The Life of North American Suburbs

Imagined Utopias and Transitional Spaces

Edited by **JAN NIJMAN**

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Introduction

Until the middle of the 20th century, the social ecologies of metropolitan America could be conceptualized accurately by the textbook models of Alonso (1964), Burgess (1925), and Hoyt (1939) in terms of processes of congregation, segregation, bid-rent, and sequent occupancy – all of which pivoted tightly around a dominant central business district and transportation hub. Since the middle decades of the 20th century, however, remarkable changes have transformed metropolitan America. In spite of these considerable changes, only passing attention has been given to how these changes have been transcribed into the settlement patterns of cities and metropolitan areas. Have the stereotypical patterns of the Chicago School and of Murdie's famous model (1969) shown signs of giving way to a more complex social spatial structure? Or should Los Angeles be considered the paradigmatic postmodern American city? All these questions remind us to reevaluate the contemporary importance of traditional theories and to test our long-standing ideas about how cities grow and change.

In this chapter, a set of cluster analysis and GIS-based spatial analyses have been developed to capture the spatiotemporal patterns of neighbourhood change in the North Carolina Piedmont region based on an analysis of decennial census tract data between 1980 and 2010.[1] This chapter focuses on (1) the spatial patterns of neighbourhood distribution; (2) neighbourhood transformation over the past three decades; and (3) the spatial patterns of neighbourhood transformation over time. We examine the spatiotemporal patterns of high-resolution changes of socioeconomic development and show how macro-level socioeconomic changes have reshaped neighbourhoods and altered the spatial structure of the metropolis.

Socioeconomic Change in the Piedmont Metropolitan Region

The Piedmont metropolitan region, including Charlotte-Gastonia-Rock Hill (CGR), Raleigh-Cary (RC), and Durham-Chapel Hill (DC) metropolitan statistical areas (MSAs), refers mainly to the hilly plateau between coastal plains and mountains in North Carolina. The fast-growing development in the North Carolina Piedmont region is somewhat typical of the US. For more than a hundred years this vast rural area that formerly produced cotton and tobacco has developed textile, processing, and other related industries. The Piedmont has been the most populated region in North Carolina (NC) for nearly a century (Meade, 2008) and for decades has been the top metropolitan area, showing continued significant growth, strong competitiveness, a strong economy, and one of the best living areas in the state (Frey, 2005, 2010; Hughes, 1990; Katz, 2010; Meade, 2008).

The Charlotte–Gastonia-Rock Hill MSA is anchored by the city of Charlotte. Hanchett (1998) has described how the city's early development involved a "sorting out" along racial and class lines. Initially driven by economics, an original antebellum "salt and pepper" ecology of spatially intermixed African American and White populations gave way to a "patchwork quilt" of racial segregation in the 1880s. A booming textile economy at the turn of the 20th century produced new wealth that quickly found expression in streetcar suburbs that were sharply segregated through restrictive covenants. After the Great Depression, the city's social ecology changed again in response to modernization and the advent of the automobile, developing – like many other North American cities – a sectoral pattern in terms of income and race. By the mid-20th century, the basic layout of modern Charlotte had been formed, with wealthy and upper middle class White families dominating the south and southeast of the city, while the north and west sides were dominated by the more modest homes of the city's large African American and working-class White populations.

Raleigh's sociospatial development followed a similar chronological pattern, but with a different geography. Here the locus of affluent White neighbourhoods was in the north of the city, while poor African American neighbourhoods were concentrated in the south. While Charlotte and Raleigh both presented a clear demarcation between rich White and poor African American populations, with each occupying one end of the city, Durham developed a distinctively different social ecology. African American business thrived in Durham, a unique phenomenon in the early South. The hub of African American businesses was Parrish Street, widely known as "Black Wall Street," adjacent to the town's tobacco warehouses. The early streetcar suburbs in Durham, in

contrast to those in Charlotte and Raleigh, were largely established to serve African American communities such as Trinity Park, Morehead Hills, Club Boulevard, and Needmore (Turner, 2002).

Since the mid-1970s, the population of the Piedmont region has grown rapidly (Berube, Katz, & Lang, 2006; The Brookings Institution, 2000). The population of Charlotte-Gastonia-Rock Hill MSA was 829,824 in 1980, and by 2010, it reached 1,758,038. The population of Raleigh-Durham-Cary combined statistical area (CSA) reached 1,634,847 by 2010 from just over 635,131 in 1980. Central city Charlotte, for example, topped the American core-cities list with a 70% population growth rate (Landis, 2009). Migrants and immigrants, drawn first by manufacturing jobs, relocated from the deindustrializing northeast and then – and in much greater numbers – by the growth of "new economy" jobs in banking, advanced business services, digital technologies, and biotechnology, contributed to rapid growth.

