

SPATIAL PATTERNS OF RACIAL EXCLUSION THROUGHOUT NORTH CAROLINA

By

Wisdom Henry

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ABSTRACT

Municipal underbounding is the process by which cities and towns deliberately avoid annexing unincorporated fringe communities. This study investigates the extent of municipal underbounding in unincorporated Black neighborhoods adjacent to municipalities throughout North Carolina a highly gerrymandered state. To assess if Black unincorporated communities were the target of underbounding I utilized block level demographic data from the 2020 decennial U.S. Census and a spatial typology of municipal boundaries developed by Durst et al. (2021) to distinguish between areas that had been annexed, underbounded, or unaffected by municipal boundary delineations. The extent of gerrymandering at the city and county level was determined by calculating the proportion of underbounded area relative to total city and county area. My analysis shows that municipal underbounding is a complex, nuanced phenomena and throughout North Carolina cities have severely gerrymandered their municipal boundaries to systematically exclude predominately African American unincorporated communities from municipal incorporation. However, the most distinct patterns of racial exclusion are seen in small mostly white municipalities avoiding annexing a predominately Black fringe. This study emphasizes the need for greater oversight of annexation procedures and state compactness standards to minimize future and correct previous discriminatory municipal boundary delineations.

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TABLE OF CONTENTS

INTRODUCTION	1
LITERATURE REVIEW	4
METHODS	11
RESULTS	15
DISCUSSION AND CONCLUSION.....	29
BIBLIOGRAPHY	31

INTRODUCTION

Municipalities grow through the process of municipal annexation; however, differing state annexation procedures determine the capacity to which and the method by which cities and towns can annex unincorporated communities (Palmer & Lindsey, 2001; Durst, 2019). North Carolina grants municipalities unilateral control over annexation procedures which allows cities to determine what communities they want to incorporate. Municipalities can choose to annex adjacent and non-contiguous areas even if those communities oppose municipal incorporation. Conversely, underbounding is the process by which cities and towns deliberately avoid annexing predominately low-income, minority fringe communities who often are seeking incorporation (Aiken, 1987; Johnson et al., 2004; Licther et al., 2007; Durst et al., 2021). Underbounded communities are most proximate to the municipality and, in extreme cases, completely surrounded by the city's jurisdictional boundaries (Durst et al., 2021). Scholars (Parnell et al., 2004; Joyner & Christman 2005) have noted that although excluded from cities, the establishment of extraterritorial jurisdictions (ETJs) keep unincorporated communities perpetually shut out from local elections and denied access to basic municipal services such as water and sewer systems. Current scholarship (Aiken 1987; Joyner & Christman 2005; Lichter et al., 2007; Durst 2014, 2019) points to race and economic considerations as the primary drivers influencing a municipality's decision to annex or underbound. Municipalities tend to aggressively target wealthy, demographically similar communities for municipal incorporation while underbounding fringe communities that are racially dissimilar and poorer than the city. Currently, municipalities can engage in targeting and underbounding practically unchecked as a result of the invalidation of Section 5 of the Voting Rights Act that prevented blatant and subtle discriminatory annexation decisions (U.S. Department of Justice n.d.). Therefore, the decision to gerrymander municipal boundaries to strategically avoid the annexation of poor, majority-minority communities is not only highly contentious but also a threat to the health and sustainability of these communities.

The processes and the effects of municipal underbounding are thoroughly studied, but the research explaining the spatial manifestations of underbounding is limited. Much of the scholarship (Aiken 1987; Johnson et al., 2004; Parnell et al., 2004; Joyner & Christman, 2005; Mukhija & Mason, 2013; Molina, 2014) has focused on small-scale case study approaches to illustrate the relationship between underbounding and effects levied upon unincorporated

communities. Other quantitative studies (Lichter et al., 2007; Durst, 2018) have analyzed socioeconomic and political factors that influence the underbounding of census blocks adjacent to the municipality's boundaries at the start and end of a decade to determine if specific factors influenced a municipality's decision to annex or not. Unlike the quantitative studies that typically examine socioeconomic and political factors that influence underbounding across a broader geography, case studies are limited in their inability to generalize broadly about the extent of the phenomenon. Moreover, case studies show how underbounding, race, and politics are related but quantitative work has confirmed that the race is a statistically significant correlate of underbounding (Lichter et al., 2007). Nevertheless, the current quantitative scholarship only examines census blocks that were recently annexed or underbounded in the past decade. This major limitation fails to identify unincorporated communities that have been underbounded for several decades. Durst et al. (2021) developed a spatial typology that identifies areas targeted and underbounded by municipalities across all US cities over multiple years, not just a single decade. Through the use of spatial buffers, Durst et al. (2021) highlight not only the demographic and socioeconomic characteristics of the unincorporated fringe, but also efforts to target certain communities and underbound others.

This paper seeks to contribute to the underbounding literature by exploring the extent and racial composition of underbounded areas in North Carolina by using the spatial typology methodology developed by Durst et al. (2021). Using statistical software, I calculated the proportion of the underbounded area at the city and county level. In addition, I identified the racial composition of census blocks affected by municipal underbounding and summarized these statistics at the block, city, and county level. This allowed me to examine distinct patterns of racial exclusion at the block level and city which are obscured from county level findings. Overall, this paper further emphasizes race as a key driver in the underbounding of Black fringe communities but utilizes a spatial typology methodology to highlight the nuanced forms of underbounding that has occurred in North Carolina.

This paper will first explore the current scholarship detailing the complexity and controversial nature of municipal annexation and underbounding. In detail I will discuss the benefits and limitations of previous work exploring municipal underbounding before describing the data and methods utilized to analyze its extent in North Carolina. Then, the paper will explain the principal results from the block, city, and county level analyses through a series of maps and

tables. Finally, I will interpret the results and implications of the underbounding of African American communities in North Carolina.

LITERATURE REVIEW

Municipal Annexation

Cities and towns acquire new land into their jurisdictional boundaries through the municipal annexation process. Regionally, municipal annexation is most prevalent and extensive in the South (Edwards, 2008). Cities engage in municipal annexation to support new developments, to increase their population and tax base, and to vie with neighboring cities for adjacent lands (Joyner & Christman 2005; Edwards 2008). There are several economic, political, and social implications of municipal annexation decisions (Aiken, 1987; Reynolds ,1992; Lichter et al., 2007; Edwards, 2008). Residents within a municipality are required to pay city taxes and conform to local land use regulations but are afforded a political voice in local elections and access to a variety of municipal services such as water and sewage provisions. Thus, municipal annexation can be a highly contentious process that impacts both the annexing jurisdiction and the annexed fringe.

While municipal annexation has considerable benefits, not all unincorporated communities seek out municipal incorporation. Nearly half of the population in the U.S. South lives outside of municipal boundaries, but access to amenities and services is unevenly divided among unincorporated White and minority populations (U.S. Census Bureau 2015b as found in Purifoy, 2021). Regardless of incorporation status, Whiter communities have greater access to amenities which further reduces the desire of predominately White fringe communities to seek out municipal incorporation (Purifoy, 2021). Resistance to municipal annexation often stems from concerns over increased taxes and stricter land use regulations (Reynolds, 1992; Mukhija & Mason, 2013). Through the defensive incorporation process, unincorporated communities can create small, fragmented localities to avoid municipal incorporation (Durst, 2019; Purifoy, 2021). Unincorporated minority communities are more likely to be located near disamenities and to lack adequate services (Purifoy, 2021). Nevertheless, some unincorporated minority communities still oppose annexation for fear that the city will rezone and develop their lands for highway infrastructure, commercial businesses, or other non-residential uses (Johnson et al., 2004). While a portion of unincorporated communities are opposed to municipal annexation, municipalities often target wealthy, racially homogeneous communities and deliberately avoid poor, minority communities just outside the municipality.

