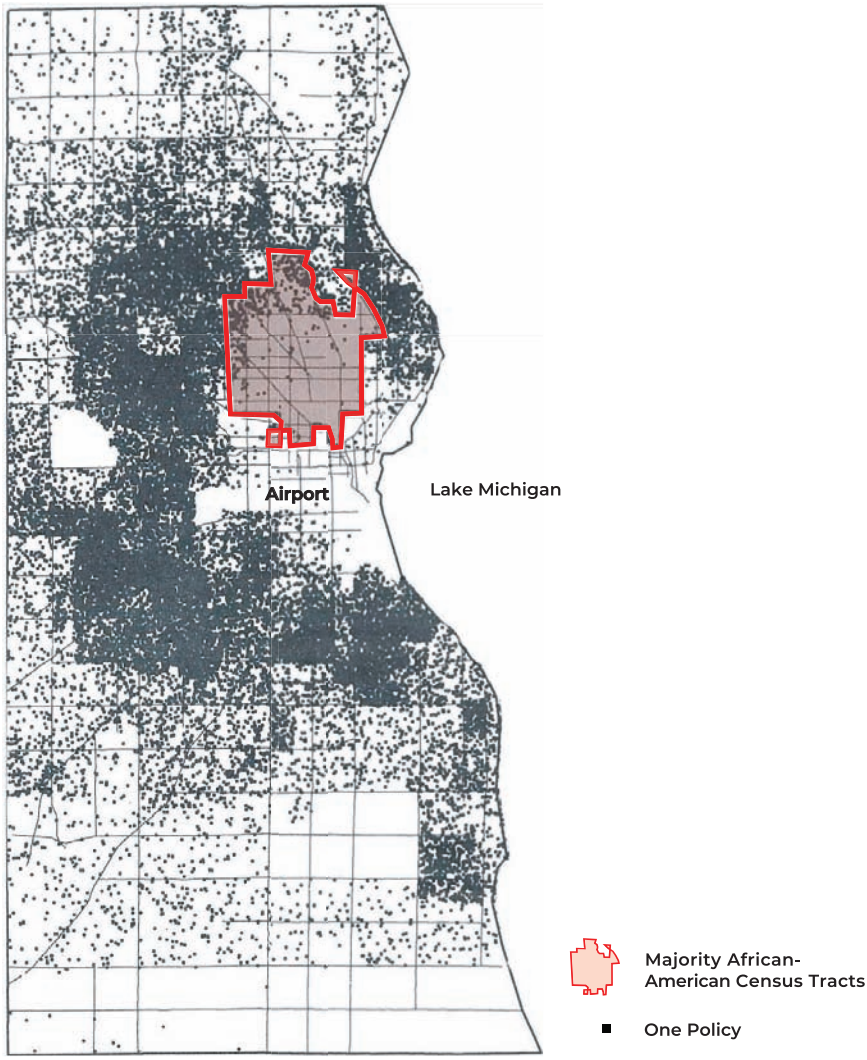


FIGURE 2.25 Unveiling the diversity of Milwaukee's urban landscape: an exploration of one-policy areas and African-American majority census tracts

2.4.1 First and Second Ring of Suburbs

Suburbs used to be defined by their relationship to the urban core area that they surround. This started to change in the late 1990s, when increasing areas in the US South and West that have no more than villages or small agricultural towns at their center began morphing into suburban corridors. Morphologically and socially, these areas act as suburbs, even if they do not have urban centers (usually defined as areas with at least 50,000 residents and more than 1,500 residents per km^2). The extent of

suburbs has been steadily increasing throughout the 20th century and in some parts of the country into the 2020s. Multiple factors have been playing changing roles in this development. As cities grew, greater numbers of "inner city" residents sought to escape the core areas, whose infrastructure was not designed to cope with the densities created by the explosion of urban populations. The first ring of suburbs was facilitated by the advent of streetcars and suburban railway systems in the first half of the 20th century. A second ring of suburbs was accommodated by the general availability of the automobile after the Second World War. Both developments were accompanied by a depopulation of rural areas, while the second ring of suburbs was also fed by (mostly White) residents fleeing deteriorating inner cities.

Starting in the (late) 1990s, as those inner cities began to re-gentrify and the infrastructure in the first ring started to deteriorate, the two populations began to replace each other. These phases played out at different times in different parts of the country until the Covid pandemic of 2020 introduced completely new settlement trends. First ring suburbs are structurally different from second ring suburbs. The former is older and denser and requires an urban core (Puentes and Warren, 2006); the latter is post Second World War and often much younger than that, has typically no rail infrastructure, and is hence car-dependent, which in turn leads to lower population densities and a lack of focus on urban functionality. See Figure 2.26 (US Census, n.d.; NHGIS, n.d.) which maps the suburbanization of Dallas over time.

2.4.2 Edge Cities

As suburban lifestyles became the norm in the United States (European and Asian cities have a different trajectory because of cultural and space constraints), suburbs became less and less dependent on an actual metropolitan center and developed as second ring suburbs both spontaneously as well as in the form of planned edge cities. Edge cities in the narrow sense of the term's inventor Garreau (1991) formed around office parks or shopping malls, which replaced the core that used to be the necessary ingredient for first ring suburbs. Individual, automobile-based transport, and an often politically motivated disdain for cities, resulting in preferential treatment of the usually White population in second ring suburbs, together with the availability of large and relatively cheap tracts of land quite literally paved the road for large swaths of formerly agricultural land to be transformed into low-density residential areas with no discernable boundaries (Firestone, 2001). Driving through those second ring suburbs in the Sun Belt or California, one is hard-pressed to see where one community ends and the next one begins. These areas are the epitome of sprawl. Figure 2.27 (US Census, n.d.; NHGIS, n.d.) highlights the relationships of densities changes from the 1980s.

2.4.3 Urban Sprawl

Urban sprawl is characterized by the lack of coordination among the communities within which it occurs. Associated with this is a lack of concern for the consequences leading to unsustainable living conditions as people age without having access to services for the elderly, and energy costs skyrocket. Another argument is

FIGURE 2.26 Phenomenon of suburbanization in Dallas, Texas

that the affected communities, similar to what we discussed for rural disadvantages in Section 1.3.5 of Chapter 1, cannot afford to provide and maintain the necessary infrastructure, or if they do, engage in a social sorting as only wealthy residents could afford the higher costs associated with lower densities. Research into the effects of urban sprawl has drawn the attention of public health scholars as the number of traffic accidents, obesity, and diabetes rates has been shown to have a positive and significant relationship with urban sprawl (e.g., Frumkin et al., 2004).

The phenomenon has received widespread attention within the planning community (e.g., Oliver, 2002; Squires, 2002). Several measures to define and determine the intensity of the phenomenon have been developed and debated (e.g., Ewing and

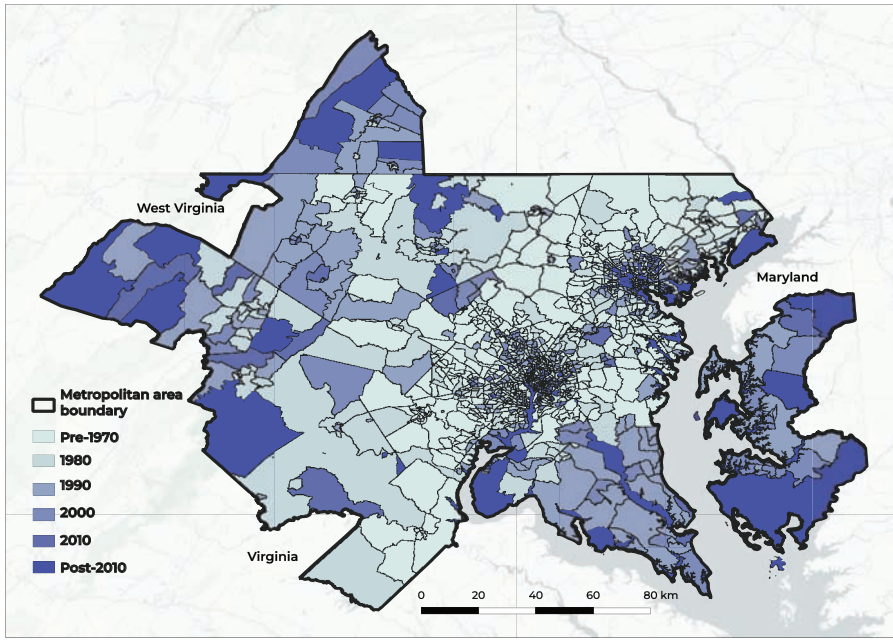


FIGURE 2.27 Metro Washington, DC growth from 1970 to 2020

Hamidi, 2014). In one way or another, all measures center around residential and job density, the distance between sites of human activity, and spatio-temporal measures of accessibility. We will discuss the sources, combination, and compilation of such measures in Chapters 4–6; let it suffice to state here that GIS is essential to the development/validation of these measures as it is the specific spatial configuration of factors that determines the effects of sprawl.

2.5 GENTRIFICATION

In our discussion of suburbanization, we mentioned the reverse movements of people living in inner cities and those who live in the first ring of suburbs. As cities turned economically around and started to become more attractive again, the demand for housing started to rise, placing financial pressure on those who had remained in city centers. The replacement of local populations by deeper pocketed ones is known as gentrification. These kinds of replacement processes have been occurring throughout the history of urban development and may as such be considered "natural". Urban planners are in the inevitable position that the very policies aimed at revitalization then also lead to the displacement of people who cannot afford the rise in rents that follow the improvements – at least in a market-oriented society.

Gentrification is a highly politicized topic and its effects have often been exaggerated. Most neighborhoods in the limelight of political discussions have not actually experienced displacement (Freeman, 2005). Instead, the "gentrifiers" move into

additional units, increasing the population density rather than replacing existing residents. This is not to say that displacement does not occur – but it happens at a much lower rate, and in many places not at all, than the process is maligned for. Part of the misconception is the general rise of unaffordable housing (see Chapter 1), an experience that gentrifying neighborhoods share with everybody else. A comparison of affordability rates in 1970 with those in 2020 shows only five rural counties (out of over 3,000), where housing has become cheaper relative to the median income in the respective county (three of those counties have fewer than 5,000 residents).

We alluded to the fact that residential change is a given; even if functionally, or social status-wise, a neighborhood remains similar to itself, the people living in those neighborhoods tend to change. New York's Little Italy and Milwaukee's Germantown are monikers for bygone eras whose residents now show little resemblance with the neighborhood's namesakes. The role of the planner is then to prevent deterioration (which usually requires collaboration with other city departments), work continuously on improving conditions, and smoothen transitions as the inevitable change is taking place. Neighborhoods find themselves in the crosshairs of multiple processes inside (aging populations) and outside (suburbanization and its reversal), but sometimes, individual events or actors may play an outsized role. Urban universities have acted as such actors of change, where growing student bodies and massive technology investments have been forces of gentrification. In the age of knowledge work, college towns and their equivalent in an urban context have been engines of growth, which if not handled carefully, can indeed result in the displacement of small local businesses and less adaptable residents. As such investments are mostly in non-residential buildings, rental costs (or home ownership) rise disproportionally leading to an additional squeeze in a housing market that is characterized by the phasing out of rent restrictions.

Zoning has been hailed (Schuetz, 2019) and vilified (Angotti and Morse, 2023) as the cause for the limited availability of housing and hence the replacement of long-term residents by those who can afford higher rents. Where zoning limits density (see also Section 3.2.6), it certainly contributes to a housing shortage – but it is hard to argue that this is a cause for gentrification. Where zoning changes allow for residential units in what was formerly non-residential, it will certainly increase housing supply – but not necessarily in the affordable range. By definition, no gentrification could take place here as these areas had no residents before. Where zoning changes from purely residential to mixed use, especially with support of public transit (such as light rail stops), it is likely to increase the attractiveness of a neighborhood, which in turn is likely to raise property prices – this is one of the conundrums that urban planners have to live with. Case studies showing that such investments lead to actual displacement, however, are rare.

Figure 2.28 (US Census, n.d.) shows a correlation between the arrival of new residents in a census tract and reduced affordability for renters. In other words, when neighborhoods are perceived as desirable, either because of their trendiness, accessibility, or affordability, newer affluent renters move in, causing spikes in the rental market. Long-term tenants in these neighborhoods are displaced in favor of those who can pay more.