One aspect of this growth in the Piedmont has been changing family structure, including a growth in the numbers of married couples with children, single-person households, and senior households. The Piedmont metro areas also became an immigration gateway in the 1990s, resulting in a marked increase in foreign-born populations, especially Hispanics and Asians (Singer, 2004; Smith & Furuseth, 2004). Meanwhile, racial segregation and its attendant inequalities have persisted within the Piedmont metro areas, despite an overall increase in affluence (The Brookings Institution, 2000).

Another aspect of this growth has included changing employment structure. As those regions have grown, the spatial locations of some sources of employment have become more decentralized, such as in Charlotte MSA; some may have experienced small changes in the spatial locations of employment, such as in Durham MSA (Kneebon, 2009). With respect to job creation and job sprawl, Weitz & Crawford (2012) used 2001–6 data to show that Raleigh MSA and Charlotte MSA gained in job creation but decreased in job accessibility. In another study, Stoll (2005) showed that Charlotte and Raleigh MSAs experienced relatively higher job sprawl but lower job mismatch for African Americans among 300 metropolitan areas based on year 2000 data.

An important factor in the growth of the Piedmont metros has been the Research Triangle, anchored by the University of North Carolina (Chapel Hill), Duke University (Durham), and North Carolina State University (Raleigh). The Triangle has been listed among the nation's top high-tech regions in terms of labour-force quality (Koo, 2005), top competence, and top population gains since the 1990s (Landis, 2009). Centred on Research Triangle Park, this area has fostered the growth of the region's new economic industries. Just as in other metropolitan regions, these employers have sought new settings well away from

congested central city areas. The result has been the emergence of a "metroburban" metropolitan form (Knox, 2008), with a polycentric structure that incorporates urban realms and corridors, "edge cities," "edgeless cites," "exurbs," "micropolitan" centres, and "boomburbs."

The Piedmont was historically a rural agricultural region but has now urbanized so much that it is swarming with the largest and fastest growing cities. Now what characterizes the Piedmont region, especially the cities of Charlotte, Raleigh, and Durham, are fast-growing, vibrant job centres for financing and hi-tech, top population growth, and racial diversification.

Data and Methods

The primary source of the data used in this study at the census tract level from 1980 to 2010 is derived from the Longitudinal Tract Data Base (LTDB) and prepared by Spatial Structures in the Social Sciences (S4). To track neighbourhood changes directly over time, we use the LTDB data that have been standardized to 2010 boundaries. Central cities of 1980 are identified based on the indicator in the Neighborhood Change Database (NCDB) produced by the Urban Institute and GeoLytics. The boundaries of the 2010 census used in GIS analysis are from the National Historical Geographic Information System (NHGIS). The central city boundaries are those of 1980, and therefore some suburban tracts in 1980 might have become central city tracts in 2010. This will affect the numbers and proportions of clusters in 2010 to a certain extent. However, the focus of this study is the spatial pattern of neighbourhood change, and the boundaries of central cities will not influence the patterns of spatial distribution and transformation.

Census tracts with populations lower than 200 in each census year have been excluded from the analysis to avoid estimations based on a small number of data. After excluding these tracts and tracts with missing data, the pooled data include a total of 2,874 tracts (632 tracts in 1980, 740 tracts in 1990, 749 tracts in 2000, and 753 tracts in 2010). All variables for each tract were standardized as z-scores relative to all the other tracts in the same census year. The major advantage of our study is that it allows direct comparisons of the relative importance and spatial organization of each major tract type from one census year to another. When analyzing the spatial changes of socioeconomic distribution from 1980 to 2010, only those tracts that have specific typologies in both census years (629 tracts both for 1980 and 2010) were included in the analysis.