State governments grant localities the ability to conduct annexation and regulate the process by which they may do so; hence, the approach enabled by state statutes influences how and the degree to which municipalities can annex unincorporated lands (Palmer & Lindsey, 2001). Municipalities in North Carolina can unilaterally expand their jurisdictional boundaries without the participation of the residents within the municipality or in unincorporated areas (Palmer & Lindsey, 2001). Involuntary annexation procedures allow municipalities to target adjacent and noncontiguous areas for incorporation against the wishes of those communities (Parnell et al., 2004; Smith, 2012). Prior to the invalidation of section 5 of the in 2013, the Department of Justice (n.d.) recognized the need to oversee annexation procedures in 14 states, including in several counties in North Carolina, to ensure that annexations were not discriminatory in intent or effect. Since the invalidation of Section 5 of the Voting Rights Act (VRA), cities previously requiring preclearance have significantly decreased the percentage of African American residents annexed (Durst, 2019). Thus, in the absence of oversight from the state and federal government, cities can deliberately expand their boundaries completely around underserved, depressed communities seeking municipal services.

Voluntary requests for annexation are not uncommon in North Carolina, but this race-neutral policy aimed at leveling the cost of annexation between the city and developers discourages poor, disadvantaged communities from seeking municipal incorporation (Parnell et al., 2004; Purifoy, 2021). Durst (2017) finds that Black neighborhoods were less likely to be underbounded when state statutes allowed for fringe voluntary requests for annexation. In North Carolina, fringe residents seeking annexation through a petition are only considered for annexation if 100 percent of the property owners in the unincorporated fringe are in support of a petition for incorporation (Smith, 2012). Unlike involuntary procedures, if unincorporated communities seek annexation voluntarily through a petition, they are financially responsible for providing adequate infrastructure (Joyner & Christman 2005). The unilateral annexation method allows municipalities substantial power to gerrymander its boundaries leaving unincorporated communities with limited control in the annexation of their neighborhoods (Palmer & Lindsey 2001).

Unincorporated Areas

Although comparable and adjacent to incorporated places, unincorporated fringe residents are denied access to municipal services and participation in local political processes. Cities and towns are not required to serve the residents in unincorporated communities just outside the municipality's jurisdiction. Therefore, counties, which are generally less equipped than cities to serve their constituents, are the most proximate government structure for residents beyond municipal boundaries (Anderson, 2007; Purifoy, 2021). Moreover, according to the U.S. Census (n.d.), unincorporated communities are places without a "legally defined boundary", nor a "functioning governmental structure", but are otherwise similar to incorporated places such as cities and towns. Aiken (1987) also finds that residents in unincorporated communities contribute to municipal revenues by shopping within the city, but due to their location outside the city do not have a say in the local decision-making processes.

Beyond subtle forms of racial exclusion, cities sometimes use their extraterritorial jurisdiction (ETJ) to permanently control development in unincorporated Black communities while continuing to exclude them. The establishment of an ETJ allows municipalities to govern and regulate areas beyond their boundaries with the intention of annexing those areas in the future (Parnell et al., 2004; Joyner & Christman, 2005). Lichter et al. (2007) explains that as the proportion of the black fringe population increases cities are less likely to annex. Many majority-White cities in North Carolina have complete land use control of an overwhelmingly African American ETJ (Parnell et al., 2004). Therefore, predominately African American unincorporated communities within an ETJ have no guarantee of annexation but remain subject to the land use regulations of the municipality. Moreover, communities within an ETJ cannot be annexed by other municipalities nor do they have a voice in the planning decision-making process that affects their communities (Johnson et al., 2004; Parnell et al., 2004). Moreover, unincorporated Black communities are more likely to rely on wells and septic sewer systems because being in an ETJ does not warrant municipalities to service those areas (Joyner & Christman 2005; Gorelick 2015,). Cities have the ability to rezone unincorporated residential areas to undesirable land uses, contributing further to the public health threat faced by black fringe communities. Municipalities abuse of ETJs perpetuate a political system of African American disenfranchisement and racial segregation.

Municipal Underbounding

Municipal underbounding is a political process by which municipalities purposefully avoid the annexation of predominately low-income, minority fringe communities, thereby denying them municipal services (Aiken 1987; Johnson et al., 2004; Licther et al., 2007; Durst et al., 2021). Current scholarship suggests that race plays an important role in the decision to annex or underbound unincorporated communities. Aiken's (1987) Yazoo Delta case study revealed that rural majority-White cities politically exclude predominately African American fringes even though they are economically integrated within the city. Mukhija and Mason (2013) explore the incorporation of colonias, federally designated rural communities along the US-Mexico Border with substantial infrastructural deficiencies, into the adjacent cities. While a third-party annexation commission facilitated the incorporation of the colonias, Mukhija and Mason (2013) recognize that the racial composition of fringe did not interfere with the municipality's decision to incorporate. Other studies in Modesto County, California point out the exclusion of predominately Latino communities lacking adequate water and sewer provisions but the annexation of nearby predominately White unincorporated areas (Molina, 2014). Likewise, three African American unincorporated communities outside the city of Mebane, North Carolina are denied access to public services even though the unincorporated communities are adjacent to the city's sewer treatment plant (Johnson et al., 2004). Although Licther's (2007) initial analysis finds that African Americans were no less likely than Whites to be annexed, subsequent analyses align with previous research (Aiken 1987; Johnson et al., 2004), suggesting that race is a significant determinant of annexation decisions. Other scholars argue that because race influences the built environment, municipal incorporation does not decrease the likelihood of minorities being in the proximity of disamenities and failing basic services (Purifoy, 2021). The proliferation of unwanted land uses in unincorporated minority communities threatens the communities' health, economic viability, and likelihood of municipal incorporation (Anderson, 2007). Thus, municipal underbounding is an additional layer of racial discrimination that is a pervasive but a virtually hidden process blighting poor, minority communities outside city boundaries (Johnson et al., 2004).

It is difficult to distinguish economic from racial motivations for underbounding because a history of systematic racism, discrimination, and segregation (Massey & Denton, 1993). Many scholars recognize that economic motivations are a core reason for municipalities to annex new

lands (Joyner & Christman, 2005; Lichter et al., 2007; Durst 2014, 2019). Municipalities vie for the highest quality services while maintaining low property taxes by attracting properties that produce a tax revenue surplus and excluding those properties that contribute to a deficit (Tiebout 1956 found in Lehmann, 2003). Thus, a municipality is unlikely to assume the financial burden of annexing poor unincorporated areas requiring substantially more municipal services than they produce in revenue. Moreover, lawsuits claiming racial discrimination in annexation proceedings have been seen to be unsuccessful as municipalities argue that decisions to not annex predominately minority communities are a result of lack of resources rather than racial bias (Romney 2005 as found in Mukhija & Mason 2013). A case study in Moore County observes that a one-fifth of the impoverished population throughout North Carolina is African American, whereas less than 10 percent is White (Joyner & Christman, 2005). As a consequence of excluding the poor from municipal annexation, municipalities exclude African Americans from cities and towns.