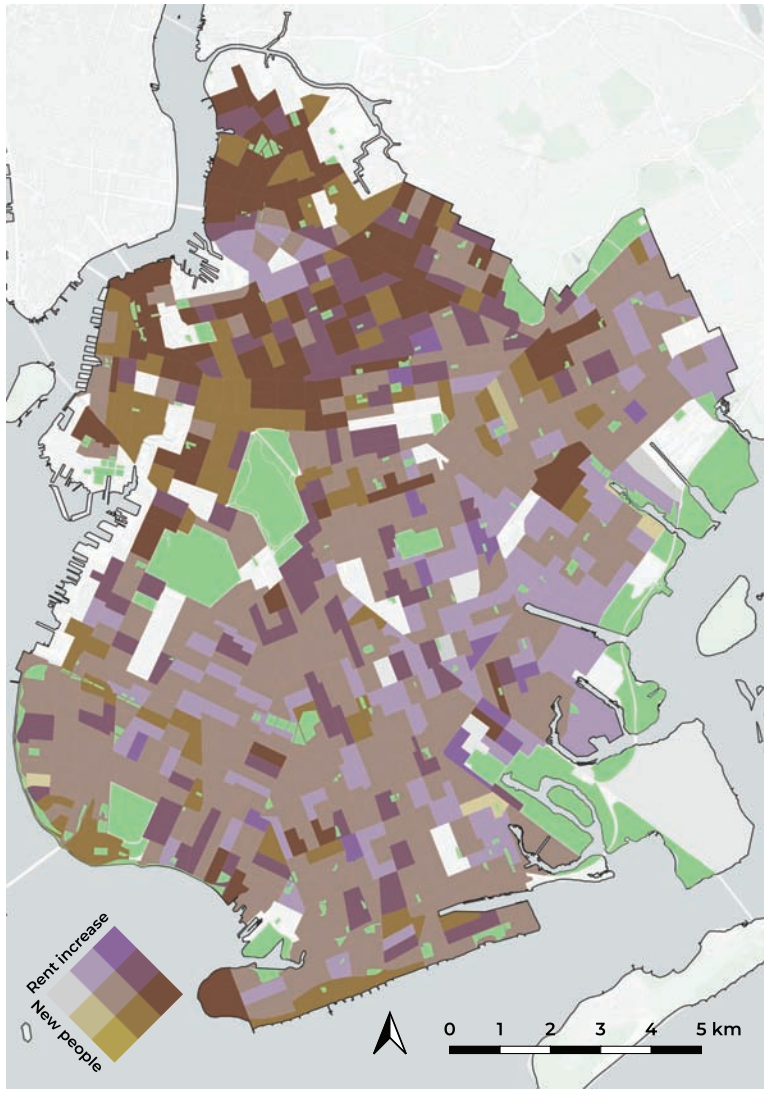


FIGURE 2.28 Dynamic Brooklyn (NY): Mapping rent increases and neighborhood changes revealing the relationship between rent and resident mobility with density reflecting recent census tract inflows

Up-zoning (increasing heights and easing restrictions such as parking minimums) has its advantages; in The Bronx, a planned growth strategy has encouraged infill development along major transit corridors (see Figure 2.29 (MapPLUTO, n.d.; MTA, n.d.). Although the bulk of the new development is in The South Bronx (closer to Manhattan), the map indicates that overall, The Bronx is seeing the benefit of planned rezoning in terms of the increase in new housing supply.

FIGURE 2.29 The new Bronx

2.6 THE LIMITS OF ZONING

This brief historical run through focuses on understanding the demographic and technological shifts that shaped urbanization and suburbanization in late 19th and 20th century America. While not the main focus of this book, this chapter serves to remind GIS specialists about the complex social and political histories associated with zoning, not to mention its racist and exclusionary overtones that have disenfranchised and harmed African American communities and people of color. For GIS specialists, zoning is probably nothing more than a base layer of data that can be used to support complex analyses. While this is true, zoning is also an instrument that imposes a variety of land use controls that can empower or harm the lives of everyday people especially in contested spaces. On either side of the political spectrum, affordable housing activists and commercial housing developers will claim that restrictive zoning delays housing production, increases production costs, thereby

reducing affordability, and creates exclusionary up-market residential enclaves. While it is easy to blame zoning for everything that is wrong with the housing situation, zoning is often the practical resolution of a value conflict – representing a compromise between preservation and development, between low and high density, and between having a single set of uses in a neighborhood vs. having a mixture of sometime incompatible uses in a neighborhood. This list can go on. Zoning cannot be relied upon as the only way to create and support a robust pro-housing agenda. In Chapter 3, we present a range of design and policy innovations that spur the development of just and sustainable housing options.

NOTES

1. "Rent control" has a different connotation in Europe than in the United States. The ceiling is not hard and there are better established negotiation mechanisms, especially for larger multi-family complexes.
2. This was less prevalent in Texas and west of the Rocky Mountains as these states still had plenty of undeveloped land.

REFERENCES

American Planning Association (APA), 1994. *Land Based Classification Standards*, LBCS. https://www.planning.org/lbcs/, last accessed 6 March 2023.

American Planning Association (APA), 2023. *Planning History Timeline*. https://www.planning.org/timeline/, 21 October 2023

Angotti, T, and Morse, S, 2023. *Zones Out! Race*, *Displacement*, *and City Planning in New York City*. New York: New Village Press.

Bechler, Gustavus R., Wenig, E. and Bechler & Wenig. Map of Washtenaw County, Michigan: from actual surveys. Philadelphia: Bechler, Wenig & Co, 1856. Map. Retrieved from the Library of Congress. www.loc.gov/item/2012593013/

Bloom, N, Umbach, F, and Vale, L, 2015. *Public Housing Myths: Perception*, *Reality*, *and Social Policy*. New York: Cornell University Press.

Caro, R, 1975. *The Power Broker: Robert Moses and the Fall of New York*. New York: Vintage.

Cavanaugh, E, 2020. *The Routledge Handbook of the History of Settler Colonialism*. Philadelphia, PA: Routledge.

City of New York, 2022. *NYC Open Data Portal*. https://data.cityofnewyork.us/Housing-Development/Building-Footprints/nqwf-w8eh, 19 March 2023.

Dillon, L, and Poston, B, 2021. "Freeways Force Out Residents in Communities of Color—Again". *Los Angeles Times*, 11 November. https://www.latimes.com/projects/us-freeway-highway-expansion-black-latino-communities/, last accessed 26 February 2023.

En.wikipedia, Absecon 59 at. "Wikimedia Commons." 1 1 2023. https://commons.wikimedia.org/wiki/File:PSFS-MarketSt.JPG, 19 October 2023.

Ewing, R, and Hamidi, S, 2014. *Measuring Urban Sprawl and Validating Sprawl Measures*. Salt Lake City, UT: Metropolitan Research Center. https://gis.cancer.gov/tools/urban-sprawl/sprawl-report-short.pdf, last accessed 2 June 2023.

Firestone, D, 2001. "90's Suburbs of West and South, Denser in One, Sprawling in Other". *NY Times*, 17 April. https://www.nytimes.com/2001/04/17/us/90-s-suburbs-of-west-and-south-denser-in-one-sprawling-in-other.html, last accessed 26 December 2022.

Freeman, L, 2005. "Displacement or Succession? Residential Mobility in Gentrifying Neighborhoods". *Urban Affairs Review*, 40(4): 463–491.

Frumkin, H, Frank, L, and Jackson, R, 2004. *Urban Sprawl and Public Health: Designing and Building for Healthy Communities*. Washington, DC: Island Press.

Garreau, J, 1991. *Edge City: Life on the New Frontier*. New York: Doubleday.

Gillham, O, 2002. *The Limitless City: A Primer on the Urban Sprawl Debate*. Washington, DC: Island Press.

Google Earth. "Google Earth." 14 January 2022. *Earth.google.com.* 29°49'00"N 95°23'30"W. 19 October 2023.

Gomby, G, 2022. "Reassessing HOLC Redlining Maps to Support Claims of Environmental Injustice". *Proceedings of the National Academy of Science*, 119(17). Doi:10.1073/pnas.2200211119.

Hall, P, 2014. *Cities of Tomorrow: An Intellectual History of Urban Planning and Design Since 1880*. West Sussex, UK: Wiley Blackwell.

Hennes, R, 2020. *Black Towns Matter' Mural Painted on Street in Houston's Independence Heights*. Chron. https://www.chron.com/houston/article/Black-Towns-Matter-mural-painted-on-street-in-15351923.php, last accessed 6 March 2023.

Hirt, S, 2014. *Zoned in the USA: The Origins and Implications of American Land-Use Regulation*. New York: Cornell University Press.

Hoch, C, Dalton, L, and So, F, 2000. *The Practice of Local Government Planning*, vol. 3. Washington, DC: International City County Management Association (ICMA) Press.

Holzner, M, and Huberman, M, 2022. "Red Vienna: A Social Housing Experiment." *The Journal of Interdisciplinary History*, 53(1): 49–88. Doi:10.1162/jinh_a_01798

Kull, A. *Property Visual Syllabus*. n.d. http://propertykull.weebly.com/village-of-euclid-v-ambler-realty-co.html, 21 October 2023

Lee, E, 2016. *The Making of Asian America: A History*. New York: Simon & Schuster.

MapPLUTO, n.d. *New York City Department of City Planning parcel database*. Online resource available at https://www.nyc.gov/site/planning/data-maps/open-data/dwn-pluto-mappluto

MTA, n.d. *New York Metropolitan Transit Authority*. Online resource available at https://open-data.cityofnewyork.us/data/

National Geographic, 2022. *The Chicago Fire of 1871 and the 'Great Rebuilding'*. https://education.nationalgeographic.org/resource/chicago-fire-1871-and-great-rebuilding/, last accessed 14 April 2023.

Office of Policy Development and Research. HUD User: Assisted Housing: National and Local. n.d. <https://www.huduser.gov/portal/datasets/assthsg.html>, last accessed 19 October 2023.

Perry, A, and Harshbarger, D, 2019. *America's Formerly Redlined Neighborhoods Have Changed, and so Must Solutions to Rectify Them*. Washington, DC: Brookings. https://www.brookings.edu/research/americas-formerly-redlines-areas-changed-so-must-solutions/, last accessed 29 May 2023

Pew Research Center, 2015. *Modern Immigration Wave Brings 59 Million to US, Driving Population Growth and Change Through 2065*. https://www.pewresearch.org/wp-content/uploads/sites/5/2015/09/2015-09-28_modern-immigration-wave_REPORT.pdf, accessed 1 June 2023.

Planning, NYC Department of City. *ZOLA New York City's Zoning and Land Use Map*. N.d.. zola.planning.nyc.gov, 13 July 2023.

Powell, J, and Graham, K, 2002. "Urban Fragmentation as a Barrier to Equal Opportunity". In Piche, D, Taylor, W, and Reed, R (Eds.), *Rights at Risk: Equality in an Age of Terrorism*. Report of the Citizens Commission on Civil Rights. Washington, DC: Citizens Commission on Civil Rights.

Ramasubramanian, L, 1995: "Building Communities: GIS and Participatory Decision Making". *Journal of Urban Technology*, 3(4): 67–79.

Riis, J, Bacher, O, Cox, K, Drake, W, Fitler, W, and Pérard, V, 1890. "Riis, Jacob A, photographer. *How the Other Half Lives: Studies Among the tenements of New York*. New York: Charles Scribner's Sons. https://lccn.loc.gov/04011775, last accessed 31 May 2023.

Robert K. Nelson, LaDale W., Richard M., Nathan C., et al., "Mapping Inequality". In. Robert K. Nelson and Edward L. Ayers (Eds.), *American Panorama*. https://dsl.richmond.edu/panorama/redlining/#loc=12/40.831/-73.917&city=bronx-ny&area=B10&adview=ful…], last accessed 21 October 2023.

Rothstein, R, 2018. *The Color of Law: A Forgotten History of How Our Government Segregated America*. New York: Norton Publishing.

Sanborn Fire Insurance Map from Ogdensburg, St. Lawrence County, New York. Sanborn Map Company, Sep, 1898. Map. Retrieved from the Library of Congress, www.loc.gov/item/sanborn06140_003/

Sanderson, E, 2009. *Manahatta: A Natural History of New York City*. New York: Harry N. Abrams, Inc.

Saunders, P, 2019. "Is Chicago's Legacy of Segregation Causing a Reverse Great Migration?" *Chicago Reader*, Jan 24. https://chicagoreader.com/news-politics/is-chicagos-legacy-of-segregation-causing-a-reverse-great-migration/, last accessed 26 December 2022.

Schiller, P L, and Kenworthy, J, 2017. *An Introduction to Sustainable Transportation: Policy, Planning, and Implementation*, 2nd edition. London: Routledge

Schuetz, J, 2022. *Fixer-Upper: How to Repair America's Broken Housing Systems*. Washington, DC: Brookings Institution Press.

Schwartz, A, 2021. *Housing Policy in the United States*, 4th edition. New Philadelphia, PA: Routledge

Squires, G D (Ed.), 2002. *Urban Sprawl: Causes, Consequences and Policy Responses*. Washington, DC: The Urban Institute Press

Talen, E, 2005. *New Urbanism and American Planning*: *The Conflict of Cultures*. Philadelphia, PA: Routledge.