In seeking to delineate the sociospatial transformation of these Piedmont metros, we have pooled the standardized tract-level data from 1980 to 2010 for the three MSAs and employed a k-means cluster analysis to
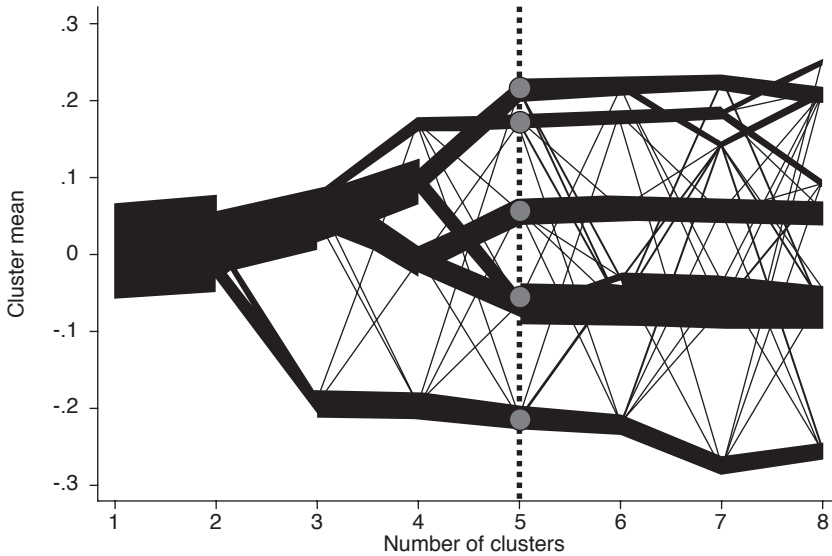
Figure 5.1 Visualization of clusters via clustergram.

develop the overall typologies. K-means is a method of cluster analysis that partitions N observations into k clusters. In this process, each observation belongs to the cluster with the nearest mean. To identify the number of clusters that are relatively stable, we relied on a data-visualization technique – clustergrams – to guide the choice of the number of clusters. The clustergram is used to examine how the members of these clusters are formed as the number of clusters increases. The width of the line segments indicates the number of observations that are assigned to a cluster. Ten variables related to demographics, socioeconomic status, and housing characteristics were selected based on the literature of neighbourhood typologies (Hanlon, 2009; Kitchen & Williams, 2009; Mikelbank, 2004, 2011; Morenoff & Tienda, 1997). To determine just how the spatial patterns of Piedmont metros have changed since 1980, we have drawn on tract-level decennial census data on this standard set of ten socioeconomic variables. We first divided the pooled data into two to eight clusters using k-means algorithms. The three to five group solutions have the relatively larger values based on the Calinski/Harabasz pseudo-F test. Then, a clustergram indicates the relative stability of the five-cluster choices (figure 5.1). Thus, our analysis is based on the fivefold classification of census tracts in the Piedmont metros.

Table 5.1 Z-score means across clusters

Variable	Middle class	Lower/ aging	Black/ poor	Upper income	Immigrant/ renter
Demographic					
Percentage of persons age 17 years and under	0.29	0.10	0.51	0.49	−1.09
Percentage of persons age 60 years and over	0.04	0.73	0.17	−0.40	−0.33
Percentage of persons of Black race, not Hispanic origin	−0.22	−0.14	2.42	−0.69	−0.03
Percentage of foreign born	−0.38	−0.61	−0.24	0.35	1.07
Socioeconomic status					
Percentage of persons with at least a four-year college degree	−0.25	−0.91	−0.93	1.27	0.61
Percent unemployed	−0.32	0.27	1.77	−0.59	−0.07
Percentage of manufacturing employees (by industries)	−0.17	1.46	−0.20	−0.34	−0.77
Median household income	0.11	−0.62	−1.23	1.53	−0.44
Housing characteristics					
Percentage of owner-occupied housing units	0.58	0.19	−1.11	0.65	−1.24
Percentage of vacant housing units	−0.33	0.10	0.54	−0.14	0.18

Table 5.1 lists the means of the ten variables for the five clusters. A significant group of tracts are dominated by *middle class* households – the classic demographic of America's "sitcom suburbs" (Hayden, 2003): family-oriented, White, and relatively stable home-owning households. In comparison, *lower/aging* tracts have lower homeownership and median household incomes with a relatively higher proportion of seniors. *Black/poor* tracts are characterized by the highest percentages of African American populations and the lowest median household incomes. We describe the fourth group of tracts as *upper income*: households with significantly higher than average median household incomes, as well as the highest proportion of persons with a higher education. *Immigrant/renter* describes those tracts with the lowest homeownership and the highest proportions of foreign-born populations. It should be emphasized that these results reflect the dominant general patterns among the pooled tract data for the period 1980 to 2010.