Municipal underbounding is a complex phenomenon and scholars have used a variety of qualitative and quantitative methods to study its extent and effects. A substantial proportion of scholarship examining the underbounding of Black and Latino communities are case studies in the rural South and West (Aiken, 1987; Johnson et al., 2004; Parnell et al., 2004 Joyner & Christman, 2005; Mukhija & Mason, 2013; Molina, 2014). The mostly White city of Mebane, North Carolina, refuses to annex several predominately low-income African American communities adjacent to the city but regulates their land use through an extensive ETJ (Johnson et al., 2004). Elsewhere in Moore County, North Carolina, minorities on the outskirts of predominately White cities lack political power, access to municipal services, and face redevelopment pressures (Joyner & Christman, 2005). Aiken's (1987) study of the rural Yazoo Delta area shows that black communities are the majority racial group outside of cities, and White controlled municipalities contort their municipal boundaries to maintain racial homogeneity and political power. Molina (2014) explores how leaders of underserved and underbounded Latino and African American communities advocate for basic infrastructure improvements. All of these case studies corroborate that majority White cities disproportionately exclude minorities from the jurisdictional boundaries through the use of underbounding and ETJs which have compounding effects on the community's habitability, quality of life, and government investments. Nevertheless, these case studies only highlight the relationship between

race and municipal underbounding in selected communities. While these studies provide rich, qualitative knowledge of communities excluded from municipalities, they are not generalizable nor rigorous enough to establish causality.

Most of the prior quantitative research on municipal underbounding examines the phenomenon by identifying census blocks that were in close proximity to cities and then identifying which blocks had been annexed ten years later. By comparing the demographic and socioeconomic characteristics of these blocks, scholars have examined the degree to which and the factors that influence the underbounding of communities of color (Lichter et al., 2007; Durst, 2018). Initial data in both Durst (2018) and Lichter et al. (2007) are inconsistent with the claim that minority communities are underbounded substantially. However, additional empirically robust analyses reveal a more nuanced process of racial exclusion. Using a multivariate analysis Lichter et al. (2007) find race to be statistically significantly associated with a municipality's decision to annex, but due to data limitations cannot definitively confirm that race rather than economics influenced the exclusion of African Americans. Nevertheless, there is also evidence that predominately White communities are more likely to underbound the Black fringe compared to racially diverse municipalities (Lichter et al., 2007). Durst's (2018) regression analysis provides additional evidence that economic factors, such as property values, contribute to municipal annexation, and suggests as well that the local laws that govern the process play an important role in shaping patterns of underbounding by race. In general, laws that expand the control of residents within the city contribute to the underbounding of Black neighborhoods, while those that grant residents in unincorporated areas a say in annexation decisions lead to the annexation of Black neighborhoods (Durst, 2018). Although this method is useful in identifying contemporary boundary changes that result in the underbounding of specific communities, it cannot identify communities that have been underbounded for extended periods of time.

To reiterate, prior quantitative methods rely on an analysis of changes in municipal boundaries over time and cannot, therefore, identify neighborhoods that have been underbounded for a long period of time. To my knowledge, only one study (Durst et al., 2021) has method for identifying areas that have been underbounded regardless of the year in which it occurred. To do so, they identified areas that have been partially or entirely surrounded by cities. By examining the morphology of municipal boundaries, Durst et al. (2021) demonstrate that, generally, as municipalities expand, they have created enclaves of land surrounded but not annexed by the

municipality. However, across all cities in the nation, only a handful of states have substantially large underbounded areas. Demographically, more than 10 million people are politically excluded from municipalities, but Whites tend to be less prevalent in underbounded areas (Durst et al., 2021). Lastly, Durst et al. (2021) highlight that Black unincorporated areas are likely to be underbounded by surrounding municipalities. Taken together, a spatial analysis of boundary changes confirms previous scholarship (Aiken, 1987; Lichter et al., 2007) that underbounding primarily impacts Black fringe communities, but the study sheds light on the nuance of municipal annexation processes that target and exclude certain neighborhoods based on racial motivations.

This paper seeks to contribute to current scholarship on the extent of municipal underbounding and the racial composition of affected populations in North Carolina. According to Durst et al. (2021), cities in North Carolina have the greatest proportion of underbounded land relative to the area of the city. Previous research points toward racial motivation as a key driver in the underbounding of southern, fringe predominately African American communities excluded from municipal services. Through block, city, and county-level analyses, I will show that the immediate fringe of cities throughout North Carolina have been underbounded and have greater shares of African Americans than the city and the surrounding areas not affected by the annexation process. I begin by identifying the data and describing the methods used to study municipal underbounding. Then I will explain the major findings at the block, city, and county level before interpreting the results and implications of the underbounding of African American communities across North Carolina.

METHODS

In this study, I examine the extent of municipal underbounding in North Carolina and identify its impact on Black neighborhoods through block-, city-, and county-level analyses. My analysis relies on the dataset produced from Durst et al. (2021) to analyze the morphology of North Carolina municipalities. I selected this state for two reasons. First, Durst et al. (2021) identified North Carolina as the state with the most gerrymandered municipalities, with cities in that state having an average underbounded area equivalent to nearly 40 percent of the total city area. Second, prior to the invalidation of section 5 of the Voting Rights Act (VRA), nine states and 40 of the 100 counties in North Carolina were required to submit preclearance to the Department of Justice before modifying any election processes and procedures to ensure such modifications did not have a discriminatory intent or affect (DOJ n.d.). To conduct this analysis, I downloaded and extracted North Carolina state and place shapefiles from the 2020 National States and Places datasets from the National Historical Geographic Information System (NHGIS). ‘Places’ according to the NHGIS (n.d.) include incorporated places (e.g., cities, towns, and villages) and unincorporated places (e.g., census designated places). Only incorporated places were extracted for further analysis. The 2020 County shapefile data was obtained from North Carolina’s OneMap (2020) resource which provides a variety of statewide data using the most recent survey data from several state agencies. From the 2020 decennial U.S. Census, I collected block-level racial and shapefile data, which has been aggregated and averaged to city- and county-level estimates.

This analysis builds on the national spatial typology of municipal boundaries database created by Durst et al. (2021), which used the 2010 jurisdictional boundaries from the U.S. Census Bureau’s TIGER/Line shapefiles¹ to distinguish between annexed areas that are within municipal jurisdictional boundaries, underbounded areas on the fringes of cities, and unaffected areas not impacted by municipal boundary delineations. To spatially distinguish between cities’ underbounded and unaffected areas, Durst et al. used the Python programming language to create a series of buffers to expand, contract, and extract parts of the city and surrounding unincorporated land. Then a minimum rotated rectangle covering the entire municipality was created. Next, the width (W) of the rectangle was measured to create a buffer around the city that is half the width of the rectangle (.5W). This inflated city boundary was then contracted by a

¹ The municipal boundaries therefore predate the state, place, and block level data I use by a decade.