US Census, n.d. Generic American Community sSurvey (ACS) data published by the US Census Bureau. Online resource available at census.gov/programs-surveys/acs/.

U.S. Census. *U.S. Census Bureau Construction Spending - Characteristics*. n.d. Online source https://www.census.gov/construction/chars/current.html, 28 July 2023.

US Census, 2000. *Historical National Population Estimates*, July 1, 1900, to July 1, 1999. Sourced from Population Estimates Program, Population Division, US Census Bureau. resource available at https://www2.census.gov/programs-surveys/popest/tables/1900-1980/national/totals/popclockest.txt, last accessed 6 March 2023.

US Census, 2021a. *Historical Population Change Data (1910–2020)*. https://www.census.gov/data/tables/time-series/dec/popchange-data-text.html, last accessed 24 May2023.

US Census, 2021b. *United States Census Bureau today Delivers State Population tools for Congressional Apportionment*. https://www.census.gov/library/stories/2021/04/2020-census-data-release.html#:~:text=The%202020%20Census%20shows%20that,7.4%25%20since%20the%202010%20Census, last accessed 31 May 2023.

USGCRP, n.d. *US Global Change Research Program at North Carolina State University*. Online resource available at https://scenarios.globalchange.gov/loca-viewer/

USHUD, 2023. *US Department of Housing and Urban Development. Housing Developments*. Online resource available at https://hub.arcgis.com/datasets/fedmaps::public-housing-building

Vale, L, and Freemark, Y, 2019. "The Privatization of American Public Housing: Leaving the Poorest of the Poor Behind." Anacker, K, Nguyen, M, and Varady, D (Eds.), *The Routledge Handbook of Housing Policy and Planning*, pp. 189–206. Abingdon, UK: Routledge. doi:10.4324/9781315642338-15.

White, N, and Willensky, E, 2000. *AIA Guide to New York City*, 4th edition. New York: Crown.

Wilkerson, I, 2011. *The Warmth of Other Suns: The Epic Story of America's Great Migration*. New York: Vintage.

3 Contemporary Design Adaptations and Policy Interventions

3.1 THE CONTEMPORARY HOUSING LANDSCAPE

In Chapter 1, we framed the housing challenges in the United States in three ways – considering the housing supply challenge, the housing affordability challenge, and the lack of housing for the most vulnerable, the homelessness challenge. In this chapter, we expand and complicate these ideas further by discussing the contemporary design adaptations and policy interventions that have emerged recently, that is, in the last three decades. Each adaptation and intervention attempts to address one or more of these challenges, and in doing so, has created new problems for planners and city managers. We return to our socio-behavioral and cultural definitions of housing also referenced earlier to begin this discussion.

We will use the Census Bureau's definition of housing units throughout our discussion of housing. According to the bureau's definition, "a housing unit is a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. Separate living quarters are those in which the occupants live and eat separately from any other persons in the building, and which have direct access from the outside of the building or through a common hall" (U.S. Census Bureau, 2023a). The accepted definition of a housing unit is not related to the entity providing/maintaining the housing unit. A housing unit may contain multiple people that occupy the same unit, as in a family occupying a single-family home. Alternatively, a housing unit can contain only one person, such as a single person occupying a unit in an apartment building. We can infer that a housing unit includes living spaces that are separate and private for occupants and has access to the outside without having to pass through private spaces assigned to other persons. In other words, a residential housing unit is imbued with expectations of privacy accorded by law and societal norms.

About 65% of housing in the United States is in the form of single-family homes.[1] Appropriately, this housing type occupies a prominent place in conversations about housing, especially the production and financing of new homes. Census data suggests that about 10% of housing units are vacant (U.S. Census Bureau, 2023b). There may be many reasons for these housing units to remain unoccupied; for example, some of these vacant units could serve as short-term accommodation, as vacation homes, as temporary rentals (a way for owners to generate additional income), or as second homes that are used seasonally and remain unoccupied for a good part of the year (in some counties of the United States, such vacation homes constitute over

DOI: 10.1201/9780429243066-3

50% of all housing units). Vacant properties could also be part of an inventory of properties listed for sale or rent, or the properties could be in foreclosure proceedings. Vacant residential properties often contribute to negative public perceptions of a neighborhood. Funding for home sales in the United States comes from a variety of sources. As Figure 3.1 (data source, US Census and HUD, 2023) shows, in the early 2000s conventional mortgage loans played a dominant role in financing home purchases. However, with the recession of 2008 there was an overall decrease in home sales, but the share of government-backed loans, such as FHA and VA loans, gained prominence as alternate funding sources. As the economy recovered and the housing market stabilized, conventional loans regained their popularity and the market saw a steady rise in home sales funded through traditional channels until 2020.

The remaining 35% of housing includes multi-family housing (e.g., apartments or condominiums), manufactured homes, and group quarters. When considering total housing stock (the number of newly constructed housing units plus previously built units available for use), it is useful to remember that a certain percentage of units will become obsolete every year (e.g., because of the removal of structurally unsafe units, or the removal of housing units to create non-residential uses). Figure 3.2 (data source, US Census Bureau, 2023b) shows the creation of types of privately owned housing from 1970 to 2020. Single-family homes continue to be the dominant type of housing units being built and buildings with 2–4 units represent a very small number. It should be noted that although the upturn of creation from 2010 to 2020 for both single units and properties with five units or more, the total number of housing units remains on a downward trend.

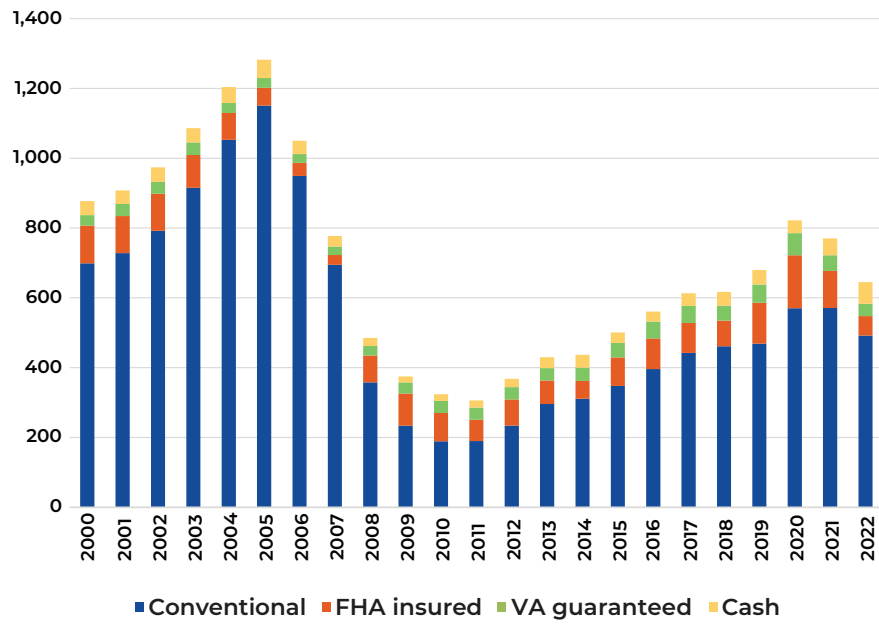


FIGURE 3.1 Home Sales from 2000 to 2022 by funding source

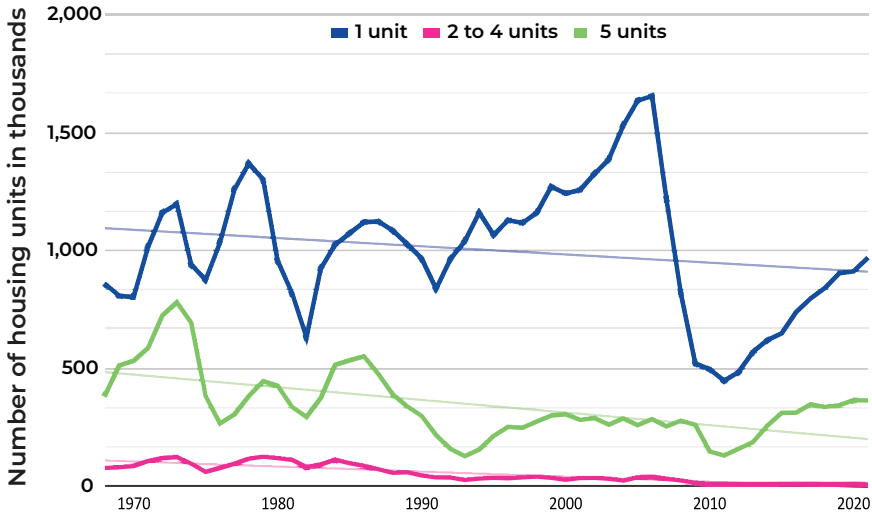


FIGURE 3.2 New privately owned housing units from 1970 to 2020

Group quarters make up approximately 3% of all housing and these residential housing units are not considered part of the housing unit count in mainstream discussions about housing. Group quarters represent diverse groups of the population. They are defined by the US Census as "places where people live or stay in a group living arrangement that is owned or managed by an organization providing housing and/or services for the residents" (US Census Bureau, 2021). These places include college dormitories, military bases, nursing facilities, group homes, worker homes and prisons. The socio-economic and demographic characteristics of residents living in group quarters can vary widely, depending on why/where unrelated individuals and households are living together. In Figure 3.3 (data source, US Census Bureau, 2021), when we break apart group quarters between institutional and non-institutional, we can see men have a significantly higher presence in institutional settings, likely from prison populations. In Figure 3.4, (data source, US Census Bureau, 2021), which breaks down group quarter residents by age group, we can see that a majority of 18–24-year-olds are in non-institutional settings, likely college dormitories and military bases. The prevalence of group quarters can impact surrounding neighborhoods because they usually offer a range of support services that bring in increased presence of people, cars, and other activity into the neighborhood. Very often, they do not conform to the scale or character of the neighborhood. They often attract protests from NIMBY (Not-In-My-Backyard) groups citing concerns such as increased traffic, overflow of cars parked on residential streets, noise concerns, and security concerns. While these may indeed be valid considerations, opposition based on nonconformity with existing neighborhood character can be thinly veiled prejudice.

Housing is not a single area of specialization, even though it may seem as such to the outsider. Housing specialists in the private sector can include developers, financiers, architects, and realtors. Many more intermediaries are involved when housing production is supported through the use of public funding sources. The sheer

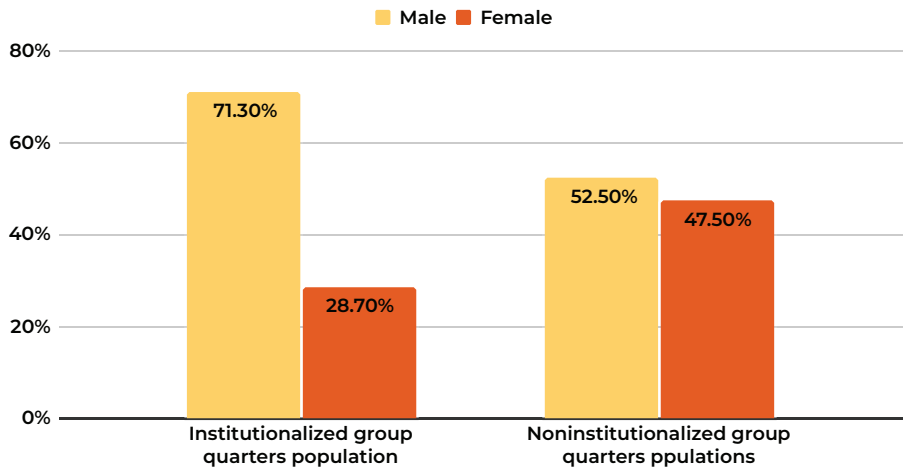


FIGURE 3.3 Group Quarters Demographics: comparative analysis of gender distribution in institutional vs. non-institutional settings

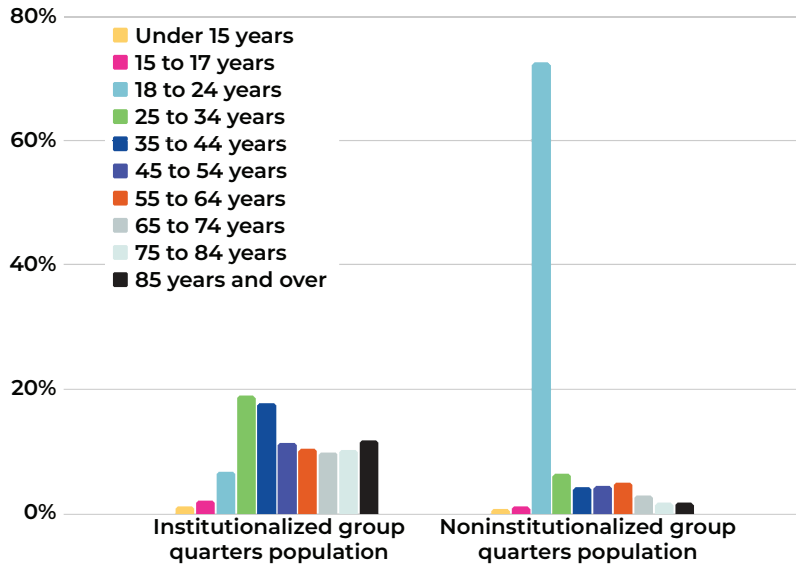


FIGURE 3.4 Comparative analysis of institutionalized vs. non-institutionalized populations

complexity of the enterprise has led to a culture of hyper-specialization. As we encourage housing specialists to explore and take advantage of the wide range of tools and methods available under the umbrella of Geographic Information Science or GIS applications, we note that establishing a common vocabulary becomes very important. For instance, the previously listed housing specialists are likely to have a common understanding of what they mean when they reference "neighborhood amenities". They impose a social values-based assessment of the businesses and services

that are likely to be viewed by the general public as "enhancing" the desirability of a neighborhood. For a data analyst who is tasked with mapping or displaying the same neighborhood amenities – the phrase is coded, and they are not able to operationalize the phrase to translate it into a mapping operation. Thus, neighborhood amenities can only be mapped, if additional information and insight are provided, for example, by describing the types of services or businesses that are considered desirable and worthy of being listed as a neighborhood amenity. For example, as necessary as they are, shoe-repair or appliance-repair shops are not considered desirable neighborhood amenities in affluent neighborhoods because of the societal meaning-making that occurs around the concept of repair (suggesting thrift rather than affluence).

