Open Spaces, Bounded Places: Does the American West's Arid Landscape Yield Dense Metropolitan Growth?

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Abstract

This article presents data on the 50 largest metropolitan areas in the United States to compare the metropolitan population density in the eastern and western parts of the country. The data show that the West often has more densely settled metropolitan areas than the East, especially when compared with the Southeast. The difference is due in part to the arid and rugged environment in the West.

The article also develops a new understanding of Sunbelt development by comparing its eastern and western halves. The growth patterns of the Sunbelt are often contrasted with those of the Northeast and Midwest, the assumption being that its newer metropolitan areas share a common, lower-density urban form. However, this study shows that intraregional differences within the Sunbelt make such comparisons difficult and deceptive.

Keywords: Land use; Sprawl; Urban policy

Introduction

> [The West's] vast open spaces create the illusion of a continuing opportunity that its prevailing aridity prohibits. (Stegner 1982, 163–64)

Wallace Stegner, a writer known for vivid descriptions of western landscapes, often commented on how the American West contrasts with the East. He especially focused on their different physical environments and how the dry lands of the West often dashed the hopes of those who sought to settle them like they had the East. His comment captures the West's often contradictory mix of possibilities and limits.

This article also contrasts East and West. Although the differences between the regions may be a bit muted today compared with the 19th century, their metropolitan growth patterns remain somewhat distinct, due in part to environmental forces.

The United States so effectively built great metropolises in diverse settings that it is easy to overlook the role environment plays in shaping metropolitan development. The built environments of hot and dry Phoenix and hot and humid Atlanta seem similar. In both cases,

technology overcame whatever limitations nature once placed on their growth.

Yet research also shows that the eastern and western halves of the country developed differently over the past 150 years (Lang, Popper, and Popper 1995, 1997). The difference is due in part, as Stegner (1982) notes, to the environment in the West. Nine-tenths of the region west of the 100th meridian (which roughly cuts the United States in two) is arid or semiarid, the major exception being the Pacific Northwest. The aridity and rugged terrain of the West at times slowed or altered a broad, continuous rural settlement (Lang, Popper, and Popper 1995). Over the years, many researchers have made a similar observation, including Sparks (1902), Bowman (1931), Webb (1932), Worster (1985), and Popper (1986). But the effect of the West's environment on metropolitan growth patterns has only recently emerged as an issue (Lang 2000c; Lang, Popper, and Popper 1997).[1]

This article assumes that western urban expansion is constrained by three key forces[2]:

1. *Aridity.* Outward expansion often requires an expensive extension of the metropolitan water supply. The surrounding rural hinterland that does not share this water supply may not be able to sustain even moderate exurban development such as large-lot subdivisions (Lang, Popper, and Popper 1997).

2. *Public and Indian lands.* The West's aridity resulted in its having more public lands (Popper 1986). Western metropolitan areas, especially those in the Intermountain West, are often surrounded by nonprivate land holdings (Fulton 2000).

3. *Slope.* The West, including the Pacific West, is mountainous, and thus buildable land there is often limited. Many of the Pacific metropolises are built on coastal shelves between the mountains

[1] The environment and landform in the East also shaped its metropolitan development. Many East Coast cities are on bays or are split by rivers. Some inland cities such as Pittsburgh are in narrow river valleys. Metropolitan areas on the Great Lakes, such as Chicago and Cleveland, wrap around the shoreline in great semicircles. Even inland cities, such as Houston, on flat terrain, have urban forms that are influenced by large wetlands and other natural barriers. But, in general, it is likely that western metropolitan areas face more severe constraints to their expansive and outward growth than those in the East.

[2] Metropolitan areas throughout the nation are also contained by public policies such as urban growth boundaries (Nelson and Dawkins 2003). Given that these policies are often independent of the physical limits focused on here, they are not considered in this article.

> and the sea. Land that seemed unlimited when these cities began often ran out by the late 20th century (Findlay 1992; Fishman 1987). The resulting land shortage can drive up costs and reduce building lot sizes.

Still, to many observers the western metropolis seems to sprawl (for example, see Egan 1996). Most characterizations of places such as Los Angeles mention their sprawl. Some even refer directly to "LA-style sprawl" (Ewing 1997). The problem is that the West's urban landscape is often misread. Consider, for example, a recent report published by the Brookings Institution on metropolitan Atlanta, which compares the region with Los Angeles (Brookings Institution 2000). By and large, it is a good report. But it also contains the following passage:

> Atlanta is not, nor has it ever been, a large dense urban center like Philadelphia or New York. Its patterns of growth have been much more akin to Sunbelt cities like Los Angeles rather than other urban centers of the East Coast. (Brookings Institution 2000, 32)

Los Angeles is equated with Atlanta in that they are both mostly products of a common low-density, postwar, Sunbelt development. However, this article will show that there are two distinct patterns of Sunbelt metropolitan growth—eastern, or wet Sunbelt development, and western, or dry Sunbelt development. To paraphrase Stegner (1982), Los Angeles gives the "illusion" of Atlanta-like sprawl, which its physical environment often "prohibits."

Much of the settlement in the West remains in metropolitan areas, making the region the most rural (in land area) and the most urban (in population) in the nation (Lang and Hornburg 1997; Lang, Popper, and Popper 1995). The metropolitan West sits in a vast sea of open space (Abbott 1993). The space seems limitless—yet the western metropolis is relatively contained. Containment may, as this article indicates, increase population density in some western metropolitan areas.

This often dense metropolitan development is only starting to be understood. Descriptions of western growth now include such labels as "dense sprawl" (Fulton 2000) and the "dense onion" (John Landis, personal conversation, September 16, 2000). Even a recent *USA Today* story noted the West's limits on sprawl in contrast to the East's urban expansiveness:

> A key finding of the [*USA Today's*] sprawl index is the impact of geography and water. Mountains and other natural barriers and limited supplies of water have prevented many Western cities from

> sprawling; flat land and plentiful water have allowed most Eastern cities to grow as they please. (El Nasser and Overberg 2001, A1, A8)[3]

I use data on changing metropolitan density patterns to compare the West's urban development with the East's. As Director of Urban and Metropolitan Research at the Fannie Mae Foundation, I commissioned several projects that measured sprawl. Many of the data and observations that appear in this article derive from this research agenda.[4] The sprawl projects include research by Downs (1999), Galster et al. (2001), and Fulton et al. (2001). In addition, the Brookings Institution funded my research on the spatial distribution of office development (Lang 2000a, 2003).