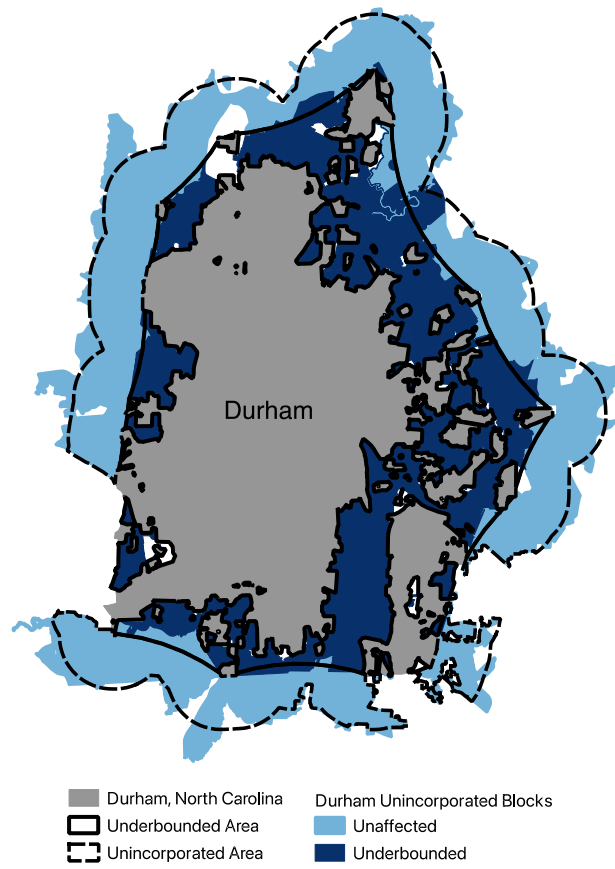
buffer of the same distance ($.5W$) to produce a convex hull of the city's jurisdictional boundaries. This convex hull shape surrounds the city and the underbounded areas; this shape therefore represents the city's jurisdictional boundaries with minimal gerrymandering. Durst et al. (2021) also identified unaffected areas that are outside of the city's jurisdictional boundaries but within the general vicinity of the city and its underbounded area by creating an additional buffer of $.125$ of the width of the minimum rotated rectangle ($.125W$). Next, the researchers identified and removed other cities in proximity of the expanded buffer. Finally, by using an overlay analysis, the unaffected areas that were not within the convex hull or neighboring other cities were identified and underbounded areas not within the city boundaries or surrounding cities were identified. The result of this process is illustrated in Figure 1 for the city of Durham.

I examined the extent of gerrymandering at the city and county levels. To conduct such an analysis, for each city, I calculated the total area of all land in the underbounded and city typologies. The ratio between the underbounded and city area is the city-level underbounded ratio. To calculate a county underbounded ratio, the portion of each county that is underbounded relative to the total area of all cities in that county, I took the centroid of all city polygons and grouped all cities with a centroid located inside of the same county together. Then I averaged the city-level underbounded ratio across all cities whose centroid is within that county to produce a county-level underbounded ratio.

In this paper, I identify racial disparities by comparing the percentage of African Americans located in underbounded and unaffected areas around each city. Exploring racial disparities across different spaces is a useful approach to identifying municipal underbounding patterns because many scholars (Aiken, 1987; Parnell et al., 2004; Lichter et al., 2009) have indicated that underbounding disproportionately targets African American communities. Moreover, according to the U.S. Census (2022), African Americans comprise nearly a quarter of the total population in North Carolina. Thus, a substantial proportion of North Carolina's total population could be the target of exclusionary local boundary manipulations. Unless noted, all data cleaning and analysis were conducted in R. I first calculated the percentage of residents in each census block that were African Americans. I converted the block polygons to block centroids using the *sf* package. Then, I spatially joined the block points to the underbounded areas to identify the part of the city or its unincorporated fringe in which the blocks were located. To identify the percentage of the population in each block who were African Americans, block-

level data from the 2020 decennial U.S. Census were added; however, all blocks not located in an underbounded, unaffected, or city area with a total population less than 30 were removed to reduce the impact of blocks with small populations on the average racial composition, which reduced the sample of blocks from nearly 250,000 to approximately 60,000 blocks. This subset of blocks was used to aggregate both city- and county-level data, but all blocks were used for mapping block level municipal boundary changes. Next, I calculated the average racial composition in each city's underbounded, unaffected, and city areas. All cities that did not have either an underbounded or unaffected area were removed, as I could not calculate a proportion of African Americans in areas that do not exist. This reduced the data set from 530 incorporated cities to 256 cities. The difference between the average black population in underbounded and unaffected areas is used to examine the degree to which underbounding impacts Black North Carolinians and the specific cities in which it occurs. A similar process was conducted to identify racial disparities at the county level across 81 counties unincorporated fringe.

Figure 1. Municipal Boundary Delineations



RESULTS

Introduction

This chapter analyzes the data retrieved from the ACS and decennial census to examine the extent of and possible factors influencing the racial exclusion of African Americans from municipal boundaries. First, several block-level analyses of racial exclusion will highlight the two distinct forms of municipal underbounding seen throughout North Carolina, a highly gerrymandered state. Next, I examine key characteristics of the 50 cities with the most extreme cases of racial underbounding. Then, an analysis of county level descriptive statistics will be presented through a series of statewide choropleth maps.

Block Level Analysis

The block level analysis provides an illustrative example of spatial segregation that occurs through local political processes. Nationally, North Carolina is the most gerrymandered state. Thus, cities are frequently engaging in annexation processes that deliberately circumvent groups of people who are adjacent to the city's boundary, contribute local tax revenues, and, often, rely on municipal services. To further highlight this process of spatial segregation, I first begin by examining how the current shape of the city has created underbounded areas. Then I will assess the demographic composition of all the blocks along the city's unincorporated fringe to emphasize distinct forms of spatial segregation occurring throughout North Carolina.

Compared against all cities across the nation, Pittsboro, North Carolina, is a highly gerrymandered city, but relative to other North Carolina cities Pittsboro is only moderately gerrymandered. Previous research (Durst et al. 2021) suggests that cities in North Carolina are on average the most gerrymandered, having underbounded areas approximately 40 percent of the size of the city itself. However, Pittsboro has an underbounded area that is 75 percent the size of the city. Moreover, 35 percent of the sampled cities in North Carolina have an underbounded area greater than three-fourths the size of the city.