Table 5.2 Populations by cluster

Year	Total tracts	Middle class	Lower/ aging	Black/ poor	Upper income	Immigrant/ renter
1980	632	342,756	313,787	186,017	224,807	233,931
1990	740	532,238	472,646	209,501	292,937	401,728
2000	749	813,804	580,484	220,320	434,422	502,557
2010	753	1,259,841	575,685	301,266	617,502	636,792

Table 5.3 Distribution (tracts%) of clusters

Location	Year	Total tracts	Middle class (%)	Lower/ aging (%)	Black/ poor (%)	Upper income (%)	Immigrant/ renter (%)
Suburbs	1980	509	38.90	22.00	6.09	21.02	11.98
Suburbs	1990	618	39.00	23.14	4.37	18.77	14.72
Suburbs	2000	627	36.52	24.88	4.31	20.41	13.88
Suburbs	2010	631	37.40	20.44	7.45	19.02	15.69
Cities	1980	123	13.01	5.69	30.08	16.26	34.96
Cities	1990	122	9.02	2.46	32.79	10.66	45.08
Cities	2000	122	8.20	3.28	31.15	9.02	48.36
Cities	2010	122	5.74	4.92	31.97	12.30	45.08

Changing Spatial Patterns of Neighbourhood Distribution

This section revolves around the question of what spatial patterns of neighbourhood distribution may be discerned in the Piedmont region. Given the nature and extent of changes in metropolitan form and in social and demographic structure, it is reasonable to expect that the remarkably consistent social ecology of mid-20th-century North American cities – zones, sectors, and clusters – has evolved in significant ways. The contemporary urban social fabric might be fragmented at the fine-grained level but integrated at the macro level (Marcińczak & Sagan, 2011). Thus, we expected a consistent pattern in the spatial expression of neighbourhood distribution.

Plotting the spatial distribution of each tract type over the three decades reveals some interesting patterns in segmentation, diversification, and evolution of different socioecological settings in the North Carolina Piedmont region. Tables 5.2 and 5.3 summarize the populations and distributions of clusters. Given the overall growth of MSAs over
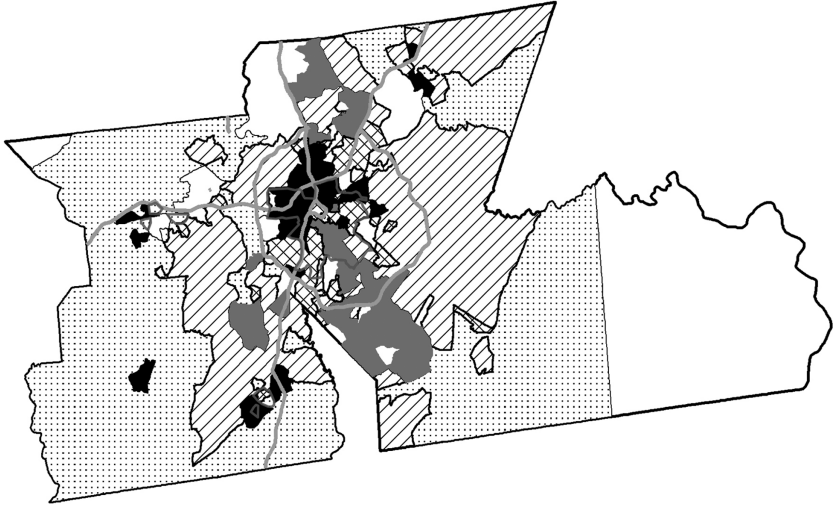
Figure 5.2 Spatial patterns of clusters in CGR MSA in 2010.

the period, the general trend for most tract types is towards an increase in aggregate populations and tract numbers, but the percentages of tracts vary by tract types. Figures 5.2 and 5.3 show the spatial patterns of the five types of neighbourhoods in CGR MSA and RDC CSA in 2010. Generally speaking, *immigrant/renter* and *Black/poor* tracts are generally located near urban cores. *Middle class* socioecologies form rings in the suburbs of the region. The *upper income* neighbourhoods occupy one or several sectors. The *lower/aging* tracts are located generally in outer suburbs and exurbs. In many cases, *immigrant/renter* tracts occupy the sectors between *Black/poor* and *upper income* neighbourhoods. Using the extended urban region – the North Carolina Piedmont – as the basis for the empirical analysis, a spatial model (Piedmont model) is developed and illustrated in figure 5.4.

