

## Integrating Spatial Analytics into Housing Policy Research: A Review of GIS-Based Methods Supporting Equitable Urban Development in the United States

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**Abstract:** Spatial inequities in housing in the United States naturally involve space, but in the traditional housing policy studies, the concept of geography in determining access, affordability, and opportunity is overlooked. The research is a scoping review of the GIS-based approaches used in the housing policy research to justify fair urban development, including the works published between 1995 and 2025. We map the methodological landscape of prevailing GIS techniques, data ecosystems, spatial scales, and conceptualizations of equity using 30 peer-reviewed studies, books, and selected grey literature based on PRISMA-ScR. The results indicate that GIS is used in a continuum, with one end having diagnostic tools, which can be used to map the differences in housing and infrastructure, and the other end as evaluative tools, which may measure policy effects, and the other decision-support that can be used to guide zoning, affordable housing location, and infrastructure planning. The operationalization of equity is based on distributive, procedural, and recognitional scales, although methodological challenges such as magnitude incompatibilities, stagnant variables, bias of data, and the inadequate use of lived experience remain. The major approaches are spatial accessibility modeling, hotspot and cluster analysis, multi-criteria decision analysis, network-based walkability analysis, and participatory GIS, which are based on data from the Census, administrative records, remote sensing, and new real-time GIS platforms. The review highlights the potential of mixed-method GIS, longitudinal and dynamic spatial data, and ethically grounded approaches to translate spatial evidence into actionable housing policy. By situating GIS within broader equity and policy frameworks, this study provides a roadmap for integrating spatial analytics into justice-oriented urban development, demonstrating how GIS can move beyond mapping inequity to inform transformative housing policy in U.S. cities.

**Keywords:** Geographic Information Systems (GIS), Housing Policy, Urban Equity, Spatial Analytics, Participatory GIS.

### INTRODUCTION

Housing inequity in the United States has been well-known as being a spatially produced and spatially reinforced process of interaction between land-use regulation, housing markets, infrastructure investment, the environment, and socio-demographic processes. The accessibility, quality, and affordability of housing and exposure to environmental risk are entrenched in urban form and urban governance hierarchies, and exhibited on the neighborhood, municipal, and metropolitan scales. Initial GIS-based environmental equity research has shown the disproportionate burden of marginalized populations by hazards and undesirable land uses and has laid the groundwork to use spatial analysis of inequality (Glickman *et al.*, 1995; McMaster *et al.*, 1997). Recent research has applied this spatial equity framework to urban green infrastructure, service access, and resilience planning, establishing the importance of space at the heart of the explanation of uneven urban growth (Heckert and Rosan, 2018; Pallathadka *et al.*, 2022; Kifayatullah *et al.*, 2025). However, though the nature of the housing inequity is spatial in nature, the housing policy literature has traditionally utilized analyses that are either almost aspatial or spatially crude. The traditional policy analysis usually focuses on the indicators of jurisdiction level, aggregate statistical models, or

program studies, which mask the intra-urban variation and neighborhood-level differentiation. These methods do not permit the determination of localized patterns of disadvantage or an evaluation of the policy-spatial interaction. The argument by Ramasubramanian *et al.* (2023) that housing outcomes cannot be explained without place-based processes, and that explanatory power and policy relevance are limited by the inability to utilize spatial heterogeneity, is valid. In the same manner, zoning reform and affordability arguments often fail to consider the spatial distributional impacts, although it has immense ramifications for equity within neighborhoods (Buti, 2024).