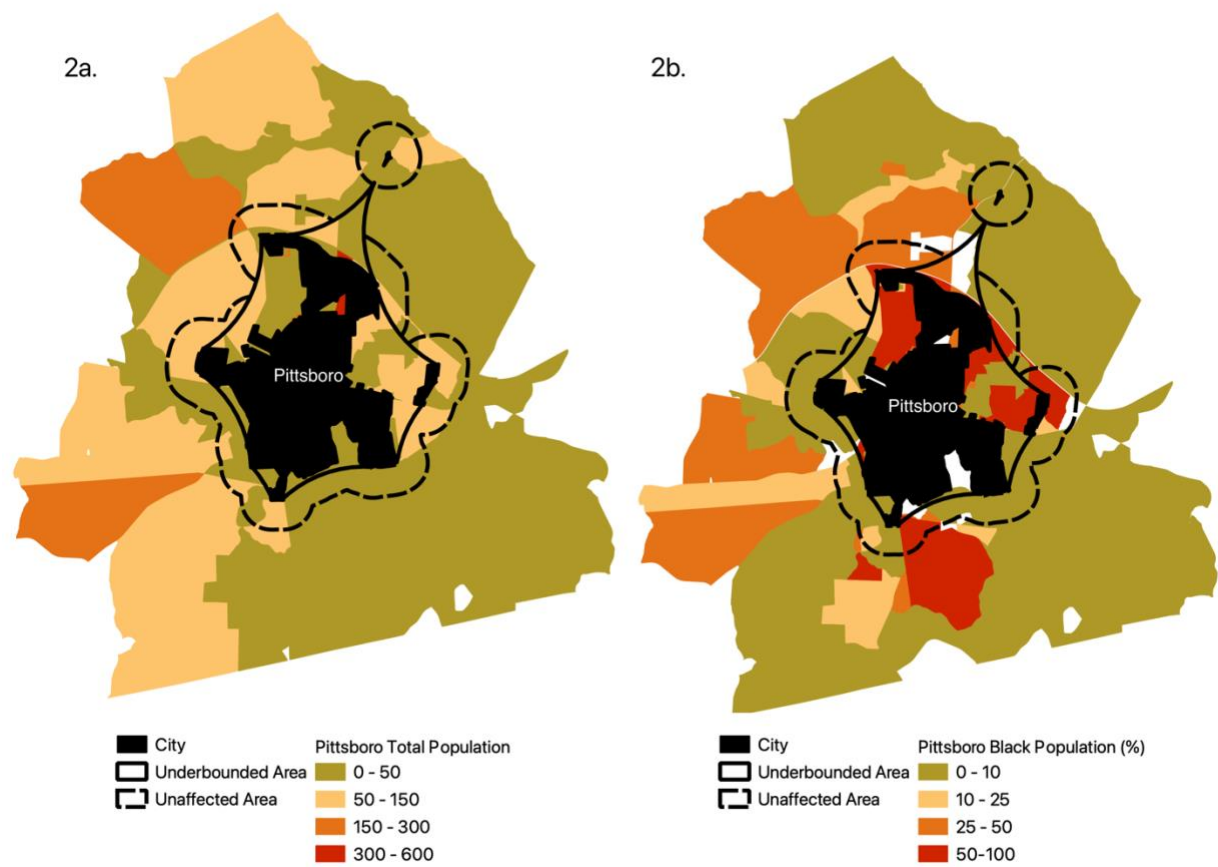
The shape of Pittsboro has been deliberately formed to exclude certain areas while targeting other areas for municipal incorporation; see Figure 2. Specifically, the two noncontiguous, satellite annexations in the northern and eastern part of the city represent what appears to be an intentional selection of these areas to be incorporated into the municipality's boundaries. Other municipal targeting efforts are represented by Pittsboro's numerous peninsulas protruding from the city's core. The unincorporated area in between the noncontiguous satellite

area to the east and the incorporated peninsulas creates an underbounded enclave, an area of space on the fringe of a municipality that has been excluded from municipal incorporation. Whether the contorted and separated shape of the city of Pittsboro highlights a willful refusal to annex specific groups of people on the edges of the Pittsboro's municipal boundaries requires an analysis of the demographics of these areas.

Pittsboro has underbounded extensive shares of African Americans and has an unincorporated fringe that is smaller in total population and an unaffected area that consists of primarily non-black populations. The underbounded and unaffected areas outside of Pittsboro are generally lightly populated; however, a few blocks in the underbounded area closest to the city itself have larger populations, see Figure 2a.

The northern and Eastern portion of Pittsboro's underbounded area are disproportionately, black having at least half of the total population being an African American, see Figure 2b. In contrast, a considerable portion of blocks in the southern portion of the underbounded area have low shares of African Americans, with black residents comprising less than 10 percent of the total population. Overall, Pittsboro's underbounded area is more than 40 percent Black while only 1 percent of the unaffected population is Black. This finding suggests that Pittsboro has underbounded relatively few non-black populations but has underbounded a substantial share of African Americans in blocks with both small and large total populations. While some blocks in Pittsboro's unaffected area are predominately African American, the majority of the population of unaffected areas is non-black people. Taken together, Pittsboro appears to be deliberately avoiding the annexation of predominately African American communities adjacent to the city. Simultaneously, the suburban majority non-black unaffected areas could be resistant toward targeted municipal incorporation efforts.

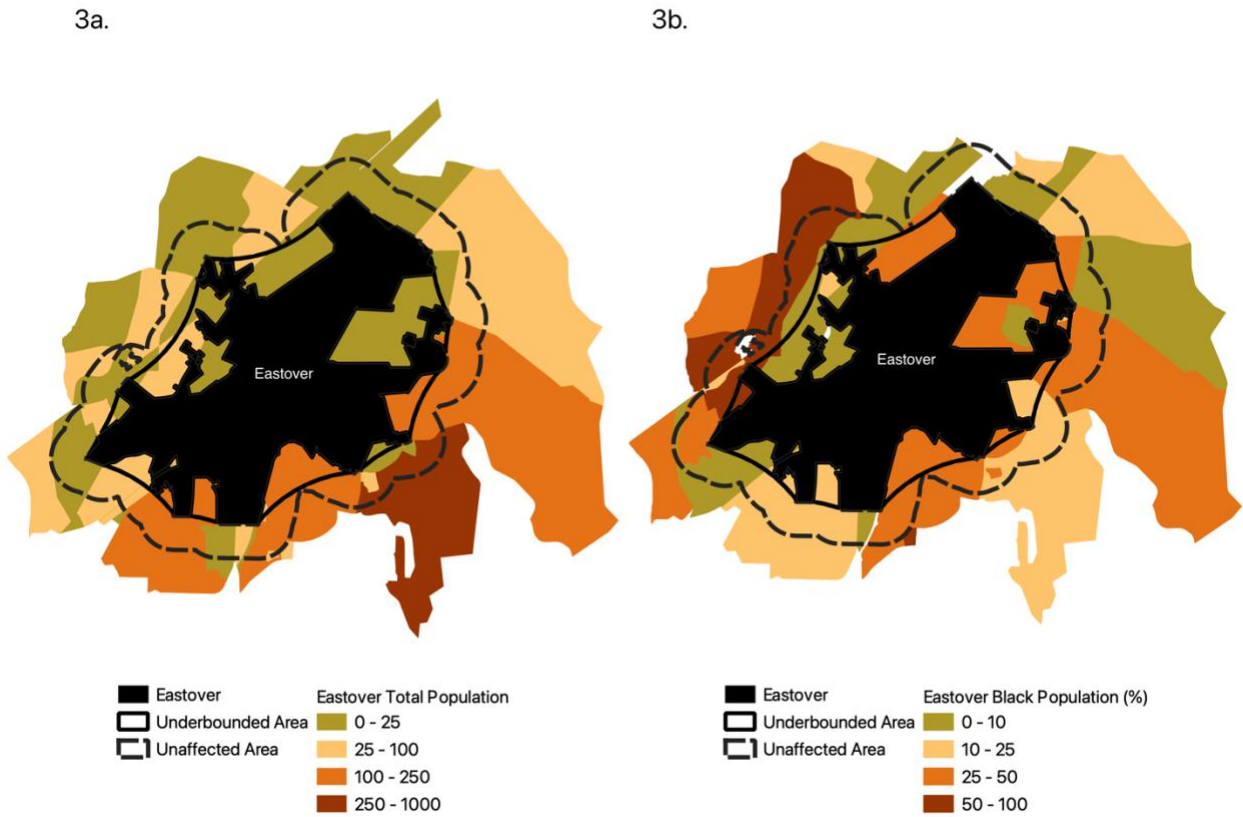
Figure 2. Pittsboro North Carolina Block Level Boundaries



I now turn to a discussion of a second case study. The city of Eastover is slightly more gerrymandered than all cities nationally, but relative to other cities in North Carolina it is only somewhat gerrymandered. The area of Eastover's underbounded area is approximately 45 percent of the size of the city. Nearly 40 percent of all sampled cities have an underbounded area that is less than half of the city's total area. Thus, a substantial portion of municipalities do not have highly gerrymandered boundaries, but of the municipalities that do, they are severely gerrymandered. Unlike Pittsboro, Eastover has not annexed any non-contiguous areas into its municipal boundaries; see Figure 3. Nevertheless, the city has contorted its municipal boundaries to avoid certain areas while simultaneously creating contiguous peninsulas that jut out from the city core, producing underbounded enclaves as a result (see Figure 3). Eastover is a mild case of gerrymandering in North Carolina which is fairly uncommon throughout the state.