Describing a housing development and situating it in the context of the lived experiences of a neighborhood require a classification scheme that does not focus on the architectural design or housing form alone, although form (appearance) is one aspect of a meaningful description. Yet, housing and neighborhood characteristics are strongly influenced by activities (functions) that occur within that housing development, making function a part of that classification. Finally, the number of people present in the development (density) becomes a variable to consider because of its impact on the neighborhood – traffic being an often-cited example, although demands on water supply and sanitation could be considered within this category. GIS specialists opting to work with housing specialists would do well to consider the complexity of classification schema (typologies, in other words) used by housing specialists.

3.1.1 Housing Typologies

Housing typologies organize the different types of residential structures, focusing on a range of variables. In architectural terms, a typology may emphasize a design aesthetic, which in turn can also communicate embedded information about a building's height (bulk), the number of rooms (indirectly addressing density). Architects and historic preservationists use terms such as "Cape Cod", "Colonial", "Craftsman", or "Mid-Century Modern" to describe individual properties, focusing on architectural design, the choice of materials, or a cultural characteristic that evolved over a period of time. Realtors may describe the same properties with some additional details, for example, a Colonial with x number of bedrooms and n number of bathrooms. In this book, we will not focus on the design and style of housing because these typologies have evolved over time influenced by availability of materials, methods of construction, and cultural norms. Our research suggests that most neighborhood-level typologies are purpose-built to achieve and accommodate decision-making. For example, historic preservationists may focus on a typology that organizes a neighborhood based on the historic styles of housing and the age (date of construction).

Our discussion of housing typologies focusses on "bulk" (form) and function. In so doing, our framing is closely aligned with the New Urbanist interpretations of housing/neighborhood typologies that emphasize (1) the relationships of the house to the street, (2) the relationship of the street to the neighborhood, and (3) the neighborhood to its location within the city/region. Bulk influences how the structure is experienced at the street scale. By adding function in a consideration of housing typology, we consider

the number of people using a particular building type. Density (the number of people within an area) is a computable measure that impacts planning for support services – such as grocery stores or public transportation (we will revisit this topic when we talk about how to deploy GIS for such analyses in Sections 5.5 and 6.2). When contemplating housing typologies, taking into account both density and bulk, we observe the potential for diverse activities and uses. For example, a mid-rise apartment building can consist of individual market rate apartments, supportive housing like a drug rehab facility or serve as campus housing for a university. Figure 3.5 is an infographic that summarizes the housing typologies that we have identified.

We organized the facilities that accommodate residential living by considering both form and function as: (i) single family, (ii) multi-family, and (iii) supported and transient housing. Among these function groupings, single-family units are the dominant type in the United States. We restate this for emphasis: low-rise, detached, and single-family homes on individual lots are the dominant housing type for residential housing throughout the United States. According to the American Community Survey (ACS, 2020, 5-year estimate) nearly 68% of all housing units in the United States are single-family homes and of that, only 6% are attached homes. Figure 3.2 (three pages back) shows historical data for completions of privately owned housing units. The second function type is multi-family dwelling units, which include any residential structure that houses any number of dwelling units larger than one. Multi-family dwelling units can be further segmented to include (i) low-rise detached

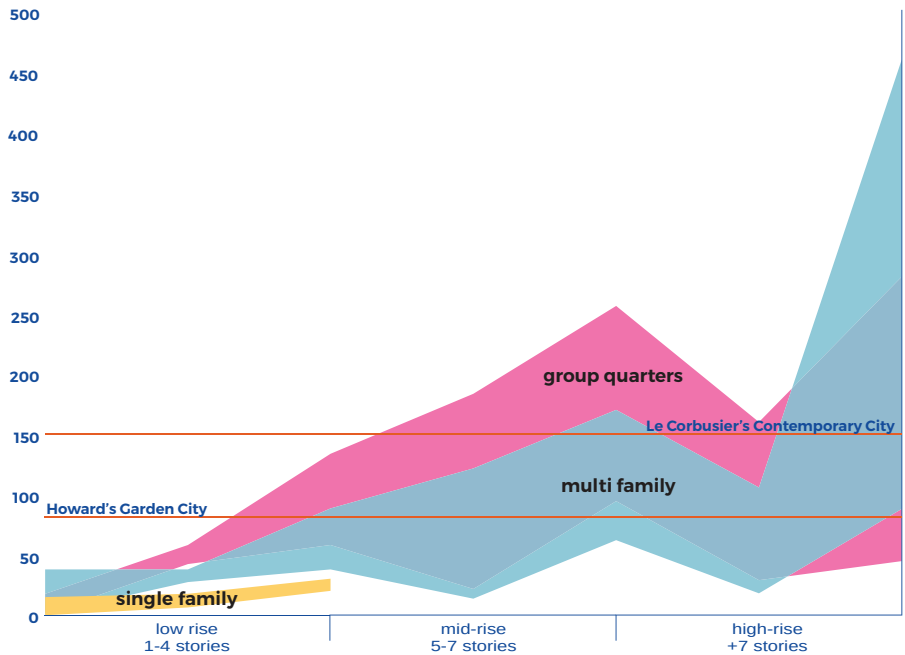


FIGURE 3.5 Charting housing typologies from low-rise to high-rise, exploring the range of building heights and density

buildings that can accommodate two to four dwelling units, (ii) small apartment complexes accommodating eight to ten dwelling units, and (iii) high-rise structures accommodating hundreds of dwelling units. The multi-family housing type can be found at widely varying densities; in other words, a multi-family house that includes two dwelling units can be situated on a single-acre lot that can also accommodate a medium-rise multi-family dwelling unit with upwards of 200 dwelling units per acre. To a large extent, these differences are governed by local zoning laws.

The New Urbanist movement has directly confronted the tension between the uses (functions) of a building and its appearance (architectural and physical characteristics) (Talen, 2005). The movement's proponents have argued that re-scaling buildings to "fit" the existing styles on a street or neighborhood could help reduce negative reactions against density or certain types of functions such as supportive housing being placed in a neighborhood. Furthermore, the movement's proponents have reasonably argued that increasing density is not an all or nothing proposition. Although the lowest densities are reasonably associated with a single-family dwelling unit, and the highest densities are likewise associated with high-rise multi-family dwelling units, Figure 3.5 illustrates that there is a great deal of variation and possibilities for gradually increasing density in an urban environment.

In the design of multi-family units, it appears that two to four family units have not been popular in recent years. Older cities like Buffalo, New York, or Milwaukee, Wisconsin have a robust supply of duplexes and triplexes because multi-generational families lived together in close proximity and these types of dwelling units also allowed for creating opportunities for rental income. However, the production of these types of units has not risen in the past two decades, even after the great recession of 2008. Missing Middle Housing (Parolek, 2020) is a relatively new movement that advocates for modestly scaled residential buildings with multiple units in walkable neighborhoods. Figure 3.6 begins to identify this "missing middle" bulk and density in NYC when the % of building types is applied to the typology chart. Different architectural forms and massing can increase the density without unduly affecting neighborhood character. Missing Middle housing typologies advocate for a return to duplexes, triplexes, fourplexes, townhouses built as row houses or around a courtyard, and live/workspaces (shops on the street level, house above), as innovative ways to increase densities. When mapped on our housing typology infographic (see Figure 3.6), we can see the missing middle density in NYC. Ultimately, the drive to grow missing middle housing acknowledges that there is a need to move beyond the dichotomy between single-family housing and high-rise apartment housing, regardless of ownership arrangements. It also acknowledges the pre-eminence of low-rise/low-density housing as the preferred option for most Americans.

This discussion of housing typologies should encourage housing advocates and GIS specialists to examine the complex relationships between architectural and urban design methods and their application to public policy approaches addressing the housing challenges we discussed in Chapter 1. On the technical side, the research arms of large firms like Arup Foresight and KPF Urban Interface are developing the tools to capture these complex relationships. And the overall housing shortage and the relative unaffordability of housing in many major markets can (in theory) be addressed by increasing the types of housing that are actually built and made

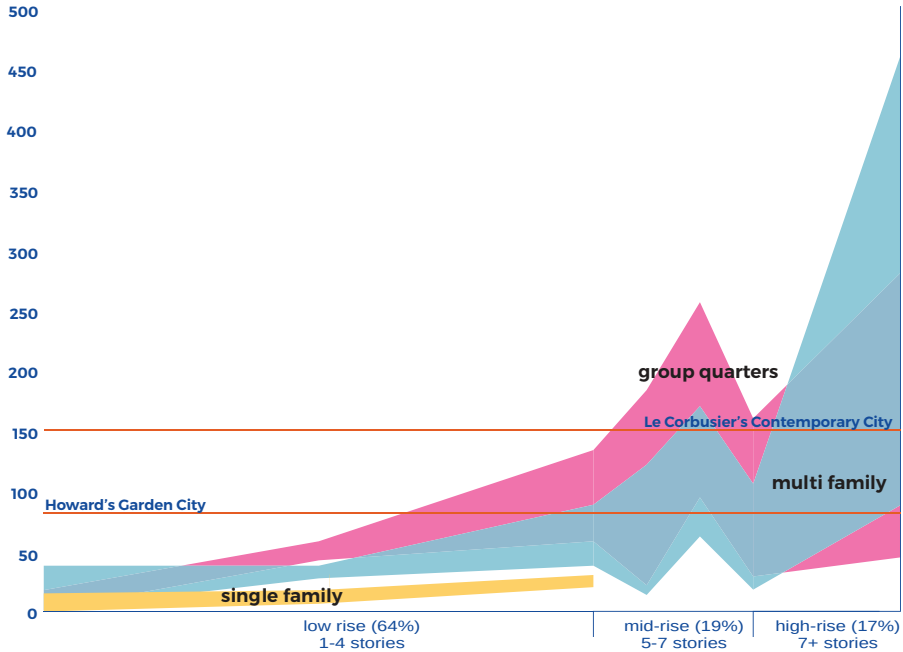


FIGURE 3.6 Charting housing typologies in New York City

available by the private sector. Undoubtedly, the cost of housing production and returns on investment influence these decisions, but changing legislation about what types of housing is allowed to be built in certain communities must also become part of this conversation. The innovations discussed in Section 3.2 begin to address these concerns.

3.2 HOUSING DESIGN INNOVATIONS

While the image of single-family homes on large lots has come to epitomize the American idea of a home/residential living unit, this image is largely a post-World War II ideal (Gans, 1967, 2017). In Chapter 2, we discussed the trends that created and shaped these outcomes. In this section, we discuss a few housing design innovations that have expanded the available range of housing alternatives.

3.2.1 Single Room Occupancy (SRO) Units

A Single Room Occupancy Unit or SRO is a residential unit that provides private dwelling quarters with access to shared bathroom and kitchen facilities. Although the affluent lived in residential hotels (a type of SRO) as early as the 1800s, this was not the norm. Conventionally, SRO residents rented/leased small spaces (minimum 120 square feet), and had a safe space to rest, store their belongings, and a permanent address for an extended period of time. In smaller towns, SRO options were

provided by homeowners who rented out rooms in their house (taking in boarders). In other instances, a rooming house/boarding house (several rooms available for rent in a single building) offered a similar option for a group of unrelated individuals. Throughout the early 20th century, in cities such as New York, Chicago, and San Francisco, SROs provided affordable shelter options for single men and women who were under-employed or working low-wage jobs, see Figure 3.7 (Byron Collection). Although they provided for basic needs and may have prevented these individuals from becoming homeless, they were not viewed as a desirable option because of unhealthy and unsanitary living conditions. Consequently, SRO housing stock was demolished or zoned out of existence citing health and safety concerns.