Over the last 30 years, the recent growth in geographic information systems (GIS) and the growing availability of geospatial and administrative data have greatly transformed the nature of urban research and planning practice. Spatial analytics developed on the GIS platform now take center stage in urban planning, environmental management, and the decision-making of the public sector to provide a fine-grained analysis of spatial disparities and provide evidence-based policy formulation (Attah *et al.*, 2024; Mehta, 2025). The emergence of interdisciplinary computational urban science has

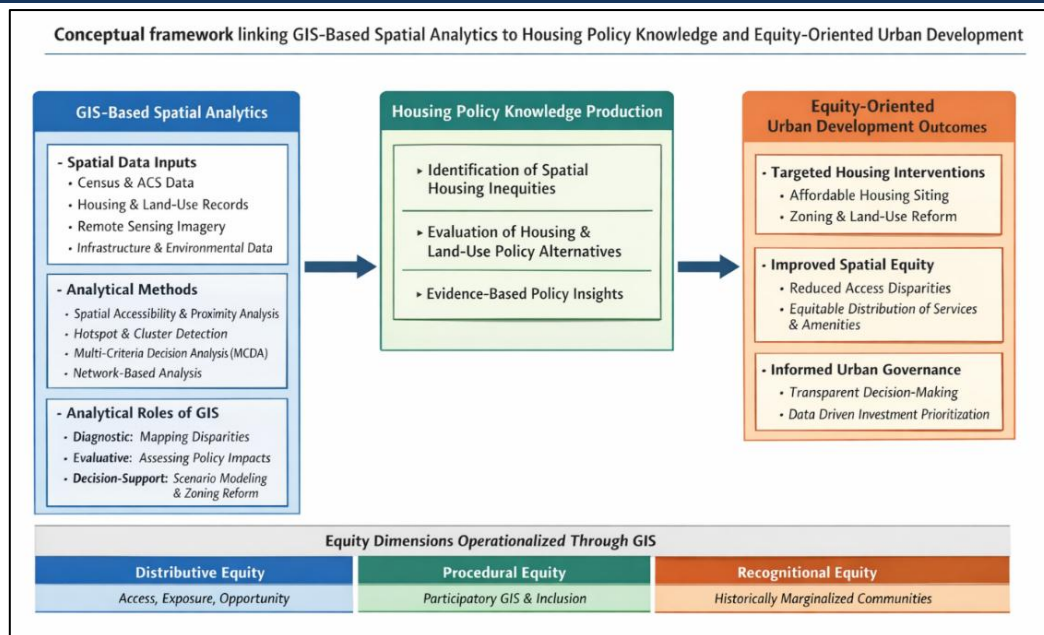
also extended the range of analytical tools of researchers, incorporating spatial data science with social science investigation and urban theory (Tao, 2013; Wang and Corcoran, 2025). In this wider context, GIS has been more actively used in addressing the questions that directly address the housing policy, such as land-use suitability, accessibility of services and amenities, urban density patterns, and city-region dynamics (Irfan, 2024a; Irfan, 2024b; Xu and Coors, 2012). An increasing number of studies indicate the possibilities of GIS to aid in terms of distributive forces in urban development by rendering spatial differences visible and analytically manageable. Affordable housing siting has been assessed using spatial accessibility models, multi-criteria decision analysis, hotspot and cluster detection, network-based walkability analysis, and participatory GIS (PGIS) approaches to evaluate zoning and land-use policies as well as assess different access to infrastructure and green space (Saleh and Setyowati, 2020; Maronedze *et al.*, 2024; Al-Homoud and Al-Zghoul, 2025). Investigations of urban green infrastructure and environmental planning also reveal the notion of using spatial analytics to inform distributive equity by targeting underserved communities and making investments (Wu *et al.*, 2025; Gorjian, 2025; Ali *et al.*, 2024). Nevertheless, according to a number of systematic reviews, the methodological diversity and conceptual heterogeneity of GIS-based equity research exist, with disproportionate incorporation of policy frameworks and little focus on how spatial understandings could be converted into actionable housing policy deliverables (Malaker and Meng, 2024; Rezvani *et al.*, 2023). In this growing interdisciplinary literature, housing policy has seldom been seen as a primary line of analysis using a synthesized GIS-based analytical prism. Current reviews are organized in a way that they do not review the deployment of GIS methods to promote the equitable design and assessment of housing policies in the United States on a systemic basis, but instead mainly on the adjacent disciplines, which include urban resilience, green infrastructure, environmental justice, or smart cities (Wu *et al.*, 2025; Gorjian, 2025; Adu *et al.*, 2025). Consequently, little synthesis can be made of the specific spatial analytics that are applied in

the study of housing, the operationalisation of equity by the spatial indicators, and the spatial scales and data that predominate in this literature. This is an especially inimitable gap considering that there are still policy discussions on affordable housing provision, zoning reform, digital and infrastructural access, and spatial distribution of public investments (Adu and Aliu, 2025; Ajani, 2025; Emmanuel, 2025; Droj *et al.*, 2024).