The spatial typology of Eastover and its unincorporated fringe highlights that largely Black blocks are underbounded by the city which contradicts statistical measures of the demographic composition of the unincorporated fringe. Blocks in the Northern portion of Eastover's unincorporated area are generally lightly populated, whereas the southern unincorporated area tends to have larger populations; see Figure 3a. Interestingly, on average only 16 percent of the underbounded population in Eastover is Black, but nearly 30 percent of the unaffected population is Black. On the surface, it thus appears that Eastover has not deliberately underbounded unincorporated African Americans; however, block-level spatial analysis shows that African Americans comprise a disproportionate share of the population in almost all lightly populated northern underbounded blocks and a handful of more populated southern underbounded blocks; see Figure 3b. Moreover, the greatest concentration of African Americans unaffected by boundary changes is in the lightly populated northern portion of Eastover's unincorporated area; see figure 3b. Thus, Eastover has a higher proportion of Blacks in its underbounded area than in its unaffected area, and regardless of the size of the population in the block, Eastover appears to have deliberately avoided incorporating largely black neighborhoods into the municipality.

Figure 3. Eastover North Carolina Block Level Boundaries



City-level Analysis

The purpose of this section is to identify patterns, if any exist, between cities with dissimilar demographic characteristics in their underbounded and unaffected areas. I selected fifty cities throughout North Carolina with the greatest disparity among its African American underbounded and unaffected populations. Of these cities, 40 percent are located in counties that were previously covered under section 5 of the Voting Rights Act, which ensured fair changes to election processes: including municipal boundary changes. This analysis finds two major patterns: cities underbounding the greatest shares of African Americans tend to have smaller populations along their urban fringe, and of these cities the underbounded black population is generally much larger than the share of black people in the city.

The results of this analysis suggest that cities that underbound disproportionate shares of African Americans have fewer people in the unincorporated fringe, but cities that underbound predominately non-black populations tend to have a larger, more urbanized fringe. In Table 1 I examine the 25 cities that have the largest racial disparity for black residents in underbounded areas relative to unaffected areas – i.e., the greatest pattern of black underbounding. These “black underbounded” areas represent cities with the greatest average black population difference in the unincorporated fringe, with substantially more shares of African Americans in underbounded rather than unaffected areas. By contrast, I examine 25 other cities where unincorporated black residents are the least affected by underbounding processes thus likely to reside in an unaffected area (see Table 2). Therefore, “black unaffected” areas highlight cities with the lowest average differences in the black population of underbounded and unaffected areas, with consistently higher shares of African Americans in unaffected areas.

As illustrated in Table 1, cities engaging in the underbounding of black neighborhoods tend to be smaller than cities underbounding predominately non-black populations, with substantially more shares of blacks being in unaffected areas. For example, the underbounded and unaffected areas around these cities have average population sizes of 287 and 248, respectively; see Table 1. On the other hand, in the underbounded and unaffected areas of cities where blacks are predominately unaffected by annexation processes, the total population is at least 1.6 and 2.7 times larger than cities underbounding black neighborhoods, respectively; see Table 2. This suggests that the most extreme efforts to underbound Black residents are concentrated among cities with smaller populations on their urban fringe.

My results also show that cities that underbounded higher shares of African Americans tend to have city populations that are substantially whiter than the underbounded area, whereas cities where Blacks are unaffected by underbounding have Black city populations that are comparable to the underbounded Black populations. Approximately 42 percent of the population in underbounded areas are Black, but only a quarter of the residents in the city are Black; see Table 1. This suggests that the concentration of larger Black populations on the edges of municipal boundaries may have prompted cities to deliberately exclude such neighborhoods from municipal annexation. Municipalities where Black residents are generally unaffected by boundary manipulations have lower but similar shares of African Americans in the city and underbounded unincorporated fringe. Cities have nearly 16 percent of their total population consisting of Black residents while the underbounded fringe has on average 13 percent of the population being African Americans; see Table 2. Taken together, cities that do not target predominately African American communities for municipal exclusion, are less Black in the city and on their underbounded fringe. Moreover, other cities underbounding Black areas avoid Black neighborhoods when the proportion of the Black residents greatly exceeds the city's Black population.

Table 1. Cities with the greatest average difference between underbounded and unaffected areas
(Black Underbounded Areas)

Name	avg_diff_uu	Underbounded_total_pop	Underbounded_avg_perblack	Unaffected_total_pop	Unaffected_avg_perblack	City_total_pop	City_avg_perblack	under_ratio
Candor	67.65	68	67.65	48	0	362	11.24	0.26
Burgaw	48.29	653	50.08	56	1.79	2062	29.36	0.28
Maxton	43.01	287	51.67	89	8.65	951	67.52	0.86
Pittsboro	41.68	504	42.74	305	1.05	3342	12.84	0.75
Creedmoor	41.3	206	46.13	62	4.84	4309	35.16	0.64
Yanceyville	38.71	103	69.9	907	31.19	1427	54.59	0.66
Tarboro	31.37	274	71.24	138	39.87	7801	48.94	0.37
Dunn	31.1	818	35.55	475	4.45	4919	36.43	0.78
Cajah's Mountain	30.59	277	30.69	427	0.1	2322	2.17	0.15
Pinebluff	30.58	123	57.58	707	27	677	13.09	0.16
China Grove	29.06	138	37.68	638	8.62	2878	6.49	0.41
Green Level	28.13	646	67.12	463	38.99	1846	46.44	0.5
Weldon	27.92	226	90.84	178	62.92	855	77.54	0.18
Whiteville	26.6	184	51.26	160	24.66	2940	43.05	0.23
Gamewell	26.32	440	33.82	659	7.5	3277	5.07	0.2
Kenansville	24.08	116	57.41	39	33.33	598	28.32	0.63
Biscoe	23.39	140	40.85	106	17.46	1404	25.49	0.43
Rocky Mount	21.13	681	46.45	4627	25.32	44649	65.74	0.54
Sweepsonville	17.51	441	22.32	248	4.8	2256	16.93	0.61
Pembroke	16.61	2306	21.75	221	5.13	2218	9.19	0.53
Pinehurst	16.6	1322	23.3	1311	6.7	13927	3.88	0.33
Jonesville	15.7	128	23.27	129	7.57	1807	7.7	0.4
Greensboro	15.29	24865	25.5	22345	10.21	283398	36.64	0.54
Ranlo	15.08	837	20.94	652	5.87	3526	13.96	0.41
Ramseur	15.02	312	17.99	195	2.96	1366	12.88	1.58
Median	27.92	287	42.74	248	7.57	2256	25.49	
Mean	28.9088	1443.8	44.1492	1407.4	15.2392	15804.68	28.4264	

Table 2. Cities with the lowest average difference between underbounded and unaffected areas
(Black Unaffected Areas)