Post-2000, SRO housing has been rediscovered as a viable housing option for transient and hard-to-house populations, including those populations who are in recovery. Modern SRO units include in-unit bathrooms and kitchens, see Figure 3.8 (SRO Housing, 2023). These SROs are directly or indirectly supported by the State or philanthropic organizations. As a housing type, college dormitories, retirement homes, and long-term care facilities have the physical characteristics of SROs although they are not classified as such. The main distinction appears to be the type of ownership and the social class of people residing in these units (US Department of Housing and Urban Development (HUD), 2001).

Cities such as San Francisco have introduced measures to stabilize and protect existing SRO housing stock and amend restrictive zoning laws that prevent new SRO

FIGURE 3.7 SRO historical photo

FIGURE 3.8 SRO contemporary photo

housing from being constructed. In Miami-Dade county, SROs run by private companies use a Section 8 Single Room Occupancy Program for very low-income people that are on the street or in a shelter. While far from an ideal option, SRO housing units, especially those combined with supportive services, are a reasonable affordable housing option for low-income people. However, zoning policies may not allow the production of new SRO units and exclude SRO housing from the range of housing typologies that are available in many cities.

3.2.2 Accessory Dwelling Units (ADUs)

Accessory Dwelling Units or ADUs have been known over the years by a number of names, such as in-law units, granny flats, secondary units, or mother-daughters. They refer to a part of a residential property that is shared and can be used for the purpose of renting to help the owner recoup the costs associated with purchasing and maintaining the property. Typically, these units are located in a single-family residence, such as a basement, attic, or a garage. Although these ADUs have been present over a period of time, many building codes and zoning regulations have systematically prohibited their use, usually citing health and safety concerns. With ADUs, we can distinguish between those that can be attached to the primary residence and those that are detached from the primary residence.

Many cities endeavor to formalize and legalize the existence of ADUs by amending zoning laws and ancillary regulations. At a time where the square footage of

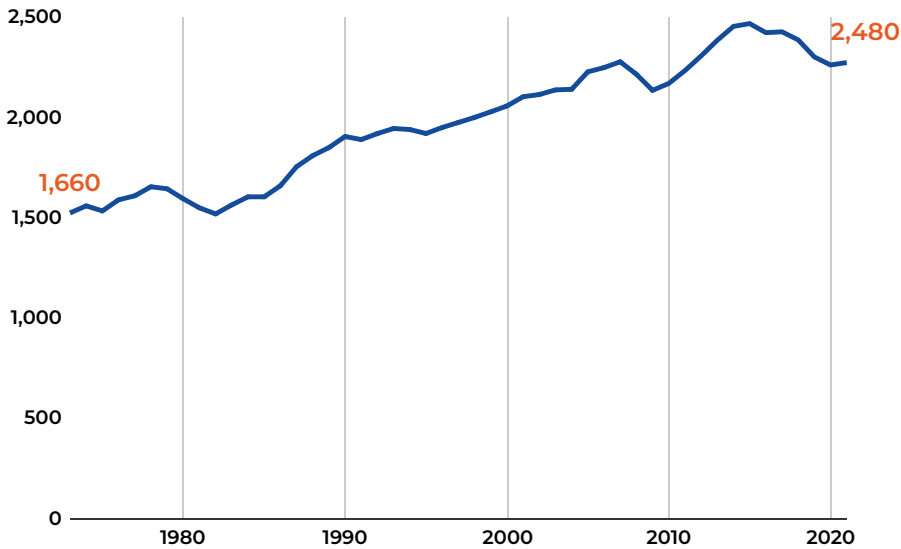


FIGURE 3.9 Increase in square footage of single-family homes

single-family homes has increased, see Figure 3.9 (data source, US Census, 2023d), there is even more opportunity than before to create these ADUs in residences. ADUs offer low-income homeowners a practical way to lower the burden of housing costs and encourage and support property ownership. Some proposed regulations limit ADU uses such as encouraging the creation of multi-generational households by restricting leasing only to family members.

Allowing ADUs generally requires a municipality to make changes to their zoning regulations. This requirement has contributed to the difficult legal implementation of ADUs in many places. Existing regulations governing parking, allowing accessory buildings on lots, and single-family zoning place limits on scaling up the use of ADUs as a viable housing option. For example, parking regulations in many ordinances require a new parking spot be created for a new dwelling unit. This regulation makes the addition of an ADU more costly and less feasible. In California, the state legislature made sweeping changes to ADUs, allowing them to be built in areas zoned for single-family housing. The government code was amended so that a city does not require replacement of parking if a garage was converted for the ADU and waives the need for parking if the ADU is within a half mile of public transportation, if it is in a historically significant area, or if the ADU is part of the primary home or accessory structure (California Department of Housing and Urban Development, 2022). California also asked all municipalities to develop a plan on how to adopt ADUs within their cities and counties in order to promote a statewide effort to increase ADUs. The California Health and Safety Code (HSC) Section 65583 (c)(7) requires that cities and counties develop a plan that incentivizes and promotes the creation of ADUs that can be offered at affordable rent for very low to moderate-income households. These new regulations' effectiveness can be seen in the overall increase in ADUs in California as depicted in Figure 3.10 (data source, ADU 2022).

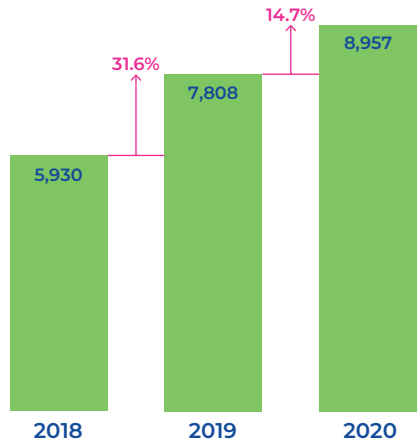


FIGURE 3.10 Unlocking Housing Potential: ADU creation in California from 2018 to 2020

ADUs have been written into the zoning ordinances of places like Lexington, Massachusetts, Santa Cruz, California, Portland, Oregon and Fauquier County, Virginia. These places have removed restrictions in the zoning for the allowance of accessory buildings that house ADUs and the restrictive single-family zoning. In Lexington, Massachusetts, the ADU code section allows for attached ADUs for lot sizes up to 10,000 square feet but allows for a detached ADU on lots that are at least 18,000 square feet.

3.2.3 Manufactured Housing

Manufactured homes were traditionally called "mobile homes". Mobile homes, as defined by the Department of Housing and Urban Development (HUD) do not require a building permit, have no foundation, and are built to have a gear that allows them to be moved on their own chassis. Mobile homes are "manufactured" in a factory and then moved or placed on an available plot of land. The land can be a single parcel, or part of a trailer park that houses many manufactured homes. Manufactured homes began life as a home on a trailer that was pulled by an automobile. In the 1930s these trailer homes were typically used for auto-camping. After WWII trailers began to be used for housing. These homes were used for temporary accommodations for migrant workers, and for use in neighborhoods and communities that are affected by natural disasters like floods or tornados that destroyed existing housing stock. However, as housing affordability has decreased, manufactured mobile homes, formerly used for temporary housing are now used as a permanent housing solution.

Manufactured mobile homes are regulated by HUD, and since 1976 all manufactured homes must meet certain standards and be given a sticker from HUD that certifies the home. The federal Manufactured Home Construction and Safety Standards Code (the HUD Code) requires compliance for fire resistance, energy efficiency, strength, and durability. Some jurisdictions require HUD compliance for a home to be located in a trailer park and use the HUD certification to avoid imposing additional

code requirements. The Manufactured Housing Institute (MHI), an industry group, cited HUD data to state that 22 million people live in over 8 million manufactured homes in the United States (Manufactured Housing Institute MHI, 2023).

Manufactured home production is completely based in the United States, with Texas leading the production and consumption of manufactured homes (US Department of Housing and Urban Development, 2023). According to the ACS 2020 (5-Year Estimates), in states like New Mexico and South Carolina, mobile units make up 16% of all housing unit types, unlike states like Nebraska and Utah where only 3% of all housing unit types are designated as mobile homes. There is a high variability in the percentage of residential dwelling units that are designated as mobile manufactured homes and there is intra-state variability as well. Table 3.1 (data source, US Census, 2023c) shows nine counties with over 50% of the housing share as manufactured homes. Even though Utah has only 3% of all housing units as manufactured homes, one county on the list is from Utah. Geography matters, as does public acceptance of manufactured homes because living in a manufactured home continues to be stigmatized (U.S. Census Bureau, 2023c).

Manufactured homes have a number of options for location and ownership. In itself, a manufactured home is in-fact movable and typically not considered "real" property, but rather as personal property. This personal property can be located in a trailer park, on an owned parcel of land, or as part of a cooperative, where mobile home owners also own a share of the mobile home park. Formerly categorized as "temporary use", such locations did not have the privileges of residentially zoned areas, meaning that the residential status was tenuous. The status of the mobile home changes from being personal property to real property when the mobile home is located on a parcel of land that has the same owner. When a manufactured home is located in a trailer park, the manufactured homeowner is in fact renting a parcel of land within a community. There is risk associated with this type of ownership because the trailer park owner can evict the tenant. The eviction can happen if the trailer park closes or sells the land. Although a manufactured home is by definition able to be moved, it is a difficult and costly endeavor.

TABLE 3.1
Counties With Over 50% Manufactured Homes

County	State	% Manufactured Homes
Daggett	UT	50.2
Glades	FL	50.7
Brantley	GA	51.6
Gilchrist	FL	51.9
Suwannee	FL	52.3
Quitman	GA	54.4
La Paz	AZ	55.1
Echols	GA	55.9
Lander	NV	56.9

Manufactured homes as a part of housing cooperatives are another innovative way to build wealth. Homeowners in trailer parks that are part of a cooperative can own a share of the land and therefore mitigate the risks associated with renting the land. Shared ownership also stabilizes the community as there is an investment in the land as well as the manufactured home. These types of cooperatives have been occurring within senior retirement communities allowing for a low-cost way of living, but at the same time protecting wealth. The New Hampshire Community Loan Fund is one of the oldest lending programs that serves 146 resident-owned manufactured home communities (ROCs) in New Hampshire (Community Loan Fund, 2023). The Loan Fund provides the infrastructure, technical assistance, and training to create and support manufactured housing cooperatives. There are additional financing options available to purchase manufactured homes. The HUD FHA program insures mortgages for manufactured homes sold with land, which is a Title II loan. The Title II program allows for a loan when land is not owned. In addition to the FHA loan programs, manufactured homes can be financed as personal loans since they are considered personal property.

Manufactured homes allow for the American Dream of home ownership to expand to people with a lower income that may not be able to afford a home built with traditional materials. However, as seen in Figure 3.11 (data source, US Census, 2017) the share of manufactured homes has been decreasing since 2009. The Biden administration considers investments in manufactured homes as one of the strategies to address the housing crisis. HUD expanded the Title I guidelines for manufactured homes and incorporated them into the Single Family Housing Policy Handbook 4000.1. The move aims to "enhance value determinations, expand allowable income sources, and allow additional flexibility in calculating student loan debt". These new revised guidelines are aimed at combating the housing crisis and HUD has identified these manufactured homes as a key opportunity of doing so.

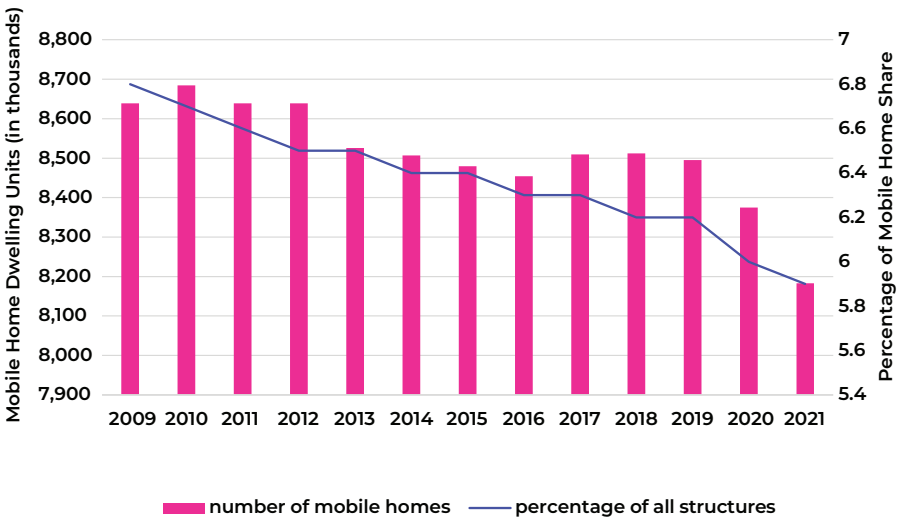


FIGURE 3.11 Declining trend for mobile home dwelling units in the United States

3.2.4 Tiny Homes

Tiny homes are just what they seem: small homes that are typically between 60 and 400 square feet. The average size of a single family in the United States ranged from 2,473 sf in 2020 to 2,485 sf in 2022 making these tiny homes significantly smaller than the average single-family home, see Figure 3.12. Tiny Homes are also smaller than their manufactured home counterpart, whose average is 1,184 sf. According to the Tiny Home Society, an intentional advocacy group that advances the concept, tiny homes can include houses on foundations, houses on wheels, accessory dwelling units (discussed earlier in this chapter), and park model recreational vehicles or RVs. The tiny house movement "offers more affordable and sustainable housing alternatives for millennials, environmentalists, and others seeking unconventional living" (Alexander, 2022).