This article begins with a brief comment on western settlement history that places its modern development patterns in context. A methods section follows. Various data comparing density in the nation's 50 largest metropolitan areas are then presented.[5] These data are not intended to be a definitive measure of sprawl, but rather to show basic differences in regional development patterns.

Understanding how western and eastern metropolitan development differ is important to public policy. Those in the New Urbanist and smart growth movements, which among other goals seek to increase urban density, typically overlook this difference (see, for example, Duany, Plater-Zyberk, and Speck 2000). I conclude by considering how growth management policies may come to better match the diverse metropolitan density patterns that sprawl research reveals.

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[3] I worked with Haya El Nasser and Paul Overberg (2001) of *USA Today* to develop the "sprawl index," which ranked all 271 U.S. metropolitan areas by density measures. The *USA Today* index is adapted from one developed by Downs (1999) in a study seeking to establish a connection between urban decline and sprawl.

[4] The preliminary findings for the Fannie Mae Foundation's sprawl research program were presented at a conference entitled " 'Fair Growth': Connecting Sprawl, Smart Growth, and Social Equity," held in cooperation with the Association of Collegiate Schools of Planning Fair Growth Conference in Atlanta, GA, on November 1, 2000 (Fannie Mae Foundation 2000).

[5] The 50 metropolitan areas in this study all exceed a million residents, except for Richmond, VA, which contains just under a million. The intent was to look only at metropolitan areas above a million, but because Richmond neared this mark and its inclusion brought the number of cases to 50, it was added.

Fannie Mae Foundation

The West's history of contained growth

The West's contained settlement pattern appears in the census's original analysis of the American frontier. Census scholars developed a density-based frontier definition in the late 19th century to track national settlement since the first census in 1790 (Gannett 1893; Walker 1874, 1875). They defined the frontier as lands with a population density between two and six people per square mile, which is much lower than in typical rural places. The frontier definition captures deep rural land.

By 1840, about half the land east of the Mississippi River had settlement that exceeded six people per square mile (Lang, Popper, and Popper 1997). It is interesting to note that, by 1990, roughly half the West (the Pacific and Intermountain states) remained frontier (Edmondson and Fost 1991; Lang, Popper, and Popper 1995). The East erased half of its frontier in the early industrial era—the West did so at the end of the 20th century. Although the West was settled later than the East, this delay alone does not account for why so much open space has remained in the region even into the 21st century.

Despite the relatively limited reach of settlement, urban centers in the West grew rapidly. This seeming contradiction of a large, evenly expanding frontier amid rapid urbanization perplexed 19th-century scholars. Henry Gannett, the U.S. Bureau of the Census's first geographer, went so far as to label the pattern "peculiar" (1903). Commenting on the West's 1890s urban population boom, he noted:

> It is a peculiar fact that, in spite of the great increase in the population of [the] continental United States from 1890 to 1900, the unsettled area also increased, principally in the Western states. In these states, however, the population of settled area increased sufficiently to balance the loss in sparsely settled districts, and the density of population for the state and territory as a whole, did not decrease. (Gannett 1903, 36)

A century ago, the West was showing a pattern of growth that distinguished it from the East to such an extent that social scientists were hard-pressed to explain it. To some degree, the confusion continues. The wide-open spaces ringing western metropolitan areas are deceptive; their ruggedness can often inhibit urban expansion. As the following data indicate, many urban parts of the West remain bounded places surrounded by open spaces.

Methods

The literature on sprawl shows it to be a multidimensional phenomenon (Burchell et al. 1998; Galster et al. 2001; Malpezzi 1999; Peiser 1989; Torrens and Alberti 2000). The literature is also divided on whether sprawl is a condition or a process (Burchell et al. 1998; Torrens and Alberti 2000). This article does not measure sprawl, but rather one key dimension of it: metropolitan density. Density is sometimes used in this study and others as a rough proxy for sprawl. Density is the most common (and perhaps most important) indicator of sprawl (Black 1996; Burchell and Listokin 1991; Burchell et al. 1998; Calthorpe and Fulton 2001; Danielsen, Lang, and Fulton 1999; Gordon and Richardson 1997; Lockwood 1999; Moskowitz and Lindbloom 1999; Orfield 1997). Here, density is treated as a condition and a process by including both static and dynamic measures. The data come from the U.S. Bureau of the Census (1999) and the National Resources Inventory (NRI) compiled by the U.S. Department of Agriculture (2001).

Census data are used to calculate the percentage of a metropolitan area's population that lives in an urbanized area. The 1990 census defined "urbanized area" as those parts of the metropolitan area with 1,000 or more residents per square mile. If a metropolitan area has a substantial percentage of its population living outside an urbanized area, it indicates relatively low density (Downs 1999). The reverse indicates relatively high density. Change in the percentage of residents living in the urbanized area is also important, because it shows roughly whether a region is growing more or less dense.

In the past, urban density measures were often derived from inappropriate units of analysis (Gordon and Richardson 1997). Some measured density by dividing metropolitan area population by county land area. But land within the outer metropolitan counties is often rural, and thus the density denominator could be distorted. Consider the eastern counties in greater Los Angeles, which extend over miles of desert to reach the Colorado River. Density estimates for the Los Angeles metropolitan area based on county-unit calculations drop dramatically because they include deep rural land.

One way to exclude such land from metropolitan density measures is to base them on urbanized area. However, some rural land within metropolitan counties is developed at near-urbanized densities, for example, as large-lot subdivisions. This development should be included as built-up parts of metropolitan areas. A good way to estimate near-urbanized rural development is through the NRI data. The NRI reports urbanized acreage per county, and its inventory includes any land converted from agricultural to urban use regardless of density (U.S. Department of Agriculture 2001).