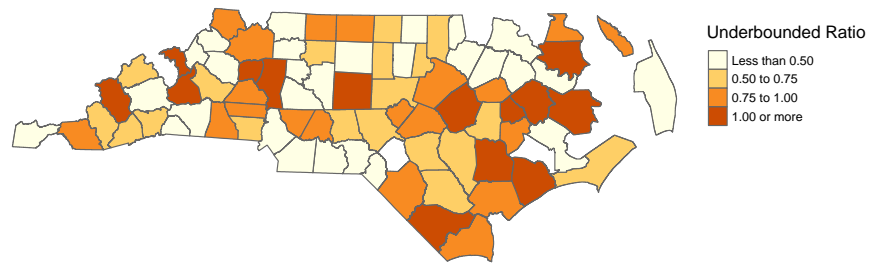
Name	avg_diff_uu	Underbounded_total_pop	Underbounded_avg_perblack	Unaffected_total_pop	Unaffected_avg_perblack	City_total_pop	City_avg_perblack	under_ratio
Havelock	-9.24	548	6.16	692	15.4	15550	15.82	0.29
Laurinburg	-9.57	877	30.75	303	40.32	10330	49.34	0.33
Huntersville	-9.73	3613	16.12	4804	25.85	55344	12.48	0.36
Eastover	-9.83	598	16.51	734	26.34	2762	20.39	0.46
Mebane	-10.13	1298	13.31	2342	23.44	15767	21.26	0.66
Elon	-11.39	472	5.03	642	16.42	10529	9.4	0.53
Smithfield	-12.7	231	9.26	417	21.96	8996	24.89	0.24
Concord	-12.97	16465	14.04	12916	27.01	96531	20.13	0.47
Hemby Bridge	-13.08	36	0	86	13.08	1392	10.94	0.25
Wendell	-13.51	1712	18.46	3165	31.97	7923	27.6	1.66
Morrisville	-13.63	1964	7.02	542	20.65	26862	9.15	0.28
Murphy	-13.83	36	2.78	192	16.61	1080	3.48	0.32
Red Oak	-14.79	201	19.68	1356	34.47	2759	9.93	0.19
Carrboro	-15.67	671	7.05	879	22.71	20237	7.37	0.26
Mint Hill	-16.26	3526	12.51	7124	28.77	25042	12.66	0.2
Ahoskie	-16.65	593	45.83	601	62.48	2482	79.95	1.1
Aberdeen	-16.78	334	20.75	1047	37.53	6729	20.24	0.65
Fairmont	-17.34	83	13.65	112	30.99	946	69.55	0.82
Haw River	-17.9	238	15.57	485	33.47	1745	10.07	0.89
Whitsett	-18.06	149	13.55	1686	31.61	403	4.96	0.25
Williamston	-20.58	216	15.42	130	36	3121	68.39	0.71
Harrisburg	-20.75	6691	15.62	5697	36.37	13550	15.65	1.12
Middlesex	-25.4	77	12.48	196	37.89	306	46.08	0.63
Butner	-53.76	131	5.62	1211	59.38	8010	30.8	0.18
Lawndale	-89.47	69	0	38	89.47	210	6.59	0.47
Median	-14.79	472	13.55	692	30.99	7923	15.82	
Mean	-19.3208	1633.16	13.4868	1895.88	32.8076	13544.24	24.2848	

County-level Analysis

I conclude by examining the extent of underbounding across the state by visualizing county-level patterns. The proportion of underbounded area relative to the total area of all cities within the county is indicative of the amount of space municipalities underbound within the county. As illustrated in Figure 4, nearly half of all counties in North Carolina have a total underbounded area at least half of all the cities' total area. A considerable number of counties have an underbounded area that is fairly small, compromising less than 50 percent of the total city area. Approximately 20% of counties have an underbounded area larger than the size of cities within the county. McDowell County's underbounded area, for example, is roughly three times the size of cities within the county, but on average counties have an underbounded area 70 percent of the total city area.

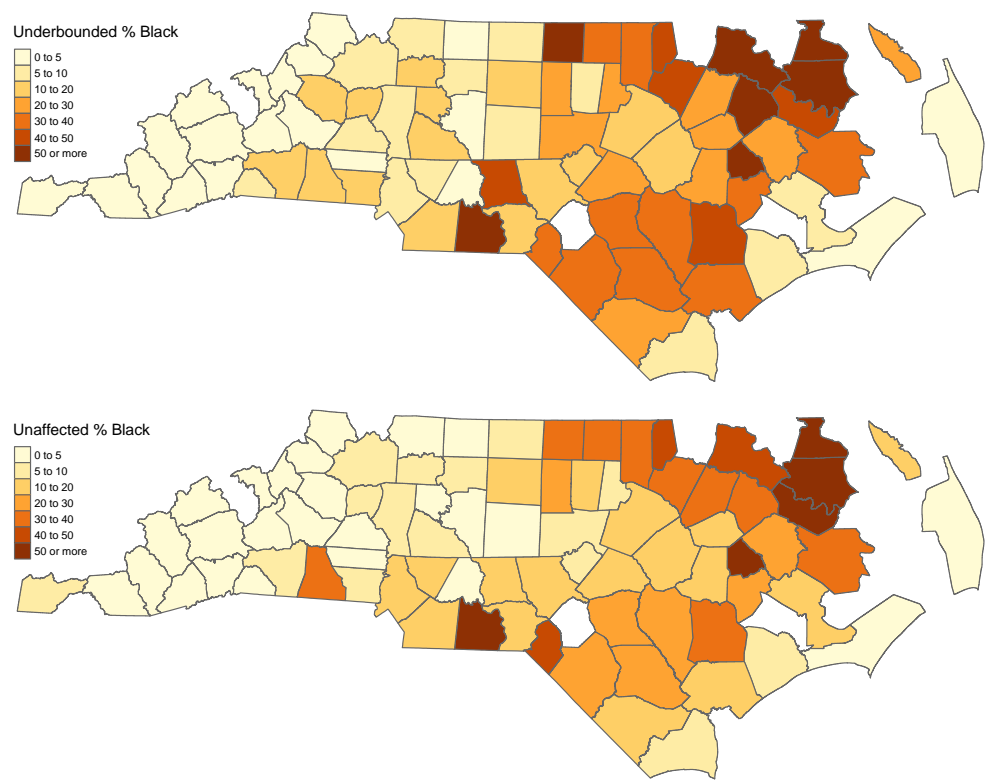
The underbounded ratio does not explain the demographic characteristics nor the unique form in which underbounding has occurred. Pitt and Duplin counties both have an underbounded areas larger than 1 times the size of their respective cities, but Pitt County has 18,000 more people in its underbounded area than Duplin. Moreover, the proportion of underbounded area relative to the area of all cities in a county doesn't indicate what racial group is being deliberately avoided for municipal incorporation. Therefore, this analysis does not solely examine the size of the underbounded ratio, but instead focuses on the proportion of racial groups, specifically African Americans, affected by municipal underbounding.