To address these limitations, this scoping review of GIS-based techniques employed in housing policy research aims to help facilitate equitable urban development in the United States. The review reviews the methodological terrain of the application of spatial analytics to housing-related policy problems by integrating the work on urban planning, geography, environmental studies, and computational urban science. It discusses the nature of GIS-based approaches used in the study of housing policy in the United States, the conceptualization and operationalization of equity using spatial indicators and spatial analysis, and the spatial scales and data sets that have predominated such literature. Also, the review critically evaluates enduring methodological gaps and shortcomings, especially the ones that impact policy applicability and equity outcomes. The paper provides a synthesis and evaluation of the current literature on the integration of spatial analytics into housing policy research, clarifies the current practices, and provides an overview of future directions on how GIS-based methods can be used to promote a more equitable urban development in American cities.

### Conceptual Framework

This review has employed a conceptual framework that places GIS-based spatial analytics as a mediator between the housing policy research and the equity-focused urban development outcomes. The framework conceptualizes GIS to run through a spectrum of diagnostic and evaluative to decision-support functions whereby housing-related inequities can be reduced by translating spatial information and analysis methods into policy-relevant knowledge and informing interventions (Figure 1).



*Source: Author's Construct, 2026.*

Spatial inequity regarding housing is addressed as a spatial phenomenon requiring the use of spatially articulate methods of analysis. GIS facilitates the identification and visualization of differences in housing affordability, accessibility, environmental exposure, and service provision in its diagnostic use case based on prior environmental equity studies showing the ability of spatial analysis to identify disproportionate burden on marginalized groups (Glickman *et al.*, 1995; McMaster *et al.*, 1997). Subsequently, these diagnostics are also applied to green infrastructure, walkability, broadband access, and neighborhood vulnerability, highlighting the usefulness of spatial analytics in determining underserved communities and unbalanced urban environments (Heckert and Rosan, 2018; Ajani, 2025; Al-Homoud and Al-Zghoul, 2025). In addition to diagnosis, GIS can be used as an assessment tool for measuring the spatial effects of housing and land-use policies. The methods include spatial accessibility modeling, multi-criteria decision analysis, and cluster detection to assess zoning regulations, affordable housing location, and infrastructure investment to produce uneven outcomes at the neighborhood and population group levels, and to support the evidence-based assessment of policy (Xu and Coors, 2012; Saleh and Setyowati, 2020; Irfan, 2024a; Buti, 2024; Droj *et al.*, 2024). The framework also conceptualizes GIS as a decision support system of progressive housing policy and planning. The recent growth of computational urban science and real-time spatial analytics has increased the amount of information that GIS

could handle in terms of scenario modelling, zoning reform analysis, and strategic planning in the environment of the public sector, especially when equity considerations are directly factored into the governance process (Tao, 2013; Mbuu *et al.*, 2020; Wang and Corcoran, 2025; Attah *et al.*, 2024; Mehta, 2025). The primary concept in the framework is that equity is multidimensional. The most widely used dimension of GIS-based housing studies is distributive equity, which refers to the spatial allocation of access, exposure, and opportunity (Pallathadka *et al.*, 2022; Kifayatullah *et al.*, 2025; Wu *et al.*, 2025). Nonetheless, procedural equity, which focuses on participatory GIS methods where inclusion and local knowledge are foregrounded and underserved regions, digital inequalities, and cumulative disadvantage are analysed (Ajani, 2025; Emmanuel, 2025; Adu *et al.*, 2025) and recognitional equity, which focuses on historically and structurally marginalised communities with analyses of underserved regions, digital inequalities, and cumulative disadvantage (Ajani, 2025; Emmanuel, 2025; The framework offers a consistent perspective on the synthesis of the literature reviewed by combining these eyes and dimensions of analysis along with considered equity. It contextualizes GIS-based approaches within larger housing policy procedures and equity goals, which allows the systematic cross-study comparison and avoids the reduction of the review to a descriptive catalog of techniques. By so doing, the framework explains the roles of spatial analytics in equity-based housing policy studies and city-building in the United States.