The million-resident cutoff was selected for two reasons. First, it resulted in more comparable cases than if all 271 metropolitan areas in the United States were included. Many of the 221 additional metropolitan areas are so small that their inclusion would distort the index ranking by skewing it toward places with well below a million residents, and scale has been shown to be an important dimension of sprawl (Torrens and Alberti 2000). Moreover, although sprawl does impact smaller metropolitan areas, the focus here is how large urban places differ. These are the metropolitan areas where a host of transportation and social equity issues (traffic and concentrated poverty, for example) are the most hotly debated (Fannie Mae Foundation 2000).

Finally, there is the issue of where the West is. Although this question is a subject of great scholarly debate (see Popper, Lang, and Popper 2001), in this study, the West begins at the row of states that runs from Montana in the north to New Mexico in the south. While the grouping does not fully match the definition of the dry West based on the 100th meridian, which would include the western half of the Plains states, it is close enough for a reasonable approximation. Here, the Northeast, Midwest, and the South together constitute the "East." The Northeast and Midwest are also grouped together so as to provide a comparison with the South and the West.

Density indexes

The density index presented next is based on the U.S. Bureau of the Census's "urbanized area" (1999). An NRI-derived density index then follows. The indexes developed here are not the most comprehensive ways to measure sprawl. They do not, for example, indicate how density varies throughout the metropolis or estimate its gradient from center to edge.[6] It may be that a metropolitan area has high density, but remains mostly auto-dependent because it lacks transit and pedestrian-oriented mixed-use development (Ewing 1997). While these indexes do not address this issue, other projects within the Fannie Mae Foundation's sprawl research program do. Other sprawl studies by the Fannie Mae Foundation and the Brookings Institution (Galster et al. 2001; Lang 2000a, 2003) will be used to help interpret the density indexes by providing more context for these numbers.

[6] For a current work that reviews methods for measuring urban density gradients, see Torrens and Alberti (2000).

The urbanized area density index

Table 1 shows a density index for the 50 largest metropolitan areas in the United States based on 1999 population data (U.S. Bureau of the Census 1999). A density index ranks metropolitan areas from the least to the most dense. Each score results from two density measures. The first comes from the percentage of people within the metropolitan area who live outside the urbanized area. The second derives from the percent change in the first measure from 1990 to 1999. Each metropolitan area is ranked by these two measures from 1 to 50. The two ranks are then combined, yielding a density score. The maximum score a metropolitan area could receive is 100 (for most dense), and the lowest score is 2 (for least dense).

The key findings from table 1 are as follows:

1. All of the nation's largest metropolitan areas are losing density, but the rate of loss varies.

2. Nashville, TN, registers the lowest density score (3), and Salt Lake City has the highest (98).

3. The South accounts for the five lowest density scores (Nashville, TN; Charlotte, NC; Greensboro, NC; Austin, TX; and Atlanta).

4. The West accounts for four of the five highest density scores (Salt Lake City, San Francisco, Los Angeles, and San Diego). The exception is Miami–Fort Lauderdale, FL.

5. None of the 20 metropolitan areas with the lowest density scores are found in the West.

6. Metropolitan areas in the South account for over half of the lowest 20 density scores.

7. Portland, OR, registers the West's lowest density score (46), followed by Seattle and Denver (tied at 49).

8. Miami–Fort Lauderdale, FL, registers the South's highest density score (96).

9. Northeast and Midwest metropolitan areas are widely distributed throughout the index.

Table 1. **Density Index Based on Urbanized Area: Top 50 Largest U.S. Metropolitan Areas**

Top 50 Rank	Metropolitan Area	State(s)	Census Region	Density Index	1999 Population	Percent Urban[a]	Rank	Percent Change: 1990–99[b]	Rank
1	Nashville	TN	South	3	1,171,096	53.0	2	−9.0	1
2	Charlotte	NC	South	6	1,405,961	56.3	3	−7.4	3
3	Greensboro	NC	South	8	1,178,495	51.3	1	−4.2	7
4	Austin	TX	South	10	1,132,817	62.0	6	−6.6	4
5	Atlanta	GA	South	11	3,824,281	67.4	9	−7.6	2
6	Grand Rapids	MI	NE/MW	18	1,045,268	62.2	7	−3.6	11
7	Louisville	KY–IN	South	22	1,003,148	76.0	16	−4.5	6
8	Memphis	TN–AR–MS	South	23	1,100,230	76.6	18	−6.4	5
9	Cincinnati	OH–KY–IN	NE/MW	24	1,957,682	75.7	15	−3.8	9
10	Indianapolis	IN	NE/MW	25	1,530,570	69.4	10	−3.2	15
11	Orlando	FL	South	26	1,531,635	74.2	14	−3.5	12
12	Rochester	NY	NE/MW	27	1,081,365	56.8	4	−2.6	23
13	Richmond	VA	South	28	964,695	76.9	20	−4.0	8
14	Washington–Baltimore	DC–MD–VA–WV	NE/MW	34	7,332,960	78.3	21	−3.5	13
15	Pittsburgh	PA	NE/MW	35	2,336,230	71.0	11	−2.6	24
16	Columbus	OH	NE/MW	37	1,478,498	72.4	12	−2.6	25
17	Hartford	CT	NE/MW	40	1,144,169	66.1	8	−2.0	32
18	Jacksonville	FL	South	42	1,058,981	79.2	23	−2.8	19
19	Houston	TX	South	43	4,473,439	80.2	27	−3.1	16
20	St. Louis	MO–IL	NE/MW	44	2,568,578	79.3	24	−2.7	20
21	Portland	OR-WA	West	46	2,177,308	72.7	13	−1.9	33
22	Raleigh	NC	South	47	1,101,410	59.0	5	−1.2	42
23	Milwaukee	WI	NE/MW	48	1,645,045	81.3	31	−3.1	17
24	Denver	CO	West	49	2,398,875	84.6	39	−3.8	10
25	Seattle	WA	West	49	3,457,616	80.3	28	−2.7	21
26	Boston	MA–NH	NE/MW	49	5,662,136	76.8	19	−2.1	30
27	Minneapolis	MN	NE/MW	51	2,856,786	79.9	25	−2.5	26
28	Sacramento	CA	West	51	1,691,695	76.2	17	−1.9	34
29	Detroit	MI	NE/MW	52	5,472,317	80.8	30	−2.7	22