Tiny homes that are built on trailers are typically coded and regulated as recreational vehicles (RVs). They can be certified as a homemade RV, but often are not. The Department of Motor Vehicles (DMV) inspects the trailer that supports the home. There are issues with applying the building code to tiny homes, as they do not meet many of the regulations as set forth in the contemporary codes for residential living, such as minimum widths for rooms and egress requirements. Right now, tiny homes are not considered to be permanently occupied dwellings and rather a place where people camp temporarily, but as more Americans move into these tiny homes on wheels for permanent living, building codes will need to be updated to ensure safety.

Although many environmentalists praise the limited impact that tiny houses have on the environment there are a number of factors to consider their efficiency. As discussed, existing building codes do not apply to these structures and therefore the energy code requirements for traditional homes are not implemented for these homes even if they are constructed with similar materials.[2] There is a high exterior surface area compared to the interior space. The study by Mukhopadhhyay et al.

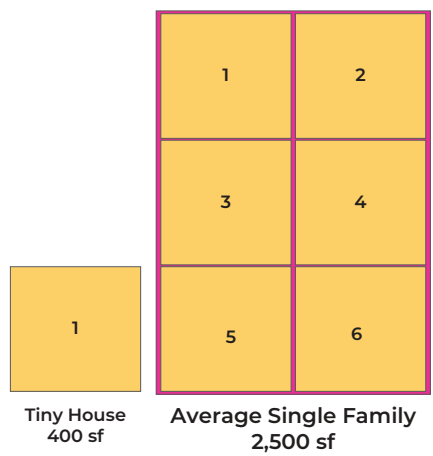


FIGURE 3.12 Scaling Down: size comparison of tiny homes to the average single-family home in the United States

(2019) conducted in a cold climate found that air filtration rates did not comply with building code standards. Heating these homes comfortably was also observed to be a challenge. These issues may be further addressed when tiny home building codes propose alternative standards and guidance to address these problems.

In addition to emphasizing individualism and a boutique lifestyle, tiny homes' proponents are advocating for their use to address the challenge of homelessness. As the body of regulations regarding tiny homes is still underdeveloped, there is as of now an additional ethical burden for developers to assure sites to locate a group of homes are appropriate and safe, and a relatively dense settlement of homes can be built and sustained. Highway underpasses, vacant lots, and other under-utilized locations can serve as safe shelter options, in essence creating humane dwelling conditions to replace homeless encampments. However, addressing hygiene, sanitation, health, and safety will require formal guidelines for the creation and maintenance of these housing alternatives.

3.2.5 Cohousing

Cohousing is a concept originating in Denmark and introduced to US audiences by McCammant and Durret (2011) that blends private living with shared open spaces and services, managed through cooperative principles. Cohousing includes attention to: (i) socio-cultural characteristics such as ensuring participatory processes in designing and managing the community, (ii) design characteristics that facilitate community interaction and engagement, and (iii) governance characteristics that consciously de-emphasize hierarchies and emphasize communitarianism. Kibbutz, for example, can be considered an agrarian co-housing model, embedded with the religious and cultural context of Israeli society. The cohousing model can support intentional communities such as cooperatives, planned unit developments, and retirement communities.

Elder Cohousing as a form of retirement housing can make housing more affordable by promoting the sharing of common areas such as cooking facilities, and resources such as on-site health care services to reduce overall expenditures for individuals. Communal living by design requires zoning variances and societal acceptance. While a conventional retirement community can offer a similar lifestyle, cohousing arrangements are defined by a culture of cooperation and collective responsibility for the wellbeing of the community. Figure 3.13 (Google, 2023) is an aerial view of an elder care cohousing community in Abingdon, Virginia, where the density of the small community is greater than the surrounding residential neighborhood.

Retrofit cohousing transforms existing suburban layouts to create shared common areas like gardens, passive recreational spaces, and workspaces. By removing fences between backyards, larger centralized and safe open spaces can be shared among six to twelve dwelling units. Likewise, larger houses can be converted to a central dining/kitchen area or club house to serve all the households aligned with the community. Angela Sanguinetti (2015) examined cohousing community locations to better understand the relationships between education levels, political affiliations, and preferences for cohousing alternatives to consider how to diversify cohousing and promote its value outside of a niche of relatively affluent, educated, and predominantly White populations.

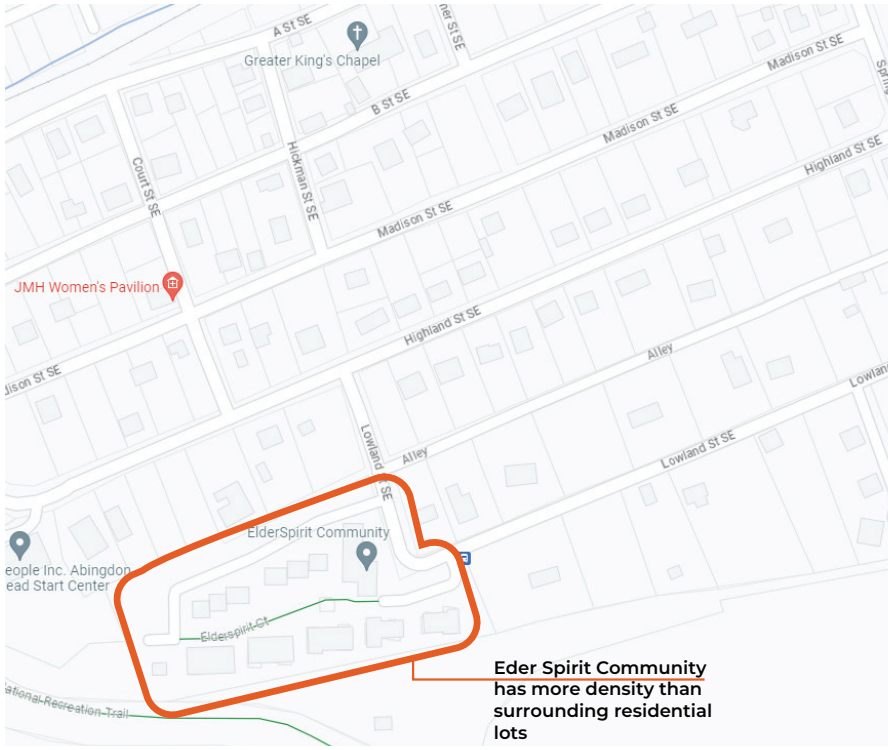


FIGURE 3.13 Increased density at the Eder Spirit Cohousing Development

3.2.6 Transit-Oriented Development (TODs)

Transit Oriented Development (TOD) emphasizes the creation of intensive high-density development around transit nodes such as light rail stops or train stations. It encourages walking and biking but provides a way to extend regional connectivity outside walkable/bikeable neighborhoods through transit networks. Initially promoted by Peter Calthorpe (e.g., Calthorpe and Fulton, 2001), the resemblance to Howard's Garden City concept is obvious. By integrating the transit infrastructure as part of the densification of development, TODs spur and direct the creation of mixed-income and mixed-use developments. The federal government views TOD as a catalyst to encourage increased ridership for transit systems, improvements in air quality, reduced traffic congestion on the roads, and other environmental benefits. It is also viewed as one way to increase housing affordability and promote neighborhood revitalization (Federal Transit Administration, 2023).

TODs are a practical way to transform the existing suburban landscape that is heavily auto-dependent by increasing densities in transit-rich areas. Zoning changes, removal of parking minimums for new developments, and relaxing other restrictions on height and bulk are essential to the success of TODs.

3.2.7 Master Planned Communities

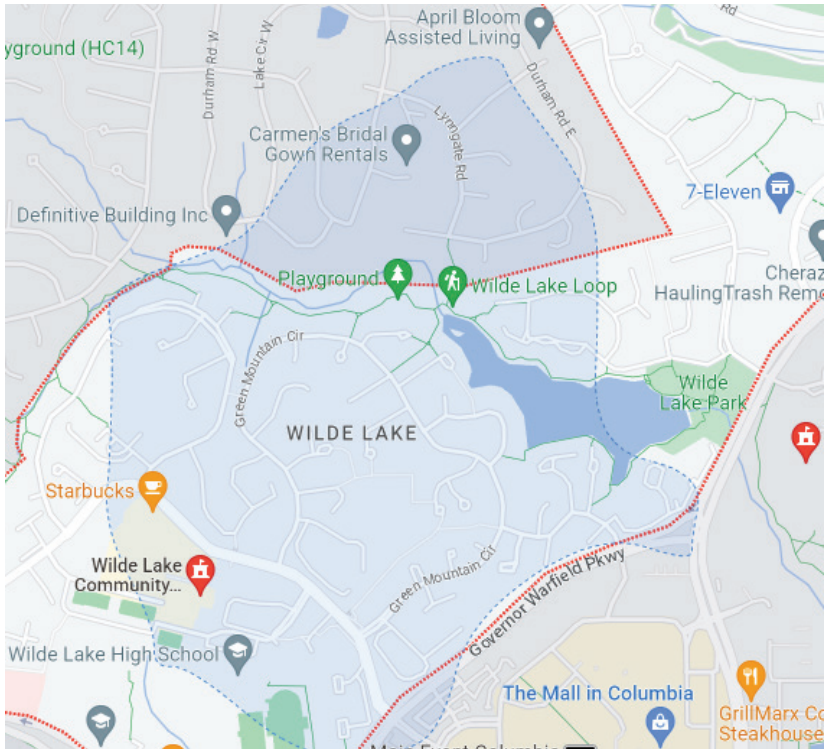
One of the more distinct features of the American housing landscape is the master planned community. These communities are large scale residential developments that

are developed like small cities. They are privately developed with financial success in mind. Early examples of master planning communities include Radburn (1929) designed by Clarence Stein and Henry Wright influenced by Howard's Garden City concept from two decades earlier. Other examples include Greenbelt, Maryland (1935) that emerged as a result of the Greenbelt Towns Program conceptualized by Rexford Tugwell and advanced by the federal government to create model communities from scratch for low- and moderate-income people. Part of the New Deal, Greenbelt, Maryland, incorporated design and planning ideas from the Garden City and Radburn.

Reston, located in Fairfax, Virginia, was the brainchild of Robert Simon, Jr., a New York real estate developer. In the early 1960s, Mr. Simon invested in a large swath of land in Fairfax County and envisioned and developed a complete community, including commercial and residential uses. It would also feature different types of housing, including condominiums, apartments, townhouses, and single-family homes. This planning was a departure from the suburban developments that Simon observed on Long Island, where residential zones were largely separate from commercial and business districts. In a speech given in 1965, Simon posited three priorities for the new community. He wanted people to live and work in Reston, with opportunities for both mind and body. He wanted it to be possible for a person to be born and live in Reston until they died. He added that the importance and dignity of each individual should be considered over the importance of the community. With these goals in mind, Reston was laid out and zones for housing, offices, medical, and government areas built around an urban core that included businesses and housing.

Developed at the same time as Reston, the Columbia Metropolitan Planned Community was built by James Rouse in the Washington-Baltimore corridor in the 1960s. Rouse used the money he made selling Carnegie Hall to NYC to fund the development. Rouse incorporated a vision of social planning that was different from other MPCs including opportunities to live and work in the same location, environmental protection goals, investments in schools, parks, playgrounds, and other family-friendly amenities, and the deliberate creation of housing alternatives to serve different income levels. Figure 3.14 (Google, 2023) of Wilde Lake in Columbia demonstrates the walkability that was planned into the small towns that make up the larger district of Columbia. Decisions that were made during its development have been largely successful for racial integration. Today, Columbia is racially diverse with 51.1% of the population of appr. 100,00 residents being non-White. Within the non-White population, 28% are Black alone, 13.3% are Asian alone, and 7.3% are two or more races.