## METHODOLOGY

This study employs a systematic scoping review to examine the use of GIS-based spatial analytics in housing policy research supporting equitable urban development in the United States. The scoping review approach is appropriate given the methodological diversity, interdisciplinary scope, and conceptual heterogeneity of the literature at the intersection of GIS, housing policy, and equity. Rather than assessing intervention effectiveness, the review aims to map existing evidence, identify dominant analytical approaches, and highlight methodological gaps, consistent with the objectives of scoping reviews.

### Review Design

To guarantee transparency, rigor, and reproducibility, the review was created based on the PRISMA Extension of Scoring Reviews (PRISMA-ScR). A systematic scoping review was the chosen model as opposed to a more conventional systematic review, as the literature includes a large scope of study designs, analysis techniques, and application of policies that cannot be analyzed through meta-analysis or outcome-based synthesis. Through this method, it is possible to cover the GIS-based approaches, data sources, spatial scales, and equity frameworks applied in the housing-related studies, as well as facilitate the analytical, but not purely descriptive, synthesis.

### Eligibility Criteria

The studies were selected according to pre-established eligibility criteria. To begin with, the paper had a narrow geographical focus on the United States because it focused on the contexts of housing policies and governance structures in the United States. Second, the studies that had been included in the topic of interest had to be eligible based on the topic of housing policy, land use, zoning, housing affordability, accessibility, or spatial dimensions of housing-related inequity. Third, the research had to utilize GIS or explicit spatial analytical techniques as one of the main elements of the analysis. Fourth, peer-reviewed journal articles and academic books were incorporated into the sample of publications, and grey literature was selected when it offered valuable methodological information. Finally, the time frame was 1995 to 2025, explained by the advent of the GIS-based environmental equity studies as early as the mid-1990s and the consequent growth of spatial analytics as research in urban and housing policy.

### Search Strategy

The systematic literature search was carried out in several academic databases, including Web of Science, Scopus, and Google scholar to cover a broad range of disciplines. Search strings were query combinations of GIS-related terms, terms associated with spatial analysis, terms associated with housing policy, terms associated with equity, terms associated with urban planning, and the United States, and were constructed using Boolean operators and syntax specific to the database. In order to increase the completeness, key articles and reviews identified in the screening process were tracked manually through backward and forward citation. To ensure transparency and replicability, the search strategy was recorded in full, with databases searched and search strings

### Study Selection Process

A two-stage screening process was used in the study selection process. During the first step, titles and abstracts were filtered according to the eligibility criteria to rule out the obviously irrelevant studies. In stage two, full-text screening was done to ensure relevance and methodological fit. Cross-checking screening decisions was done where necessary. The discussion was used to resolve inconsistencies, and this is in line with the best practices in systematic reviews.

### Data Extraction and Coding

The structured coding scheme based on the data extraction was used to extract data according to the substantive and methodological properties of the review objectives. GIS-based techniques that were utilized, the type of spatial data source (e.g., census data, administrative records, remote sensing), spatial scale of analysis (e.g., parcel, neighborhood, metropolitan), equity measures and conceptualization, and domains of policy implementation (e.g., affordable housing siting, zoning reform, service accessibility) were extracted variables. This coding scheme facilitated a systematic comparative analysis of studies and facilitated the analytical synthesis made in later sections.