Table 1. **Density Index Based on Urbanized Area: Top 50 Largest U.S. Metropolitan Areas** *(continued)*

Top 50 Rank	Metropolitan Area	State(s)	Census Region	Density Index	1999 Population	Percent Urban[a]	Rank	Percent Change 1990–99[b]	Rank
30	New Orleans	LA	South	53	1,310,213	82.5	35	−3.1	18
31	Phoenix	AZ	West	55	2,994,922	86.5	41	−3.5	14
32	Buffalo	NY	NE/MW	60	1,146,556	79.0	22	−1.6	38
33	San Antonio	TX	South	63	1,559,558	83.2	36	−2.4	27
34	Philadelphia	PA–NJ–DE	NE/MW	63	5,993,578	81.9	34	−2.2	29
35	Dallas–Fort Worth	TX	South	67	4,888,326	81.3	32	−1.9	35
36	Tampa	FL	South	68	2,281,537	83.3	37	−2.1	31
37	Las Vegas	NV–AZ	West	68	1,367,114	80.5	29	−1.5	39
38	Kansas City	MO–KS	NE/MW	69	1,751,214	79.9	26	−0.8	43
39	West Palm Beach	FL	South	70	1,038,254	89.9	42	−2.3	28
40	Cleveland	OH	NE/MW	74	2,910,733	83.4	38	−1.8	36
41	Providence	RI–MA	NE/MW	77	1,122,337	85.5	40	−1.7	37
42	Oklahoma City	OK	South	83	1,045,728	81.7	33	−0.1	50
43	Norfolk	VA–NC	South	84	1,547,085	90.3	44	−1.5	40
44	Chicago	IL–IN–WI	NE/MW	84	8,853,199	89.9	43	−1.3	41
45	New York	NY–NJ–CT–PA	NE/MW	89	20,196,774	91.5	45	−0.7	44
46	Los Angeles	CA	West	93	15,954,560	94.3	48	−0.7	45
47	San Diego	CA	West	94	2,798,201	93.8	47	−0.3	47
48	San Francisco	CA	West	94	6,898,680	93.4	46	−0.2	48
49	Miami–Fort Lauderdale	FL	South	96	3,630,497	98.3	50	−0.5	46
50	Salt Lake City	UT	West	98	1,281,817	97.6	49	−0.2	49

Source: U.S. Bureau of the Census (1999).

[a] Percentage of people living in the urbanized land part of the metropolitan area.

[b] Percent change in the number of people living in the urbanized land part of the metropolitan area from 1990 to 1999.

The results indicate that western metropolitan areas tend to be denser than those in the East. The contrast between the West and the South is especially noteworthy. The two regions are often lumped together as the Sunbelt, in contrast to the Frostbelt, or Rustbelt, which refers roughly to the Northeast/Midwest. Yet according to the index, their large metropolitan areas differ greatly in terms of density.

The fact that Portland (OR) has the lowest density score in the West is also interesting. Portland is famous for attempting to curb sprawl by using an urban growth boundary (Abbott 1997). Perhaps growth management policies, even highly enforceable ones like Portland's, may be less effective than natural barriers in containing low-density urban expansion.

Despite being in the South, Miami–Fort Lauderdale (FL) registered one of the highest density scores. But environment also plays a powerful role in constraining south Florida's urban growth (Lang 2003). Growth is limited to a 25-mile-wide strip between the ocean and the Everglades. Miami's metropolitan constraint is closer to that of a Pacific city trapped on a coastal shelf than an inland Southern city such as Atlanta, which can and does spread out in all directions.

The actual population outside urbanized areas is also worth noting, because it indicates the scale at which metropolitan residents live in low-density settings. The five southern metropolitan areas that scored the lowest on the density index all maintain well over a half-million people living outside their urbanized areas. In the case of Atlanta, the figure reaches almost 1.3 million. By contrast, metropolitan Los Angeles, with a population approaching 16 million, has less than a million people living outside its urbanized area. If Los Angeles had the same percentage of nonurbanized metropolitan residents as Atlanta, the figure would approach 5.4 million people, an amount nearing the population of metropolitan Detroit or Boston.

NRI density index

Table 2 shows a density index for the 50 most populous metropolitan areas in the United States ranked by NRI data.[7] A density score ranks metropolitan areas from the least to the most dense. Each score results from two density measures. The first comes from the population density per square acre (using 1997 population data). The second derives

[7] The urbanized area measure and NRI density are not meant to be compared. The two are used for purposes of illustration and to provide multiple perspectives on density.

Table 2. **Density Index Based on National Resources Inventory: Top 50 Largest U.S. Metropolitan Areas**