Celebration in Florida was developed by the Walt Disney Company in the early 1990s. This MPC creates a planned town of just under 10,000 residents in 2020, with many walking trails and child-friendly environments. Like Radburn, Celebration is not operated by a public governing organization, but rather a private one. This may be a contributing factor to the lack of diversity in this town. Although the intent to create a racially and ethnically diverse community was articulated early on, the current makeup of Celebration has largely failed to meet those expectations with 76.5% of the population being White. Celebration has only 0.5% Black residents compared to the state of Florida where that number is 17%. The median income of $92,110 in Celebration is also higher compared to Florida's $61,777. Figure 3.15 (Google, 2023) shows the walkability of the town and its central business district that serves a surrounding residential population.

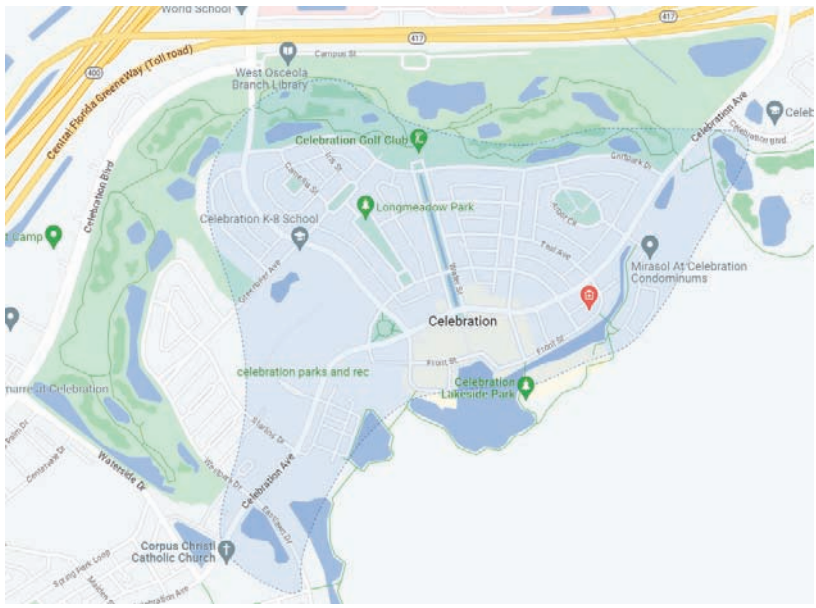


Blue shade shows 15 min walking distance. From residential areas you are able to walk to community center, school, green paths and parks, and commercial areas (yellow shade)

FIGURE 3.14 Walkability of Wilde Lake, one of Columbia, MD self contained villages

3.2.8 Universal Design

Universal Design or Inclusive Design principles call for "structures and spaces to accommodate a variety of abilities; be easy and intuitive to use; communicate necessary information, regardless of sensory abilities; minimize opportunity for error; and be able to accommodate different body sizes, postures and mobility" (Institute for Human Centered Design, cited by Lowenkron, 2021). Universal Design will serve elderly, neuro-divergent individuals, children, individuals with physical disabilities, and more. The core concept is that by creating built environments that respond to the needs of our most vulnerable, we can better serve ALL people more effectively. Consider, for example, a house that allows residents to safely age in place – this would require considerations for limited mobilities and reduced sensory perception, not to mention the need for the interior spaces to accommodate wheelchairs or other assistive devices. The initial investments will serve children and adults well, while increasing alternatives for aging adults to remain in the familiar surroundings of their own home. Specific attention to creating housing alternatives to serve aging populations is necessary given the graying of America as discussed in Chapter 1 (see Figure 1.19).



Blue shade shows 15 min walking distance. From residential areas you are able to walk to community center, school, green paths and parks, and commercial areas (yellow shade)

FIGURE 3.15 Walkability of Celebration, Florida

Collectively, the housing design innovations discussed in this section address ways in which communities can use different approaches to create housing alternatives. Geography, climate, lifestyles, and regional variations in policies and laws all influence the growth and sustainability of specific innovations.

3.3 HOUSING POLICY INNOVATIONS

While architects, real-estate developers, urban designers, and entrepreneurs have collectively engaged with developing built environment alternatives to address housing supply and affordability, housing policy advocates, federal, state, and city policymakers have proposed policy innovations and interventions to address different aspects of the housing crisis.

3.3.1 RAD Conversion

RAD conversion, HUD's Rental Assistance Demonstration Program, was enacted in 2012. RAD projects are public housing developments that can convert to being managed and supported through private funding sources, while maintaining public ownership. RAD was set up in part to eliminate Public Housing Authorities (PHA) and creates a new entity that could provide better services for the tenants, such as much needed repairs. Deferred maintenance is directly addressed, and all units are

converted from Section 9 Public Housing to Section 8 housing. In Section 9 Public Housing residents pay up to 30% of their income, but when converted to Section 8 they pay 30% of their income automatically. A few concerns of the RAD conversion are the longevity of the impact. The immediate impact of RAD conversions is that long-deferred maintenance needs are addressed and the building is restored to its original condition. However, the continued maintenance after the initial repairs are completed is somewhat less assured. Private management companies operate the housing project, and some may do a better job than others. During the first 10 years of its existence, 169,360 units were converted to long term Section 8 housing, including 1,614 different conversions across the country with the median conversion size being 72 units (US Housing and Urban Development, HUD, 2023).

3.3.2 Inclusionary Housing/Zoning

Inclusionary Housing or also known as Inclusionary Zoning is an umbrella term for policies aimed at increasing housing availability for low- and moderate-income households. Inclusionary housing can either be mandated or achieved through incentives. As Calavita and Grimes (1998) observed, the impetus of inclusionary housing's creation was the need to solve a spatial problem of concentrated poverty. The original idea purposefully disperses low- or moderate-income households among market rate households in order to integrate diversity of income and race into the segregated populations of American cities. Maryland, California, and New Jersey were among the first states to begin incorporating inclusionary housing. As of 2022, cities in at least 20 states have implemented some form of inclusionary housing.

However, there are some states that have encountered barriers to incorporating this policy into the zoning law because of conflict with a state's ban on rent control. Inclusionary housing obligates the developer to control the rent of a certain number of units in a project and therefore, from a strictly legalistic perspective, developers are creating rent-controlled units, which would be illegal in that particular state. This is true, for example, in North Carolina. There are other states that explicitly ban cities from enacting local inclusionary housing laws as a mandatory action, but generally the incentivized policies are allowed. Once inclusionary zoning policies are established, GIS tools can support the selection of sites (parcels), where new inclusionary zoning policies can be applied to spur housing production, e.g., as part of transit-oriented developments. Figure 3.16 (NYCDCP, n.d.) visualizes all inclusionary zoning locations in New York City.

3.3.3 LEED®-ND™

LEED®-ND™ which stands for *Leadership in Energy and Environmental Design for Neighborhood Development* is a rating system developed by the United States Green Building Council (GBC) for "identifying, implementing, and measuring green building and neighborhood design, construction, operations, and maintenance" (LEED, 2023). The GBC has a number of LEED programs that are related to the building scale, such as Building Design and Construction (BD+C) or Building Operations and Maintenance (O+M). LEED ND applies the goals of sustainability

to the neighborhood scale. The scale defined for LEED ND is at least two habitable buildings and no larger than 1,500 acres. Residential and nonresidential buildings, as well as buildings that combine both residential and nonresidential uses are eligible for a LEED ND designation. The LEED ND rating measures these goals assigning points or credits to specific themes/considerations. These themes include solar orientation, transportation demand management, mixed use neighborhoods, smart location, local food production, neighborhood schools, compact development, heat island reduction, and tree-lined and shaded streetscapes. For each of these themes, a

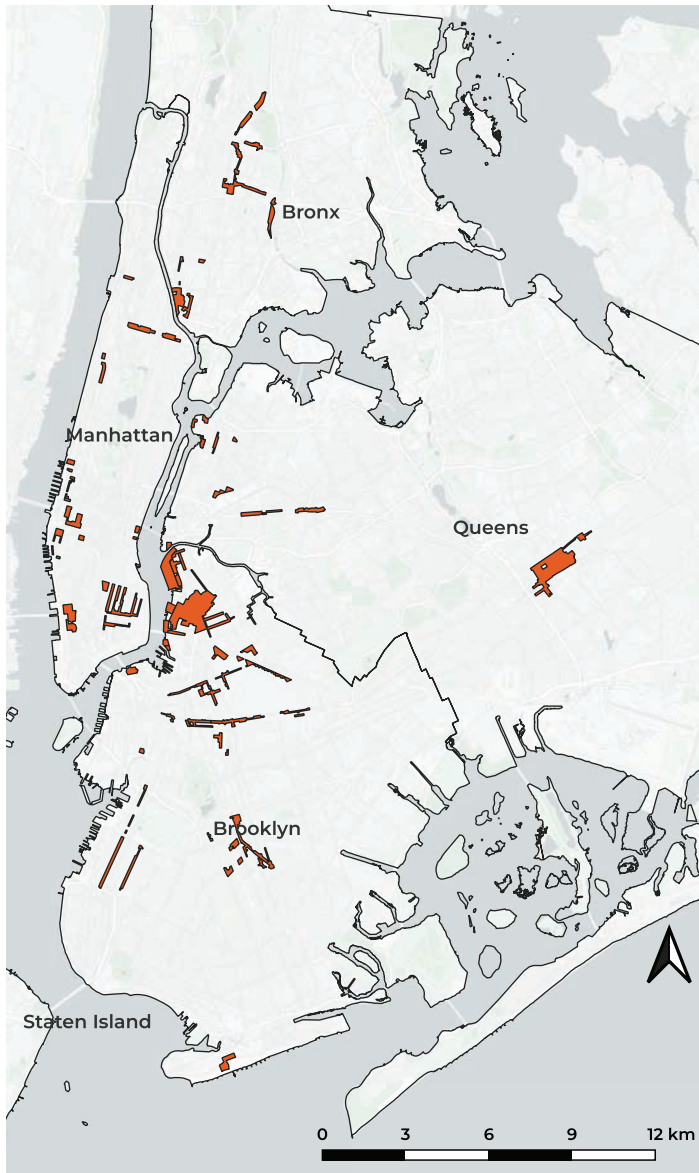


FIGURE 3.16 Inclusionary zoning developments in New York City

detailed accountability metric including a specific time frame to ensure full compliance is established. For example, under the local food production theme, the building may commit to a neighborhood garden to be constructed by the time the first building is ready for occupancy and be required for the garden to be maintained for 5 years after buildout. The size of the garden and requirements for maintaining it generate a score. In this example, more points will be accrued spending on the space assigned as growing areas and the period of time for which the area will be maintained.

Proximity to jobs and housing as well as housing types and affordability are additional scoring items. For housing types and affordability, credit is given when a project is located in a high-priority redevelopment area, such as a site listed by the EPA National priorities list, a federal empowerment zone, a federal enterprise community site, a federal renewal site, a Community Development Financial Institutions Fund (CDFIF) Qualified Low-Income Community, a HUD Qualified Census Tract, or a designated Difficult Development Area. Another way to gain credit for housing types and affordability is to include a variety of housing sizes and types in the project. For this category, the Simpson Diversity Index is used to score developments. The GBC identifies 20 housing categories, and the Simpson Diversity Index gives a higher score when there is a mix of the types. The list of housing types includes Accessory Dwelling Units.

For Housing and Jobs Proximity, credit is given when 30% of the project's residential total building floor area is located within a ½ mile walking distance of existing full-time equivalent jobs. Another way to gain credit for Housing and Jobs Proximity is to include a nonresidential component on an infill site which is a ½ mile walking distance of an existing rail transit, ferry, or tram stop and within a ½ mile walking distance of existing dwelling units. The scores for the different categories and commitments are combined to meet a total score which establishes the LEED ND Certification of Silver, Gold, or Platinum ratings.

Using GIS, Smith and Bereitschaft (2016) examined light intensity and impervious surface data for the LEED-ND projects and concluded that "by incorporating LEED®-ND™ standards into their land use planning efforts, urban planners may be able to substantially increase the overall sustainability of their urban development projects". The disadvantages of the LEED-ND rating system are that the entire system is voluntary, incentivizing desirable planning and design goals. There is also a concern that developers may invest in commitments that are focused on the physical characteristics (like energy efficiency) rather than the more socially responsible commitments like housing affordability especially over an extended period of time.