## RESULTS: MAPPING GIS-BASED METHODS IN HOUSING POLICY RESEARCH

This section presents the results of the systematic scoping review by mapping the temporal evolution, methodological approaches, and data ecosystems characterizing GIS-based housing policy research in the United States. The findings are organized to highlight dominant patterns while

underscoring methodological diversity across disciplines and policy domains.

**Temporal and Disciplinary Trends**

The literature reviewed has a definite chronology of the use of GIS in housing and equity-based studies. Early research, appearing in the mid-1990s, mainly relocated within traditions of environmental justice and risk assessment, and used GIS to record spatial injustices and exposure patterns of disadvantaged populations (Glickman *et al.*, 1995; McMaster *et al.*, 1997). These landmark works gave the diagnostic importance of the spatial analysis to equity-based inquiry. Since the beginning of the 2000s, GIS applications have spread into urban planning, housing research, and

land-use research, and with it a growing focus on the kinds of policy-related questions to be addressed by GIS applications, including the siting of affordable housing, service accessibility, and zoning effects. Literature published after 2015 is increasingly interdisciplinary, and views also include those of computational urban science, public administration, environmental planning, and resilience studies. More advanced analytical methods, combining various data sources, and direct interaction with equity frameworks are the features of this time (Heckert and Rosan, 2018; Pallathadka *et al.*, 2022; Malaker and Meng, 2024; Wang and Corcoran, 2025).

**Table 1:** Temporal and disciplinary trends in GIS-based housing and equity-related research in the United States

Time Period	Dominant Disciplinary Orientations	Primary Research Focus	Representative Contributions
1995–2005	Environmental justice; cartography; spatial risk analysis	Identification of spatial inequities and disproportionate environmental and housing-related burdens	Glickman <i>et al.</i> (1995); McMaster <i>et al.</i> (1997)
2006–2015	Urban planning; land-use planning; sustainability science	Integration of GIS into housing, land-use, and sustainability assessments; early policy evaluation applications	Xu & Coors (2012); Tao (2013)
2016–2020	Urban planning; environmental planning; smart cities research	Equity-oriented planning tools; accessibility and suitability analysis; real-time and big data GIS	Heckert & Rosan (2018); Saleh & Setyowati (2020); Mbuh <i>et al.</i> (2020)
2021–2025	Computational urban science; public policy; interdisciplinary GIS	Advanced spatial analytics; equity-focused policy evaluation; participatory and governance-oriented GIS applications	Pallathadka <i>et al.</i> (2022); Malaker & Meng (2024); Attah <i>et al.</i> (2024); Wang & Corcoran (2025); Kifayatullah <i>et al.</i> (2025)

Source: Author’s Construct, 2026.

**Dominant GIS Techniques**

Across the reviewed studies, several GIS-based analytical techniques recur consistently, reflecting their suitability for addressing housing-related policy questions.

**Table 2:** GIS techniques in U.S. housing policy research by policy application and equity dimension

GIS Technique	Policy Application Domain	Equity Dimension Addressed	Representative Studies
Spatial accessibility models	Affordable housing siting; service access; urban infrastructure	Distributive	Saleh & Setyowati (2020); Pallathadka <i>et al.</i> (2022); Wu <i>et al.</i> (2025)
Hotspot and cluster analysis	Identifying spatial concentrations of disadvantage: environmental exposure	Distributive	Malaker & Meng (2024); Kifayatullah <i>et al.</i> (2025); Emmanuel (2025)
Suitability analysis & MCDA	Land-use planning; zoning reform; scenario evaluation	Distributive; Procedural	Xu & Coors (2012); Irfan (2024a); Buti (2024); Saleh &

			Setyowati (2020)
<b>Network-based walkability analysis</b>	Connectivity assessment; transportation access; urban mobility planning	Distributive; Procedural	Al-Homoud & Al-Zghoul (2025); Irfan (2024b)
<b>Participatory GIS (PGIS)</b>	Community engagement; inclusive planning; marginalized neighborhoods	Procedural; Recognitional	Maroneddze <i>et al.</i> (2024); Yoon (2023); Emmanuel (2025)