Top 50 Rank	Metropolitan Area	State(s)	Census Region	Density Score	1982 Density[a]	1997 Density[a]	1997 Rank	Percent Change 1982–97[b]	Change Rank
1	Nashville	TN	South	5	4.14	2.72	3	−34.3	2
2	Richmond	VA	South	10	3.89	2.82	5	−27.6	5
3	Louisville	KY–IN	South	14	5.12	3.43	11	−33.0	3
3	Oklahoma City	OK	South	14	3.93	2.99	7	−23.8	7
5	Charlotte	NC	South	15	3.02	2.41	1	−20.1	14
6	Greensboro	NC	South	17	3.44	2.74	4	−20.4	13
7	Memphis	TN–AR–MS	South	18	5.00	3.50	14	−30.0	4
7	Pittsburgh	PA	NE/MW	18	5.76	3.72	17	−35.4	1
9	Raleigh	NC	South	19	3.22	2.66	2	−17.4	17
10	Cincinnati	OH–KY–IN	NE/MW	28	4.79	3.77	18	−21.2	10
11	Minneapolis	MN	NE/MW	30	4.96	3.85	21	−22.4	9
12	Cleveland	OH	NE/MW	33	5.28	4.03	25	−23.7	8
13	Indianapolis	IN	NE/MW	34	4.24	3.58	16	−15.6	18
13	Jacksonville	FL	South	34	3.67	3.16	9	−14.0	25
15	Atlanta	GA	South	38	3.20	2.84	6	−11.4	32
16	Grand Rapids	MI	NE/MW	39	3.80	3.32	10	−12.5	29
17	Kansas City	MO–KS	NE/MW	42	4.41	3.78	19	−14.2	23
17	St. Louis	MO–IL	NE/MW	42	4.59	3.89	23	−15.3	19
19	Norfolk	VA–NC	South	43	5.21	4.22	28	−19.1	15
20	Detroit	MI	NE/MW	45	5.26	4.27	29	−18.7	16
21	Boston	MA–NH	NE/MW	46	7.78	5.65	40	−27.4	6
21	Milwaukee	WI	NE/MW	46	4.60	3.93	24	−14.7	22
21	Philadelphia	PA–NJ–DE	NE/MW	46	6.37	5.03	34	−21.1	12
24	Columbus	OH	NE/MW	46	3.99	3.53	15	−11.5	31
25	New Orleans	LA	South	50	7.15	5.64	39	−21.1	11
26	Houston	TX	South	52	3.79	3.47	13	−8.4	39
27	Rochester	NY	NE/MW	54	5.13	4.41	30	−14.1	24
28	Tampa	FL	South	55	4.35	3.86	22	−11.3	33

Table 2. **Density Index Based on National Resources Inventory: Top 50 Largest U.S. Metropolitan Areas** *(continued)*

Top 50 Rank	Metropolitan Area	State(s)	Census Region	Density Score	1982 Density[a]	1997 Density[a]	1997 Rank	Percent Change 1982-97[b]	Change Rank
29	Austin	TX	South	56	2.68	3.12	8	16.2	48
30	Salt Lake City	UT	West	59	5.79	5.00	33	−13.7	26
30	West Palm Beach	FL	South	59	3.14	3.47	12	10.5	47
32	Buffalo	NY	NE/MW	61	6.75	5.74	41	−14.9	20
33	Hartford	CT	NE/MW	63	4.65	4.16	27	−10.6	36
33	Orlando	FL	South	63	4.50	4.07	26	−9.7	37
35	Dallas–Fort Worth	TX	South	64	3.92	3.78	20	−3.5	44
35	Washington–Baltimore	DC–MD–VA–WV	NE/MW	64	6.31	5.50	37	−12.8	27
37	Seattle	WA	West	66	5.78	5.10	36	−11.8	30
38	Denver	CO	West	69	4.91	4.47	31	−9.0	38
38	Portland	OR–WA	West	69	5.75	5.10	35	−11.3	34
40	Chicago	IL–IN–WI	NE/MW	71	6.89	6.02	43	−12.7	28
40	New York	NY–NJ–CT–PA	NE/MW	71	10.04	8.57	50	−14.7	21
42	San Antonio	TX	South	72	4.89	4.53	32	−7.3	40
43	Providence	RI–MA	NE/MW	77	6.66	5.93	42	−10.9	35
44	Sacramento	CA	West	83	5.71	5.55	38	−2.8	45
45	San Diego	CA	West	87	7.84	7.50	46	−4.3	41
46	Miami–Fort Lauderdale	FL	South	89	8.25	7.93	47	−3.8	42
47	San Francisco	CA	West	91	8.28	7.96	48	−3.8	43
48	Las Vegas	NV–AZ	West	94	4.42	6.67	44	50.9	50
48	Phoenix	AZ	West	94	5.91	7.20	45	21.8	49
50	Los Angeles	CA	West	95	8.09	8.31	49	2.7	46

Source: U.S. Department of Agriculture (2001).
[a] The number of people per acre.
[b] Percent change in the number of people per acre from 1982 to 1997.

from the percent change in the first measure from 1982 to 1997. Each metropolitan area is ranked by these two measures from 1 to 50. The two ranks are then combined, yielding a density score. The maximum score a metropolitan area could receive is 100 (for most dense), and the lowest score is 2 (for least dense).

The key findings from table 2 are as follows:

1. Almost all of the nation's largest metropolitan areas lost density during the 1980s and 1990s, but three in the West gained.

2. Nashville (TN) registers the lowest density score (5), and Los Angeles has the highest (95).

3. The South accounts for 8 of the 10 lowest density scores (Nashville, TN; Richmond, VA; Louisville, KY; Oklahoma City; Charlotte, NC; Greensboro, NC; Memphis, TN; and Raleigh, NC).

4. The West accounts for 6 of the 10 highest density scores (Los Angeles, Phoenix, Las Vegas, San Francisco, San Diego, and Sacramento, CA).

5. Two of the 10 metropolitan areas with the highest density scores are found in the South (Miami–Fort Lauderdale, FL, and San Antonio).

6. None of the 25 metropolitan areas with the lowest density scores are found in the West.

7. Density scores in the Northeast/Midwest are mostly grouped in the middle of the index.

Metropolitan comparisons: East versus West

The data in table 2 clearly show a distinct metropolitan density difference between the eastern and western halves of the country. The difference can be illustrated more fully by comparing case examples. Three major metropolitan areas (above 2 million) were selected from the NRI density index for the following case analysis because they are exemplars of their respective regions (see table 2) and are roughly comparable in size (they range from almost 3 to almost 4 million people). Two places—Atlanta and Cleveland—represent the East. Phoenix represents the West. The typology in table 3 shows the relationship between population and density changes in the three metropolitan

areas. No place in the East or West is losing population while holding its density.

Table 3. **Metropolitan Typology**

Population/Density	Losing Density	Gaining Density
Gaining population	Atlanta	Phoenix
Maintaining population	Cleveland	None

Note: Based on metropolitan area population and density change from 1982 to 1997.