In contrast to our expectations, cities are still organized with "zones," "sectors," and "clusters" as described in the classic urban models. The first point to make here is that the urban social patterns of Piedmont cities still bear some resemblance to the concentric zone model. A broad observation is that the *middle class* dominance in suburbs, and the *immigrant/renter* and *Black/poor* dominance in city centres have been maintained numerically and spatially throughout these decades. In the Piedmont model, neighbourhoods of immigrant/renter and
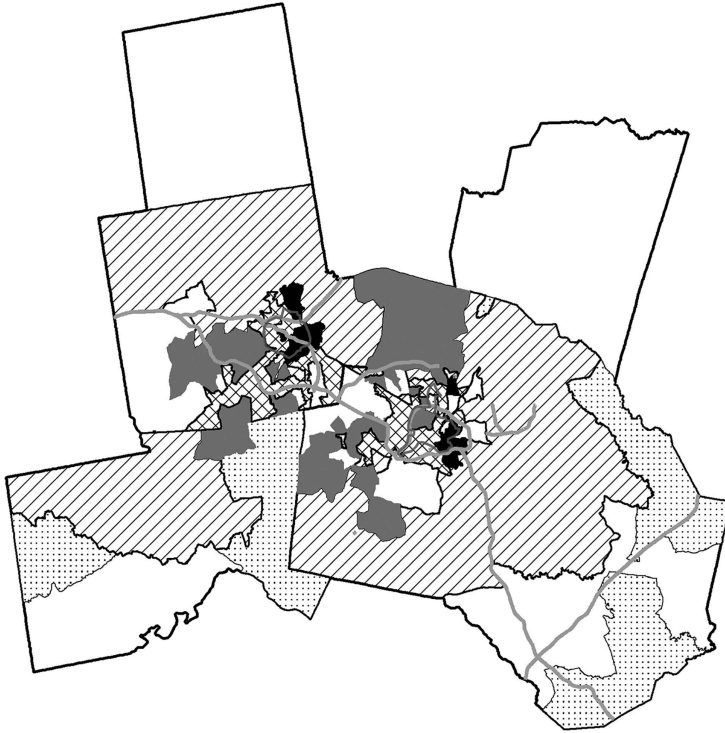
Figure 5.3 Spatial patterns of clusters in RDC CSA in 2010.

Black/poor are generally located in rings near urban cores, with the middle class in suburban rings.

At a more detailed scale, much of the sociospatial differentiation in the Piedmont region exhibits a sectoral pattern. As in most of metropolitan America, and indeed as established in the early development of the Piedmont metros, most affluent White and low-income African American neighbourhoods occupy one or several sectors; they are not only spatially segregated but located at some distance from each other. Both Charlotte and Raleigh have traditional affluent regions, barely changed except for accretion, that date back to the streetcar era. The exception, as in its own early development, is Durham, where *Black/poor* tracts are in propinquity to *upper income* White tracts. But in recent decades the upper income tracts have been separated from *Black-poor* tracts. This finding is consistent with Hoyt's sector model to a certain extent, where residential functions tend to grow in wedge-shaped patterns with sectors of low-income households and high-income households.
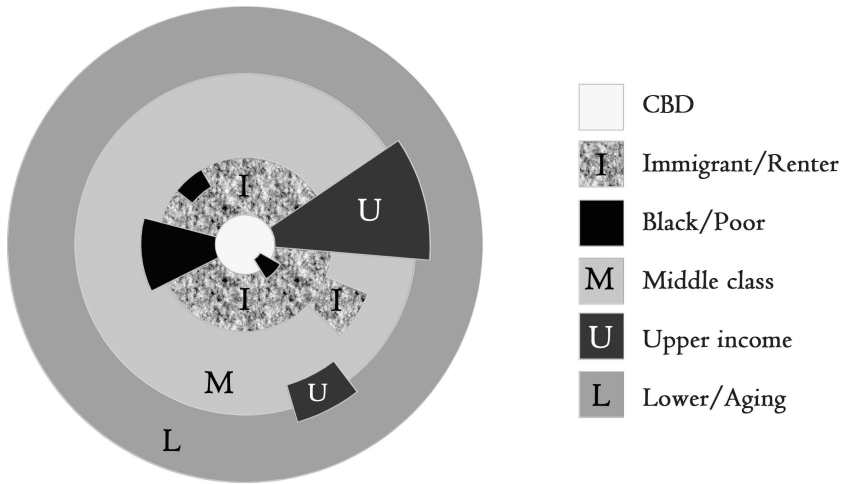
Figure 5.4 The basic version of Piedmont model.