*Source: Author's Construct, 2026.*

One of the most popular approaches is spatial accessibility models, which is applied commonly to assess access to affordable housing, services, amenities, and green infrastructure. These models define equity based on distance, the travel time, or service coverage factors and are often used at the neighborhood or metropolitan level (Saleh and Setyowati, 2020; Pallathadka *et al.*, 2022; Wu *et al.*, 2025). Hotspot and cluster analysis methods are used to typically determine housing disadvantage, environmental burden, or underserved population concentrations. These techniques facilitate diagnostic measures of spatial inequality and are commonly incorporated with demographic or socio-economic measures to disclose the patterns of cumulative disadvantage (Malaker and Meng, 2024; Kifayatullah *et al.*, 2025). The suitability analysis and multi-criteria decision analysis (MCDA) are also prevalent in the literature about affordable housing location, land-use planning, and zoning reform. To analyze alternative policy scenarios and justify planning decisions, they combine several spatial criteria, including the availability of land, accessibility, environmental limitations, and socio-economic vulnerability (Adu and Aliu, 2025; Xu and Coors, 2012; Saleh and Setyowati, 2020; Irfan, 2024a). This can be analyzed using network-based measures such as walkability and connectivity, which are becoming increasingly popular in understanding the connection between the location of housing, mobility, and access to urban opportunity. These techniques emphasize the role of transportation networks as intermediaries of housing equity and are especially important when considering studies that examine the linkage between housing policy and health, accessibility, and social inclusion (Al-Homoud and Al-Zghoul, 2025). Lastly, participatory GIS (PGIS) methods, although considered less common, are very

important in appropriate procedures of equity of process that engage community expertise and stakeholder views in the spatial study. These are the most prevalent in the studies that are specifically concerned with such a subject as inclusive planning and marginalized groups (Maroneddze *et al.*, 2024; Yoon, 2023).

**Data Ecosystems**

The review reveals a complex and evolving data ecosystem that supports GIS-based housing policy studies. Much of the research relies on U.S. Census and American Community Survey (ACS) data, which can be used to offer consistent socio-demographic indicators by analyzing housing affordability, vulnerability, and access across spatial scales (Ramasubramanian *et al.*, 2023; Emmanuel, 2025). These data are often used together with administrative housing and land use data at local levels, which allows a more detailed study of zoning, value of properties, and development trends (Droj *et al.*, 2024; Buti, 2024). There is a growing use of remote sensing and satellite imagery in studies, especially analysis of urban density, land cover, green infrastructure, and environmental exposure. These data sources help to increase the spatial resolution and cross-scale analysis of the housing-related conditions (Xu and Coors, 2012; Wu *et al.*, 2025; Gorjian, 2025). The most recent literature also indicates a new direction of big data and real-time GIS analytic utilization, specifically in the context of smart city applications and decision-making in the public sector. Although these directions remain restricted in the applications of housing policy, it can be seen that they promise dynamism in monitoring and scenario-based planning, particularly when combined with equity-driven governance goals (Mbuh *et al.*, 2020; Attah *et al.*, 2024; Mehta, 2025).

**Table 3.** Data sources in GIS-based housing policy research: frequency and analytical purpose

Data Source	Frequency of Use	Primary Analytical Purpose	Representative Studies
U.S. Census & ACS	Very high	Socio-demographic profiling; affordability analysis; neighborhood-level equity assessment	Ramasubramanian <i>et al.</i> (2023); Emmanuel (2025); Pallathadka <i>et al.</i> (2022)
Local administrative housing & land-use data	High	Zoning and land-use evaluation; housing stock analysis; policy scenario modeling	Droj <i>et al.</i> (2024); Buti (2024); Irfan (2024a)
Remote sensing & satellite imagery	Moderate	Urban density, green infrastructure, environmental exposure; cross-scale spatial modeling	Xu & Coors (2012); Wu <i>et al.</i> (2025); Gorjian (2025)
Big data & real-time GIS	Emerging	Dynamic monitoring; scenario testing; smart city and infrastructure analytics	Mbuh <i>et al.</i> (2020); Attah <i>et al.</i> (2024); Mehta (2025)

Source: Author’s Construct, 2026.