Table 4 shows population and density change from 1982 to 1997 in Atlanta, Cleveland, and Phoenix. The data indicate that

1. Cleveland rapidly lost population density, even though it barely gained population.

2. While Phoenix and Atlanta share a similar population growth rate, they differ dramatically in terms of density change. Atlanta lost population density, while Phoenix gained it.

3. Atlanta experienced a slower rate of density loss than Cleveland did, but it started with a much lower metropolitan density.

Table 4. **Metropolitan Comparisons**

Metropolitan Area	1982 Metropolitan Density	1997 Metropolitan Density	Percent Density Change	Percent Population Change
Atlanta	3.20	2.84	–11.4	60.8
Cleveland	5.28	4.03	–23.7	0.4
Phoenix	5.91	7.20	21.8	72.9

Note: Population density is for people per urbanized acre.
Source: U.S. Department of Agriculture (2001) and Rolf Pendall (personal communication, June 21, 2001).

The wet versus the dry Sunbelt

A key finding that emerges from the NRI density index is the difference in metropolitan density between the southwestern United States (or the dry Sunbelt) and the southeastern United States (or the wet Sunbelt). The dry Sunbelt, on the measure used here, contains the

densest large metropolitan areas in the nation; the wet Sunbelt contains the least dense ones. Two of the metropolitan areas in the case comparisons—Atlanta and Phoenix—illustrate the difference in development patterns between the wet and dry Sunbelts. Consider the forces that affect urban densities in these fast-growing metropolitan areas:

Atlanta

1. Is wet, and thus those who live in its exurbs can make use of wells

2. Is surrounded by land owned mostly by private parties

3. Is hilly, but has few places with severe slopes

Phoenix

1. Is bone dry—most of its water comes from distant artificial lakes and therefore must be piped to any location using it

2. Is surrounded by many public lands—Bureau of Land Management, Indian or military reservations, state land, national forests, and wilderness preserves

3. Is in a large valley, but runs up against steep mountains in three directions

The result is that metropolitan Phoenix has some limits. Atlanta, by contrast, seems limitless. Phoenix has a relatively sharp edge: The metropolitan area ends in master-planned communities, often with modest-sized lots. Beyond them lies open desert. Metropolitan Atlanta has a more diffuse edge: It slowly fades away in almost imperceptible increments into a rural hinterland.

Both Phoenix and Atlanta boomed during the postwar years. They were built with cars, interstates, Federal Housing Administration mortgages, and tract housing (Fishman 2000). Superficially, they seem the same, but in at least one critical way they are different—Phoenix's urban space is more than twice as dense as Atlanta's.

According to urban historian Sam Bass Warner (1972), growth patterns throughout the nation are similar at any one point in time because the prevailing "fashions" (e.g., architectural styles) and "feasibilities" (e.g., transportation technology) of the marketplace universally determine them. But perhaps Warner's observation holds true only as long as cities also share approximately the same physical environment. In the

case of Atlanta and Phoenix, two places that grew up together but grew differently, setting may have proved more crucial than timing.

According to other studies of metropolitan form, Atlanta and Phoenix do exhibit some similarities (Galster et al. 2001; Lang 2003). An important one is that both are auto-dependent. However, Atlanta is auto-dependent because of its low density, while Phoenix is high density but remains auto-dependent in part because it tends to lack mixed-use development and an urban design that accommodates pedestrians.

State-level NRI data

State-level NRI data also show the split between the wet and dry Sunbelts. Table 5 compares the population and density changes in six wet and dry Sunbelt states between 1982 and 1997. The states comprise the southeastern and southwestern corners of the continental United States. The regions had almost the same population in 1982 (33.9 and 34.6 million, respectively), and both grew rapidly over the next 15 years (27 and 33 percent). But as table 5 indicates, this growth was structured very differently.

The state data include all "developed land" as defined by the NRI, which encompasses "large urban built-up areas," "small built-up areas," and "rural transportation land" (U.S. Department of Agriculture 2001). Typically, the addition of the latter two categories lowers the population density of state built-up areas relative to metropolitan density. That is because these places are usually not as dense as large urban built-up areas. Their area is also mostly nonmetropolitan. Thus, states with large rural populations relative to their metropolitan ones will show the greatest discrepancy between state and metropolitan density figures. Even though state and metropolitan NRI-derived density figures are not fully consistent, the data reported in table 5 show that the same comparative regional density patterns found in metropolitan data mostly held true for the states.

The key findings from table 5 are as follows:

1. Because from 1982 to 1997, the wet Sunbelt added new developed land at roughly twice the rate of population growth, regional density dropped substantially.

2. The dry Sunbelt added new developed land and population in roughly equal proportions from 1982 to 1997, allowing the region to maintain its density.

Table 5. **Sunbelt State-Level Density Change, 1982 to 1997**

State/Region	Population 1982	Population 1997	Percent Change	Land Area 1982	Land Area 1997	Percent Change	Change Ratio*	1982 Density	1997 Density
Wet Sunbelt	33,919	43,086	27.0	12,525,300	19,718,700	57.4	2.1	2.71	2.19
Alabama	3,925	4,320	10.1	1,616,600	2,252,300	39.3	3.9	2.43	1.92
Florida	10,471	14,683	40.2	3,271,400	5,184,800	58.5	1.5	3.20	2.83
Georgia	5,650	7,486	32.5	2,367,000	3,957,300	67.2	2.1	2.39	1.89
North Carolina	6,019	7,429	23.4	2,416,700	3,856,400	59.6	2.5	2.49	1.93
South Carolina	3,208	3,790	18.1	1,348,900	2,097,300	55.5	3.1	2.38	1.81
Tennessee	4,646	5,378	15.8	1,504,700	2,370,600	57.5	3.7	3.09	2.27
Dry Sunbelt	34,576	46,134	33.4	7,986,400	10,794,900	35.2	1.1	4.33	4.27
Arizona	2,890	4,552	57.5	1,088,600	1,491,400	37.0	0.6	2.65	3.05
California	24,820	32,218	29.8	4,138,000	5,456,100	31.9	1.1	6.00	5.90
Colorado	3,062	3,891	27.1	1,236,500	1,651,700	33.6	1.2	2.48	2.36
Nevada	882	1,676	90.0	272,200	381,400	40.1	0.4	3.24	4.39
New Mexico	1,364	1,732	27.0	781,000	1,152,700	47.6	1.8	1.75	1.50
Utah	1,558	2,065	32.5	470,100	661,600	40.7	1.3	3.31	3.12

Sources: U.S. Bureau of the Census (1982, 1997); U.S. Department of Agriculture 1997, revised 2001.