In addition to zones and sectors, the Piedmont model also incorporates a clustered pattern for some social groups. For example, many new houses are developed on the edges of cities due to decentralization of retail, people, and jobs. In suburbs and exurbs, we see clusters of upper income neighbourhoods. Due to urban regeneration and gentrification, clusters of upper income neighbourhoods can also be found in central cities. Some other types of neighbourhoods also show signs of clusters. Most *immigrant/renter* tracts in the Piedmont region, for instance, are located near university areas. The North Carolina Piedmont region is home to a large number of colleges and universities (The Brookings Institution, 2000). These characteristics suggest that these areas have a higher education rate but lower homeownership rate. The finding that universities may attract well-educated immigrants and renters is consistent with certain aspects of the multiple nuclei model of Harris and Ullman.

Another broad observation, then, is that the sociospatial ecology of the Piedmont metros is characterized by a juxtaposition of a relatively stable structure with a growing fragmentation and diversification at a finer grained level. Since the 1980s, the Piedmont metros have become substantially postsuburban (Phelps, Wood, & Valler, 2010). Despite the dominance of the middle class in suburbia, the Piedmont region has shown an increasingly diverse and fragmented mosaic. Spatial patterns have become more diversified due to sociospatial restructuring, but the basic, traditional patterns and relative locations of neighbourhood types have remained largely stable over time. In other words, the

Piedmont region has largely remained stable in terms of overall pat-
terns of distribution but has also experienced increasing diversity at
the micro scale. Thus, sociospatial trajectories in the Piedmont are both
an extension of historical trends and a consequence of new forces, such
as new streams of migration and immigration, social polarization, and
gentrification.

Changing Spatial Patterns: Neighbourhood Succession

In this section, we look in more detail at specific trajectories of neigh-
bourhood change from 1980 to 2010 in order to investigate how socio-
economic changes are reflected in urban landscapes. Several further
observations emerge. Stability is the single greatest dimension of met-
ropolitan change; while for those neighbourhoods that have changed
their attributes, their succession and growth reveals some interesting
patterns. In this study, neighbourhood upgrading and downgrading
are identified based on changes in neighbourhood income.

   First, we focus on the succession process, defined as the sequences
of neighbourhood change where typologies of neighbourhoods
come to occupy a territory formerly dominated by another typology.
Specifically, we examine the different evolutionary trajectories of
ecological change across the Piedmont metro region. Table 5.4 illus-
trates the types of neighbourhood succession from 1980 to 2010. In
looking at the overall succession patterns of the five types of tracts in
the entire Piedmont region, we found that succession patterns differ
by clusters:

(1) *Immigrant/renter* and *Black/poor* neighbourhoods: A few *immigrant/
    renter* and *Black/poor* neighbourhoods have been upgraded into
    middle class or *upper income* neighbourhoods, especially in suburbs.
    Several *immigrant/renter* neighbourhoods in inner cities that are
    adjacent to *upper income* neighbourhoods have been gentrified into
    upper income neighbourhoods, especially in the Charlotte MSA.
    In addition, transitions between *Black/poor* and *immigrant/renter*
    neighbourhoods occurred both in central cities and suburbs of
    1980.
(2) *Upper income* neighbourhoods: The fringes of sectors of *upper
    income* neighbourhoods, especially those close to inner ring sub-
    urbs, have generally been superseded by *middle class* tracts and,
    to a lesser extent, *immigrant/renter* tracts. However, those *upper
    income* neighbourhoods located in central cities are relatively

Table 5.4 Neighbourhood succession from 1980 to 2010

	Types of neighbourhood change[a]	Total tracts	Suburbs	Cities	Suburbs (%)	Cities (%)
Middle class	11	122	120	2	98.36	1.64
succession	12	18	17	1	94.44	5.56
	13	20	12	8	60.00	40.00
	14	30	30	0	100.00	0.00
	15	23	18	5	78.26	21.74
Lower/aging	21	35	35	0	100.00	0.00
succession	22	69	66	3	95.65	4.35
	23	6	6	0	100.00	0.00
	24	2	1	1	50.00	50.00
	25	7	4	3	57.14	42.86
Black/poor	31	5	5	0	100.00	0.00
succession	32	2	2	0	100.00	0.00
	33	47	18	29	38.30	61.70
	34	4	4	0	100.00	0.00
	35	10	2	8	20.00	80.00
Upper income	41	38	33	5	86.84	13.16
succession	42	3	1	2	33.33	66.67
	43	0	0	0	-	-
	44	57	45	12	78.95	21.05
	45	29	28	1	96.55	3.45
Immigrant/renter	51	10	10	0	100.00	0.00
succession	52	3	3	0	100.00	0.00
	53	5	3	2	60.00	40.00
	54	16	14	2	87.50	12.50
	55	68	30	38	44.12	55.88

[a] Each two-digit number represents a neighbourhood type in each census year from 1980 to 2010. 1=middle class; 2=lower/aging; 3=Black/poor; 4=upper income; 5=immigrant/renter.

stable. In particular, no upper income neighbourhoods have been superseded by Black/poor neighbourhoods in the Piedmont region.