### ANALYTICAL SYNTHESIS: GIS, EQUITY, AND POLICY IMPACT

This section synthesizes the literature reviewed to explain the use of GIS-based spatial analytics in learning and resolving the issue of housing inequities in the United States. Based on the conceptual framework and the descriptive mappings in Tables 1-3, the synthesis helps to identify the conceptualization of equity, the policy areas that GIS affects the most, and the research methodological weaknesses and limitations.

#### How Equity Is Conceptualized and Measured

GIS-based housing research has been operationalized to bring equity in a variety of ways. According to numerous studies, the implicit equity frameworks utilize spatial proxies, e.g., proximity to services, exposure to environmental risks, or socio-demographic vulnerability indices, to identify disadvantaged neighborhoods (Glickman *et al.*, 1995; McMaster *et al.*, 1997; Pallathadka *et al.*, 2022). Other researchers follow the explicit equity approaches, which systematically combine distributive, procedural, and recognitional dimensions to the GIS analysis (Maronedze *et al.*, 2024; Yoon, 2023; Kifayatullah *et al.*, 2025). The most common way of measuring distributive equity is by use of spatial accessibility models, cluster analysis, and suitability analysis, which measure the allocation of housing resources and environmental burdens. Procedural equity is turned into practice through participatory GIS (PGIS), including local knowledge in decision-making, whereas recognitional equity can manifest itself in research that maps historically marginalized communities,

digital divide, and cumulative disadvantage (Ajani, 2025; Emmanuel, 2025; Adu *et al.*, 2025). These methods are used to show how GIS does not just measure disparities but can be used to shed light on structural inequities and build more inclusive planning processes.

#### Policy Domains Influenced by GIS

The most commonly documented policy implementation is affordable housing siting. Spatial accessibility and MCDA techniques allow planners to find appropriate sites to house the low-income population while reducing the exclusion rates and proximity to services (Saleh and Setyowati, 2020; Irfan, 2024a; Buti, 2024). Zoning reform is another area that GIS is enlightening since these practitioners are able to assess the spatial implications of regulatory interventions as well as predict distributional effects on vulnerable communities (Droj *et al.*, 2024; Buti, 2024). GIS has been used to identify the underserved communities with no parks, open spaces, or climate-resilient infrastructure in green infrastructure and environmental justice, as well as interface environmental planning with housing equity (Heckert and Rosan, 2018; Wu *et al.*, 2025; Gorjian, 2025). Lastly, GIS facilitates the analysis of infrastructure and accessibility of services, such as broadband growth, transportation, and communal facilities, and thus connects spatial planning to the wider urban equity aim (Ajani, 2025; Al-Homoud and Al-Zghoul, 2025; Mehta, 2025).

#### Strengths and Methodological Limitations

The literature reviewed has some strengths. GIS supports multi-scalar analyses, which show

inequity on parcel, neighborhood, and city levels. It helps visualize complicated spatial trends, conducts evidence-based policy analysis, and offers a logical framework to join together different data sources, such as census, administrative data, and remote sensing (Ramasubramanian *et al.*, 2023; Wu *et al.*, 2025). Nevertheless, there are major methodology shortcomings. Local discrepancies in data resolution and analytical goals, which are caused by scale mismatches between data and structural units, are likely to hide local inequities, whereas data bias and non-representation, especially in administrative and big data, may underrate marginalized populations (Mbuh *et al.*, 2020; Emmanuel, 2025). Numerous studies use fixed pointers, which makes it difficult to measure dynamic processes of the city like gentrification or displacement. Lastly, the restricted combination of lived experience and procedural equity diminishes the ability of GIS analysis to capture community priorities, although there is increased use of participatory approaches (Maronedze *et al.*, 2024; Yoon, 2023). Although GIS-based spatial analytics offer valuable means of inequity diagnosis and policy-making, achieving the maximum of its potential in ensuring equitable urban development would need interconnection across levels, approaches, and dimensions of equity and active involvement of concerned communities.