Note: Population is in thousands; developed land area is in acres.

* Land area to population change.

3. In 1982, all six wet Sunbelt states had densities above two people per acre, but 15 years later, the number fell to just two states.

4. In 1997, the dry Sunbelt had four states with densities above three people per acre, up from three in 1982.

5. The wet Sunbelt had about half the population density as the dry Sunbelt in 1997.

6. Among the wet Sunbelt states, Alabama lost density the fastest and is now the second least dense state in the region.

7. Among the dry Sunbelt states, Nevada gained density the fastest and is now the second most dense state in the region.

Policy implications

One key policy implication that emerges from the data is that density—and, by extension, sprawl—vary enough by region that solutions to growth problems should account for these differences, which are especially dramatic between the wet and dry Sunbelts. Many of the smart growth policies that seek to limit outward urban expansion through the use of such measures as urban growth boundaries would seem far more useful in the wet Sunbelt where metropolitan densities are low and land consumption is high. Conversely, large metropolitan areas in the dry Sunbelt already face many natural constraints. Such limits may result in even less developable land, which could drive up land costs.

To the extent that density indicates sprawl, it appears that the wet Sunbelt contains the nation's worst low-density sprawl. The dry Sunbelt can also be said to sprawl, but the type of sprawl there differs from that found in the wet Sunbelt. The problem in the dry Sunbelt is related to the organization of urban space, which despite being relatively high density at the metropolitan level does not typically translate into a sense of urbanity (Lang 2003).

At the moment, the dry Sunbelt's large metropolitan areas seem to experience most of the downside of higher-density development (congestion) with very little of the benefit (vibrant urban environments) because they are not structured in a pedestrian-friendly way (Ewing 1997; Galster et al. 2001; Lang 2003). The biggest improvement will come from planning and urban design practices that mix land uses at a finer grain (Calthorpe and Fulton 2001).

To start, metropolitan areas in the dry Sunbelt need more retail mixed in with housing (Lang 2000b). The standard subdivision typically contains no stores. Street scales can also discourage pedestrian use (Ewing 1997). Yet given their often relatively high densities, dry Sunbelt metropolitan areas could eventually support more neighborhood-integrated retail and walkable environments. Construction, zoning, and financing techniques that facilitate more mixed-use subdivisions are rapidly improving and could soon benefit western cities (Lang 2000b).

The dry Sunbelt's dense urban development also results in some unique challenges. John Landis, who noted the "dense onion" pattern of western development (personal conversation, September 16, 2000), argues that a dense ring of new growth in western metropolitan areas puts stress on the infrastructure in already built-up places. Each dense layer of the onion can thus raise costs for more inner layers. There is also the issue of housing affordability. Land constraints—natural and political—limit the supply of buildable lots and can thus potentially drive up housing costs (Danielsen, Lang, and Fulton 1999; Fischel 1997). In land-constrained California, this is already the case. But some places such as Phoenix maintain reasonable housing affordability (Joint Center for Housing Studies 2002). It may be that regulatory barriers, such as strict building codes, have a more direct impact on the supply of affordable housing than land constraints do (Downs 1999; Nelson et al. 2002).

Despite the difficulties, with some improved urban designs and land use practices, dry Sunbelt metropolitan areas could soon enjoy a greater urbanity. Unfortunately, the same cannot be said for the wet Sunbelt. That region, in particular the Piedmont area, faces perhaps the worst sprawl in the nation.

If Jean Gottmann, the French geographer who first described the Northeast's "megalopolis," (1961) were still writing today, he might focus his attention on the Piedmont region. Although the new Piedmont megalopolis stretches for hundreds of miles (from Raleigh, NC, to Birmingham, AL) and is home to 11 million people, it differs from the northeastern megalopolis in one critical way. Whereas the old megalopolis was anchored by large, dense cities, the hearts of the new megalopolis are themselves low density.

Gottman's original effort (1961) to describe the Northeast megalopolis was in part precipitated by the fact that the suburbs of its large cities touched. But the new megalopolis is essentially one large, extended suburb. In the Piedmont, the heart of the wet Sunbelt, there is very little density from which to create urban places. The most effective

strategy here may be to devise land use policies that begin to develop such density from scratch.

Conclusion

This article used density data to contrast metropolitan development patterns in the nation's 50 largest metropolitan areas. Although density is not synonymous with sprawl, it constitutes an important dimension of it. Density can also indicate different types of sprawl. An analysis of density patterns points to different forms of metropolitan development in the wet and dry Sunbelts. Large metropolitan areas in the wet Sunbelt were shown to typically have lower-density sprawl, while those in the dry Sunbelt often exhibit the higher-density form. The key policy implication derived from this finding is that those seeking to change land use patterns in these respective regions, through, for example, smart growth legislation, should take into account the form of sprawl the area exhibits.

Author

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References

Abbott, Carl. 1993. *The Metropolitan Frontier: Cities in the Modern American West.* Tucson, AZ: University of Arizona Press.

Abbott, Carl. 1997. The Portland Region: Where City and Suburbs Talk to Each Other—and Often Agree. *Housing Policy Debate* 8(1):11–51.

Black, Thomas. 1996. The Economics of Sprawl. *Urban Land* 55:46–52.

Bowman, Isaiah. 1931. *The Pioneer Fringe.* New York: Holt.

Brookings Institution, Center on Urban and Metropolitan Policy. 2000. *Moving beyond Sprawl: The Challenge for Metropolitan Atlanta.* Washington, DC.

Burchell, Robert, and David Listokin. 1991. *Fiscal Studies for the Governor's Commission on Growth in the Chesapeake Bay Region.* Annapolis, MD: Maryland Office of Planning.