(3) *Lower/aging* neighbourhoods: Most *lower/aging* sectors in suburban and some in exurban settings have been upgraded into *middle class* neighbourhoods. Several *lower/aging* neighbourhoods in the central city of Charlotte have changed into *Black/poor*. A few have been upgraded into *upper income* neighbourhoods or changed into immigrant/renter neighbourhoods both in central cities and suburbs.

(4) *Middle class* neighbourhoods: Elsewhere within the background of *middle class* suburbia it is possible to discern two broad trajectories of change: deteriorating *middle class* tracts and strong and rising *middle class* tracts. Generally speaking, *middle class* ecologies formed rings in the suburbs of the region; the interior perimeter of these *middle class* rings was adjacent to neighbourhoods that were previously *middle class*, but have shifted to *immigrant/renter* and *Black/poor* neighbourhoods; the outer suburban exterior perimeter of the *middle class* rings, in particular in CGR MSA, tended to consist of neighbourhoods that were previously *middle class* but have emerged as *lower/aging* tracts. These outcomes confirm the invasion-succession model to a certain extent, where neighbourhoods will change as higher income residents in outer rings are invaded and finally replaced by lower income residents from inner rings. Finally, certain sectors of the *middle class* rings have changed into *upper income* tracts, a phenomenon mainly found in tracts of 1980s suburbs.

Changing Spatial Patterns: Neighbourhood Growth

In addition to these patterns of ecological succession, it was possible to identify another aspect of metropolitan change by looking at patterns of ecological transformation: the growth of a neighbourhood type through occupation of a territory that was formerly dominated by other types.

   Table 5.5 shows neighbourhood growth by type from 1980 to 2010. Patterns of growth process can be categorized into four patterns: clustering, sectoral growth, border accretion, and greenfield expansion. The ecological changes of each typology of tracts in the Piedmont region follow one or a mix of the four patterns.

(1) Clustering: The *immigrant/renter* tracts that are a distinctive feature of the 2010 maps generally emerged from neighbourhood social ecologies that were previously dominated by White populations or, in a few small patches, by *Black/poor* populations. By 2010, these newly emerged *immigrant/renter* tracts had generally developed a cluster pattern within the central cities as well as in the suburbs.

(2) Border accretion: Most new *Black/poor* areas emerged from *middle class* tracts on the border of stable *Black/poor* districts. Many new *upper income* areas have evolved from formerly *middle class* tracts on the suburban border of stable *upper income* tracts.

Table 5.5 Neighbourhood growth from 1980 to 2010

Types of neighbourhood change[a]		Total tracts	Suburbs	Cities	Suburbs (%)	Cities (%)
Middle class growth	11	122	120	2	98.36	1.64
	21	35	35	0	100.00	0.00
	31	5	5	0	100.00	0.00
	41	38	33	5	86.84	13.16
	51	10	10	0	100.00	0.00
Lower/aging growth	12	18	17	1	94.44	5.56
	22	69	66	3	95.65	4.35
	32	2	2	0	100.00	0.00
	42	3	1	2	33.33	66.67
	52	3	3	0	100.00	0.00
Black/poor growth	13	20	12	8	60.00	40.00
	23	6	6	0	100.00	0.00
	33	47	18	29	38.30	61.70
	43	0	0	0	-	-
	53	5	3	2	60.00	40.00
Upper income growth	14	30	30	0	100.00	0.00
	24	2	1	1	50.00	50.00
	34	4	4	0	100.00	0.00
	44	57	45	12	78.95	21.05
	54	16	14	2	87.50	12.50
Immigrant/ renter growth	15	23	18	5	78.26	21.74
	25	7	4	3	57.14	42.86
	35	10	2	8	20.00	80.00
	45	29	28	1	96.55	3.45
	55	68	30	38	44.12	55.88

[a] Each two-digit number represents a neighbourhood type in each census year from 1980 to 2010. 1 = middle class; 2 = lower/aging; 3 = Black/poor; 4 = upper income; 5 = immigrant/renter.

(3) Sectoral growth: The expansion of *upper income* ecologies has tended to occur along the outer border of the original *upper income* tracts, but many of them are due to the transformation of outlying *middle class* and *lower/aging* districts through upscale new developments in sectoral patterns.