## TOWARD AN INTEGRATED SPATIAL-POLICY RESEARCH AGENDA

Based on the synthesis of GIS applications, conceptualizations of equity and policy arenas, this review proposes a more integrated spatial-policy research agenda that supports the ability of GIS to guide equitable housing development in the United States. One of the most pressing priorities is the implementation of mixed-method GIS methods that involve a synthesis of quantitative spatial analysis with the participatory or community-based approaches. Although such quantitative models as accessibility analysis, MCDA, and hotspot detection offer powerful diagnostics, the inclusion of participatory GIS (PGIS) guarantees that the inclusion of local knowledge and lived experience, as well as community priorities, can inform the spatial and policy interpretation of the data (Maronedze *et al.*, 2024; Yoon, 2023). Such a mixed-method orientation enhances procedural and recognition equity, which promotes both evidence-based and socially legitimate interventions. Another necessary frontier is the

integration of dynamic and longitudinal spatial data. The majority of the existing research operates based on fixed datasets, which restricts the information regarding the temporal dynamics of gentrification, housing displacement, or changing access to infrastructure. By using longitudinal administrative data, time-series remote sensing, and real-time GIS streams, one can analyze the temporal patterns and policy effects to implement proactive and not reactive interventions (Mbuh *et al.*, 2020; Attah *et al.*, 2024). Spatial decision-making must also be presupposed by ethical considerations. Structural inequities or misrepresented marginalized populations are unintentionally replicated and biased by GIS, unless the data bias, privacy concerns and algorithmic assumptions are reviewed. The practice of transparency and honesty in research and policymaking should be embraced by researchers and policy makers in order to advance equity, accountability and inclusiveness in the collection, analysis and sharing of spatial data (Emmanuel, 2025; Adu *et al.*, 2025). Lastly, it is important to translate GIS outputs into policy. Spatial studies should take a step further to offer decision-supportive analyses like the assessment of scenarios, projection of impacts, and prioritization of resources in line with equity goals. It means that GIS analysts, urban planners, and policymakers should closely cooperate to make sure that evidence can underpin zoning, housing distribution, planning of infrastructures, and governance decisions (Mehta, 2025; Amissah-Mensah, 2024; Wang and Corcoran, 2025). The incorporation of mixed-methods methods, dynamic data integration, ethical rigor, and practical translation can address this gap to ensure that future research can transform the spatial analytics into evidence-informed, justice-oriented housing interventions to make GIS a key instrument in the evidence-based, justice-driven housing interventions in the U.S. cities. This combined agenda is not just a progressive step in terms of methodological sophistication, but also helps to preserve the societal relevance and influence of GIS-based housing studies and makes it a perspective contribution to the research.

## CONCLUSION

This review shows that GIS-based spatial analytics offer a pivotal gap between the policy research about housing policy in the United States and the equitable urban development there. Through a systematic mapping of the methodological landscape, including dominant GIS techniques,

data ecosystems, and equity frameworks, the study clarifies how spatial analysis has been applied to diagnose disparities, evaluate policy interventions, and support decision-making in housing, land-use, and urban infrastructure planning. The synthesis highlights that equity is not one-dimensional: distributive, procedural, and recognitional aspects all have to be taken into consideration in order to make sure that housing policies are not only concerned with disparities, but also with community needs and historical context. GIS provides the ability to operationalize these dimensions by accessibility modelling, hotspot analysis, suitability and MCDA techniques, network-based mobility tests, and participatory techniques. Through policy insights, this review shows that GIS has outgrown mere mapping of inequities to guide actionable decision-making, such as affordable housing location, zoning reform, green infrastructure planning, and infrastructure access programs. Nevertheless, to make the full transformative potential of GIS a reality, it is necessary to combine mixed-methodology, dynamic and longitudinal data, and ethical considerations in addition to intensive cooperation between analysts, planners, and communities.

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