Figure 4. Underbounded Area Ratio at the County Level



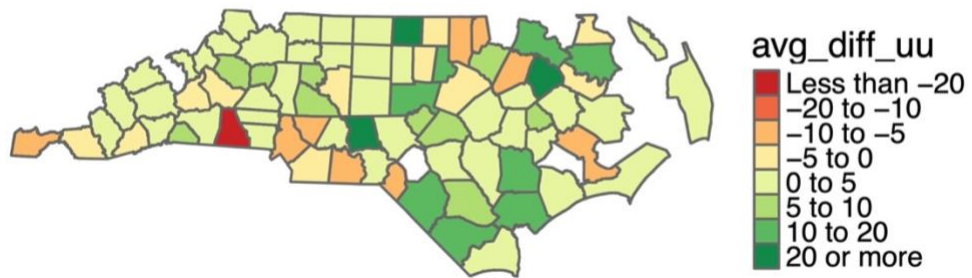
African Americans are on the unincorporated fringe all throughout the state, but some counties in the eastern part of the state are underbounding disproportionate shares of African Americans. To visualize the potential relationship between underbounding and race, I also explored the distribution of African Americans in both underbounded and unaffected areas at the county level. This analysis suggests that much of the underbounding in the state occurs in counties with moderate to low shares of African Americans. African Americans comprise approximately 20 percent of North Carolina's total population, yet African Americans are not equally distributed throughout the state; see Figure 5. Specifically, the central Piedmont and eastern Coastal Plains regions, have the highest shares of African Americans located in underbounded and unaffected areas, whereas underbounded and unaffected areas, to the west in the Appalachian region, African Americans make up smaller shares of the total population. On average, approximately a quarter of African Americans live in cities, 12 percent live in unaffected areas outside of a city, and 15 percent of African Americans live in underbounded areas that have been systemically excluded from municipal jurisdictional boundaries. Generally, African Americans are only slightly more likely to be in underbounded areas rather than unaffected areas, however, in certain counties African Americans are overrepresented in both underbounded and unaffected areas. In Halifax North Carolina, nearly two-thirds of its underbounded population and nearly 50 percent of its unaffected population consist of African Americans. This finding suggests that a considerable number of counties have an unincorporated fringe that is predominately Black.

Figure 5. Proportion of Black population in Underbounded and Unaffected Areas



A majority of counties have similar shares of African Americans in underbounded and unaffected areas, but a considerable share of counties have underbounded Blacks substantially more compared to the unaffected Black populations. Figure 6 reveals the magnitude of the disproportionate share of African Americans, represented by the absolute value of the difference between the share of African Americans in underbounded and unaffected areas, but the figure also highlights the spatial location where African Americans are disproportionately found within that county. A positive number indicates higher share of African Americans in underbounded rather than unaffected areas, and vice versa. More than 60 percent of the counties in North Carolina have modest differences, zero to five percentage points, in their African American composition. Almost three-fourths of these counties have underbounded areas that are marginally more African American than their unaffected areas. However, in several counties there is a clear disparity between underbounded and unaffected areas' Black populations. For example, on average Cleveland, North Carolina has an unaffected Black population that is 23.66 percentage points larger than its underbounded Black population; see red polygon in Figure 6. Cleveland is the only county that has an unaffected Black population at least 10 percentage points greater than the underbounded Black population whereas 22 counties (27 percent) have underbounded Black populations that are at least 10 percentage points higher shares of Black residents than in the unaffected area. For instance, Casewell North Carolina's underbounded area has on average, a Black population nearly 40 percentage points greater than its unaffected Black population. Analysis of the correlation between the underbounded area ratio and the racial disparity in underbounded and unaffected areas suggests that as the difference between the Black underbounded and Black unaffected areas' population increases, the size of the underbounded area relative to the size of the city increases only slightly ($r = 0.1005282$). Interestingly, I find as the average difference in underbounded and unaffected Black populations increases, the total county population somewhat decreases; this could indicate that racial exclusion is greatest in rural counties ($r = -0.1049666$).

Figure 6. Average Black Difference in Underbounded and Unaffected Areas



DISCUSSION AND CONCLUSION

Municipalities in North Carolina have severely gerrymandered their municipal boundaries. In North Carolina it is not uncommon for municipalities to be highly gerrymandered, exhibiting both distinct spatial patterns of targeting and avoidance. Across the state, one-fifth of counties have underbounded areas greater than the size of the county. Although cities are highly gerrymandered in North Carolina, the extent of gerrymandering is not an ideal indicator of racial exclusion of African Americans from municipalities. Cities that have engaged in the greatest share of underbounding of Blacks are on average only moderately gerrymandered. Nevertheless, gerrymandering is ubiquitous in the state and a substantial number of municipalities have manipulated their jurisdictional boundaries to simultaneously seek out and circumvent certain unincorporated communities.

Municipal underbounding is a complex, nuanced phenomenon that disproportionately affects African Americans; however, without the use of block-level spatial analysis it is difficult to identify patterns of racial exclusion. Black underbounding is prevalent throughout North Carolina, but the Eastern portion of the state has the greatest share of African Americans being underbounded. Patterns of racial exclusion are most blatant in rural counties with lower shares of African Americans and along the edge of cities with smaller unincorporated fringe populations. Spatial analysis reinforces the finding that cities with less populated fringes are selectively annexing White areas while deliberately avoiding all predominately Black communities adjacent to the city. These findings corroborate previous case study research that finds that small towns in North Carolina deliberately avoid annexing small predominately African American fringe communities (Johnson et al., 2004; Joyner & Christman 2005; Marsh et al., 2010).

Municipal underbounding is used by municipalities as a tool to prevent African American communities from full participation in local political processes. Cities that have underbounded the greatest share of African Americans have lower shares of African Americans within the municipality and larger shares of African Americans on their jurisdictional fringe. My findings are consistent with Lichter et al.'s (2007) discussion of the Black "threat" hypothesis, which suggests that Whiter cities are unlikely to annexation places in which the Black fringe population exceed that of the municipality. Additionally, my results corroborate Aiken's (1987) conclusion that the annexation of majority African American communities into a predominately White city jeopardizes the local political power structure. Gerrymandering municipal boundaries dilutes the

voting strength of incorporated African Americans and denies underbounded Black communities the opportunity to participate in local political processes.

In the end, my research affirms previous scholarship that highlights race as a key determinant in the annexation and exclusion of unincorporated communities. Municipal gerrymandering in North Carolina is very pervasive and spatial analysis makes clear that African American populations are directly impacted by these boundary manipulations. Since the invalidation of Section 5 of the Voting Rights Act, which oversaw annexation procedures, municipalities previously subject to DOJ oversight engage in exclusionary annexation procedures unchecked (Durst, 2018). The reenactment of Section 5, in addition to other quasi-legislative approaches, have been seen to reduce racial exclusion of minority communities and could be used to infill previously underbounded areas (Mukhija & Mason 2013; Durst 2018; Durst et al., 2021). However, other options may also prevent such boundary manipulations. For example, implementing a state compactness standard would ensure that municipalities expand their jurisdictional boundaries to the next closest unincorporated communities adjacent to the city. Future policy should consider these approaches to minimize future and correct past annexation procedures that contribute to the underbounding of African American fringe communities.

The methods used in this study allow for a standardized and spatially precise analysis of municipal boundary delineations that have targeted and underbounded unincorporated communities in North Carolina. However, the methods here do not examine economic factors that could potentially influence a municipality's decision to aggressively target or consistently avoid fringe communities. In part, this is due to a lack of income data collected by the U.S. Census at the block level. However, future scholarship should investigate the spatial relationship between block-level demographic and tract level economic factors to identify if in North Carolina race and economic are statistically important variables in annexation processes. In addition to the incorporation of economic data, future research should explore the outcomes of petitions for municipal incorporation through and examine if and to what extent community demographics aid or hinder efforts for municipal incorporation.

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