(4) Greenfield expansion: Most new *middle class* districts have evolved from formerly *lower/aging* tracts, or, to a lesser extent, *upper income* tracts in underdeveloped suburban areas. Several *middle class* tracts have evolved from *immigrant/renter* and *Black/poor* suburban

tracts. In addition, tracts that became *lower/aging* also exhibited a pattern of greenfield expansion. Most of these areas transitioned from former *middle class* tracts in outer suburbs, and several from the other types of tracts.

Conclusions

In the Piedmont region, as in other US metropolitan regions, external forces such as structural economic change, secular changes in social organization and demographic structure, as well as immigration, have clearly had a significant influence in shaping trajectories of ecological change. The Piedmont region has morphed rapidly into polycentric metropolitan regions with traditional city centres and suburban employment centres, and has become an exemplar of contemporary sunbelt suburbanization.

Given the joint action of postwar external forces and historical concentration of poverty and racial minorities, the Piedmont has evolved rapidly into segmented, diversified, and polarized socioecological settings and a more pronounced polycentric metropolitan form. Across the Piedmont metro region, relatively stable spatial patterns of historical trends at the macro scale have shown to be juxtaposed with growing fragmentation and diversification at a finer grained level. Segregation as reflected in long-standing structural inequalities may be the reason that the Piedmont region stays largely stable over time; while new dynamics of socioeconomic change and the emerging new-economy industries are likely the reason that this region is growing into more segmented and fragmented patterns.

Investigation of neighbourhood distribution reveal something similar to the spatial patterns of the Chicago School and the typical patterns of Murdie's factorial ecology models. Framed by core cities whose social ecology still bears some resemblance to the textbook factorial ecology model of North American cities, the social ecology of Piedmont has demonstrated that, in certain cases, urban phenomena do match those of classic models. It reminds us to reevaluate the contemporary importance of traditional theories. However, it may also question the Los Angeles School's fundamental claim that Los Angeles should be considered the paradigmatic postmodern American city. Urban development in the Piedmont region suggests that similar processes might shape spatial patterns in the way that they have in other parts of the United States, such as Los Angeles. However, just as Hanchett (1998) has pointed out, the particular historical context and racial background

in the Piedmont will more likely give this process a distinctive Southern flavour.

Further, examination of the changing patterns of metropolitan transformation revealed factors that have generally been ignored by any school. By investigating the structural dimensions of metropolitan change – succession and growth patterns over the past three decades – our study shows some interesting patterns. Despite the variations in patterns of ecological succession among the five types of tracts, a commonality exists. Overall, there are several trajectories of neighbourhood ascent within central cities and inner ring suburbs; however, urban-side tracts (near city centres or inner ring suburbs) are more likely to have experienced a downward socioeconomic transition, while suburb-side tracts tended to experience an upward socioeconomic transformation. It is consistent to the invasion-succession model that neighbourhoods will change as higher income residents in outer rings are invaded and finally replaced by lower income residents from inner rings. This may also reflect certain aspects of central city and inner ring suburban decline and the prevailing process of suburbanization. Meanwhile, this study also identified four types of patterns resulting from ecological growth: clustering, border accretion, sectoral growth, and greenfield expansion. This implies the selective operation of a variety of sociospatial processes, including segregation/congregation, filtering, invasion/succession, redevelopment and gentrification, and greenfield development.

Without comparing the changing spatial patterns of neighbourhood distribution and transformation in other metropolitan areas, it is difficult to generalize these patterns to other regions in the United States. This study only uses the North Carolina Piedmont region as the basis for empirical analysis. The literature on urban spatial form shows differences between the East and West in the United States (Lang, Popper, & Popper, 1995, 1997) and a clear split in the eastern and western halves of the sunbelt (Lang, 2003; The Brookings Institution, 2000). The North Carolina Piedmont urban complex is a clear exemplar of the southeastern form, which shares a rough spatial equivalent in regions such as Nashville and Atlanta. Yet this form is different from that in the Southwest, and even from, say, relatively nearby South Florida. Due to the limited generalizable nature of the findings within this study, future research is needed to compare the patterns we found across regions, such as western (or Midwest and Northeast) US metropolitan complex of comparable urban scale and population. By discovering what similarities or differences may exist, we can discover whether and to what

extent that the Chicago School theories about the social ecologies of the early 20th century explain today's metropolitan structure.

NOTE

1 We are grateful to David Bieri, Virginia Tech, for assistance with data compilation and analysis.

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