3.3.4 Subsidies for Energy Efficient Housing

The federal government provides subsidies, commonly called a "green tax credit", for different types of projects that use sustainable energy. These types of credits were first introduced under the Energy Policy Act of 2005, which allowed tax credits for homeowners, builders, and producers of manufactured homes. The Act of 2005 created new federal standards for the energy efficiency of residential and commercial properties. In addition, it offered tax credits for the installation of certain products. The amount of credit varied, but the top credit was $2,000 to builders. New construction and existing buildings were both eligible for the tax credit and the eligible categories for the credit include very

efficient HVAC systems, lighting, exterior envelope efficiency, insulated windows, hot water heaters, energy-efficient appliances, and fuel cell installation. The Act of 2005 also set up provisions to create a public housing energy office at HUD (Nadel et al., 2005). The HUD provisions in this act also required public housing to purchase Energy Star equipment. The tax credits for the Act of 2005 covered the years 2006 and 2007.

The American Recovery and Reinvestment Act of 2009 allowed homeowners and builders tax credits from 2009 to 2017. This tax credit program worked similarly to provide tax credits for efficient houses and products. In addition to tax credits, the act funded public housing improvements, improvements for housing of service members, increases to energy efficiency in low-income housing, rehabilitation of Native American housing, and emergency food and shelter for the homeless. Solar equipment credits were also included in this act. Since the end of the credit from Act 2009, the federal government has continued tax credits for solar generation under other programs.

These programs have not been as effective as hoped. The Energy Policy Act of 2005 set a goal of reducing energy use in new homes by 30% by 2015, but this goal, which is hard to measure, was likely not achieved. Additionally, it is worth considering that energy codes and standards have continued to evolve and improve since the Energy Policy Act of 2005. Subsequent revisions to energy building codes have further influenced the energy efficiency of new homes in the years following the act's implementation. The lack of success of these programs also can be attributed to the fact that the programs have mainly focused on new homes, but the vast majority of homes in the United States are existing homes. Subsidies focused on existing buildings can help homeowners and renters save on their energy bills and offset the cost of energy efficient upgrades, making them more affordable. They are a valuable tool that can help make energy efficiency more affordable and accessible to all, if implemented correctly.

3.3.5 LIHTC

LIHTC references the Low Income Housing Tax Credit that started in 1987 to provide tax credits as incentives to private investors to encourage them to build or rehab low-income housing. This is a federal program that works hand in hand with individual states to designate eligibility criteria and designate the period of time when low-income housing will be available in the development. LIHTC has produced 3.44 million housing units as of 2020 (US Department of Housing and Urban Development HUD, 2022) and can be regarded as the main privately funded approach for creating low-income housing in the United States. From the perspective of the sheer number of units created, LIHTC is the most successful housing program in US history.

LIHTC units must generally meet affordable rent eligibility requirements that are based on household income as a percentage of the area median income (AMI). The calculation of the percentage of a development that is required to remain below a specific AMI level has been adjusted through the years to allow for more flexibility for builders, as well as some flexibility for renters whose income may have increased over the years but still wish to remain in the same unit. Developers are required to maintain the composition of the AMI that is established for a minimum of 30 years. Exact lengths can be more restrictive on a state-by-state basis.

Unlike a tax deduction, which only reduces taxable income, the LIHTC credits offset dollar-for-dollar a party's tax liability. Developers sell the right to use these credits to investors who want to reduce their federal taxes. The investor's payment for such right, its "capital contribution" to the project, reduces the developer's need to use other financing. This then reduces the developer's debt-service costs, allowing the development to be financially appealing even with below-market rental income. This formula has been successful in attracting private dollars to create affordable housing. LIHTC can also be used to preserve projects funded or supported with other affordable housing programs, including, for example Federal Housing Act (42 U.S.C. § 1437f) Sections 8 (Rental Voucher Program), 236 (Rental Assistance Program), 221(d)(3) (Rent Supplement Program), 202 (for elderly households), 515 (for rural renters), and 514/516 (for farm workers).

Although the credit was authorized by federal law, and reduces federal tax liability, the federal government has put the administration of the program in the hands of the states. Each state has created a housing finance authority (HFA) that allocates credits to developers, administers the state's criteria and bidding process for projects, and monitors developer compliance with program regulations. In Figure 3.17 (USHUD, n.d.), we see municipalities that choose not to utilize the LIHTC program and may face limitations in their ability to create and preserve affordable housing options for their residents.

The builder receives tax credits of 9% or 4% depending on the make-up of the specific project. The tax credit is applied for the established length of affordability. Qualified Allocation Plans (QAPs) are structured to award more tax credit points for specific features like increased time period that the units remain affordable, historic preservation projects, promoting mixed income developments in a low-poverty area or meeting green building standards (Scally et al., 2018). Green building standards are not mandated but have been shown to benefit the occupants with financial savings from the efficiency of the units (Zhao et al., 2018). The low-income rent isn't based on an individual tenant's income, but rather on the 30% ceiling. An individual tenant's income is relevant only to (i) determine if they initially qualify as a low-income tenant, and (ii) determine if the developer needs to make more affordable units available if the tenant's income increases.

If a low-income tenant increases its income up to 140% of the income limit, it may still stay in the unit at the below-market rate with no other consequences to the developer. However, if its income rises to more than 140% of the limit, then the "next available unit rule" comes into play. Under this rule the developer must rent the next available unit (of comparable size or smaller) to a new low-income qualified tenant at the below-market rate. This is done because the program wants to encourage low-income tenants to increase their incomes (which may not occur if they knew a higher income could cost them their below-market rent), while at the same time still making the same number of units available to low-income households.

Once a project is built, the LIHTC property must comply with all LIHTC and project agreement terms for a 15-year compliance period. If the property falls out of compliance, investors can be subject to the recapture or loss of credits, including credits that were claimed while the project was still in compliance. For example, if non-compliance occurred in Year 14, credits in Year 1 may be subject to recapture. Following the initial compliance period, a project operates under an "extended use

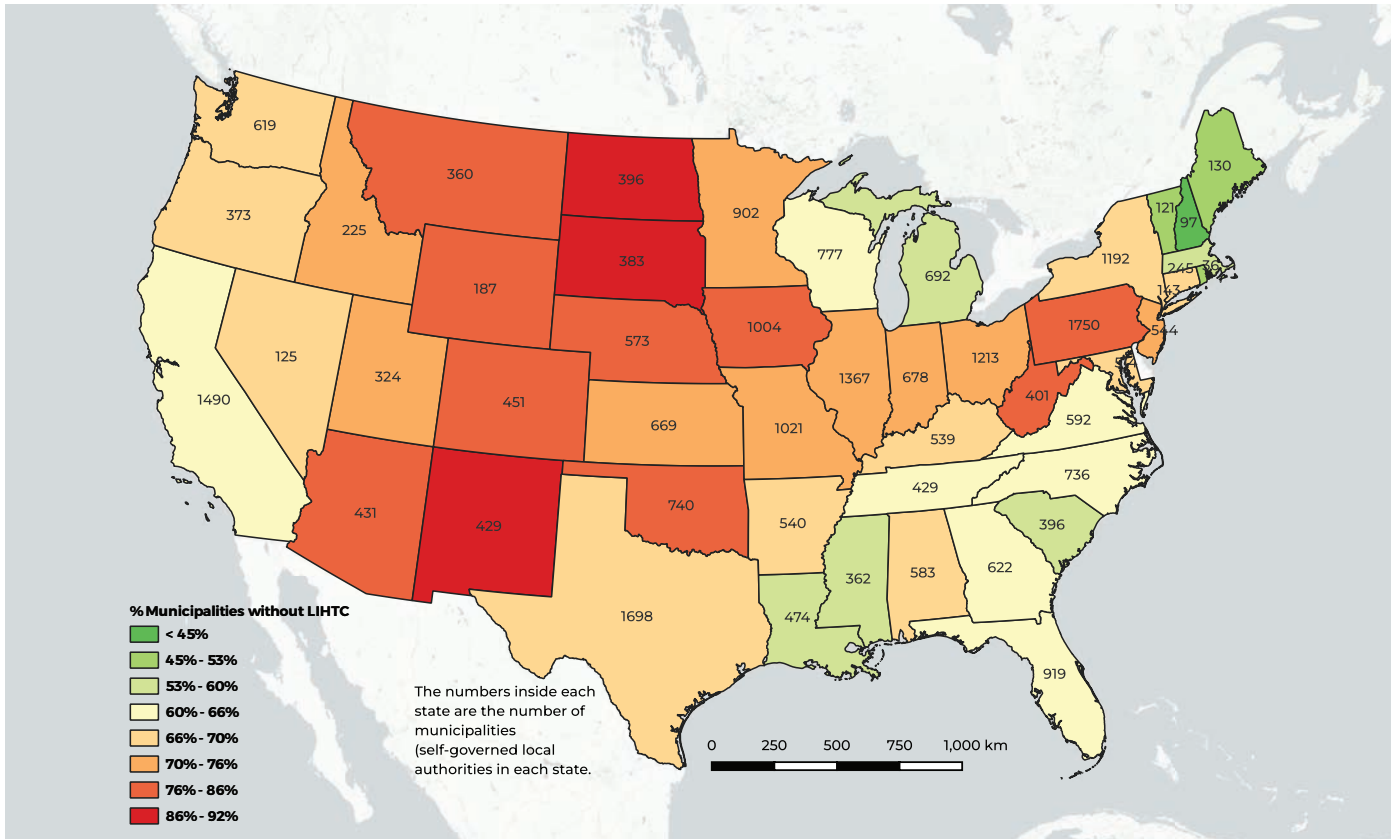


FIGURE 3.17 LIHTC Landscape: mapping municipalities in the United States without Low-Income Housing Tax Credit (LIHTC) projects

period" (EUP) of at least 15 years (states' QAPs may require a longer EUP, e.g., California has a 55-year EUP). During this period the project must continue to provide affordable housing, but the definitions of affordable housing and compliance may differ from the definitions required during the initial 15-year period. Such definitions and other terms are negotiated and included in an EUP agreement between the state and developer.

The expiration of Low-Income Housing Tax Credit (LIHTC) poses challenges to the preservation and development of affordable housing across the country. Without the incentive provided by LIHTC, there is a risk of decreased affordable housing supply and increased financial burden on low-income individuals and families. Figure 3.18 is a map of NYC lost LIHTC units that demonstrates a concerning concentration of losses primarily in Manhattan and The Bronx. This indicates a potential impact on affordable housing availability and highlights

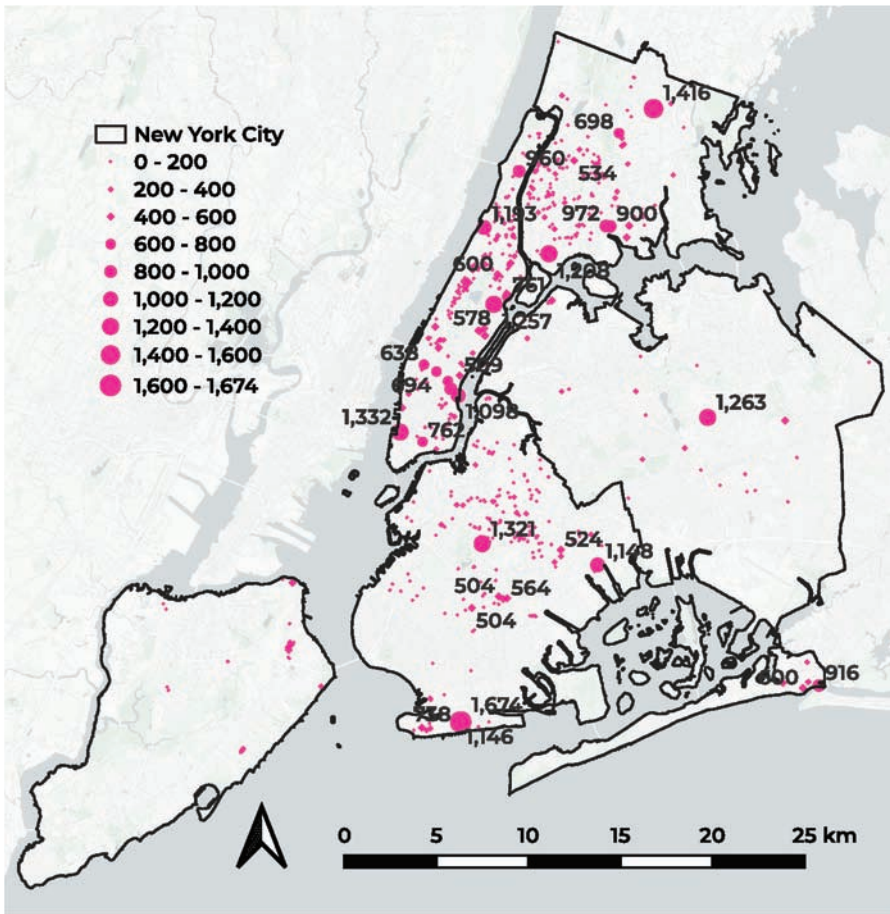


FIGURE 3.18 Vanishing Affordable Housing: mapping Lost Low-Income Housing Tax Credit (LIHTC) units in New York City