Burchell, Robert W., Navied A. Shad, David Listokin, Hilary Phillips, Anthony Downs, Samuel Siskin, Judy S. Davis, Terry Moore, David Helton, Michelle Gale, and ECON-Northwest. 1998. *The Costs of Sprawl—Revisited.* Washington, DC: National Academy Press.

Calthrope, Peter, and William Fulton. 2001. *The Regional City: Planning for the End of Sprawl.* New York: Island.

Danielsen, Karen A., Robert E. Lang, and William Fulton. 1999. Retracting Suburbia: Smart Growth and the Future of Housing. *Housing Policy Debate* 10(3):513–40.

Downs, Anthony. 1999. Some Realities about Sprawl and Urban Decline. *Housing Policy Debate* 10(4):955–74.

Duany, Andres, Elizabeth Plater-Zyberk, and Jeff Speck. 2000. *Suburban Nation: The Rise of Sprawl and the Decline of the American Dream.* New York: North Point.

Edmondson, Brad, and Daniel Fost. 1991. The Frontier Is Still Here. *American Demographics* 13:50–52.

Egan, Timothy. 1996. Urban Sprawl Strains Western States. *New York Times*, December 28, pp. A1, A29.

El Nasser, Haya, and Paul Overberg. 2001. A Comprehensive Look at Sprawl in America. *USA Today*, February 22, pp. A1, A8.

Ewing, Reid. 1997. Is Los Angeles–Style Sprawl Desirable? *Journal of the American Planning Association* 63(1):107–26.

Fannie Mae Foundation. 2000. *"Fair Growth": Connecting Sprawl, Smart Growth, and Social Equity*. Binder from the Fannie Mae Foundation/Association of Collegiate Schools of Planning Fair Growth Conference, November 1, Atlanta, GA.

Findlay, John. 1992. *Magic Lands: Western Cityscapes and American Culture after 1940.* Berkeley, CA: University of California Press.

Fischel, William. 1997. Comment on Carl Abbott's "The Portland Region: Where City and Suburbs Talk to Each Other—and Often Agree." *Housing Policy Debate* 8(1):65–73.

Fishman, Robert. 1987. *Bourgeois Utopias: The Rise and Fall of Suburbia.* New York: Basic Books.

Fishman, Robert. 2000. The American Metropolis at Century's End: Past and Future Influences. *Housing Policy Debate* 11(1):199–213.

Fulton, William. 2000. Thicker and Thicker: Can the "Thinning Metropolis" Learn from the Experience of a Growing Sunbelt City? Lecture given at the symposium titled *The Thinning Metropolis*, September 9, Cornell University, Ithaca, NY.

Fulton, William, Rolf Pendall, Mai Nguyen, and Alicia Harrison. 2001. *Who Sprawls the Most? How Growth Patterns Differ across the U.S.* Washington, DC: Brookings Institution, Center on Urban and Metropolitan Policy.

Galster, George, Royce Hanson, Michael R. Radcliffe, Harold Wolman, Stephen Coleman, and John Freihage. 2001. Wrestling Sprawl to the Ground: Defining and Measuring an Elusive Concept. *Housing Policy Debate* 12(4):681–717.

Gannett, Henry. 1893. The Movements of Our Population. *National Geographic Magazine* 5:21–33.

Gannett, Henry. 1903. *Statistical Atlas.* Washington, DC: U.S. Bureau of the Census.

Gordon, Peter, and Henry Richardson. 1997. Are Compact Cities a Desirable Planning Goal? *Journal of the American Planning Association* 63(1):95–106.

Gottmann, Jean. 1961. *Megalopolis: The Urbanized Northeastern Seaboard of the United States.* New York: Twentieth-Century Fund.

Joint Center for Housing Studies. 2002. *The State of the Nation's Housing.* Cambridge, MA.

Lang, Robert E. 2000a. *Office Sprawl: The Evolving Geography of Business.* Washington, DC: Brookings Institution, Center on Urban and Metropolitan Policy.

Lang, Robert E. 2000b. The Store Next Door. *Urban Land* 57(1):51–53.

Lang, Robert E. 2000c. Why Are Western Metropolitan Areas Denser than Eastern Ones? Lecture given at the symposium titled *Metropolitan Frontiers and the American West: Lessons for the East?* National Building Museum, Washington, DC, April 17.

Lang, Robert E. 2003. *Edgeless Cities: Exploring the Elusive Metropolis.* Washington, DC: Brookings Institution Press.

Lang, Robert E., and Steven Hornburg. 1997. Planning Portland Style: Pitfalls and Possibilities. *Housing Policy Debate* 8(1):1–10.

Lang, Robert E., Deborah E. Popper, and Frank J. Popper. 1995. Progress of the Nation: The Settlement History of the Enduring American Frontier. *Western Historical Quarterly* 26(3):289–307.

Lang, Robert E., Deborah E. Popper, and Frank J. Popper. 1997. Is There Still a Frontier? The 1890 U.S. Census and the Modern American West. *Journal of Rural Studies* 13(3):377–86.

Lockwood, Charles. 1999. Sprawl. *Hemispheres,* September, 82–91.

Malpezzi, Steven. 1999. *Estimates of the Measurement and Determinants of Urban Sprawl in U.S. Metropolitan Areas.* Unpublished paper. University of Wisconsin, Center for Urban Land Economics Research.

Moskowitz, Howard, and Carl Lindbloom. 1998. *The New Illustrated Book of Development Definitions.* New Brunswick, NJ: Rutgers University, Center for Urban Policy Research.

Nelson, Arthur C., and Casey Dawkins. 2003. The Containment of Urban America, or How to Really Revitalize Central Cities. *Housing Policy Debate,* forthcoming.

Nelson, Arthur C., Rolf Pendall, Casey J. Dawkins, and Gerrit J. Knaap. 2002. *The Link between Growth Management and Housing Affordability.* Washington, DC: Brookings Institution, Center on Urban and Metropolitan Policy.

Orfield, Myron. 1997. *Metropolitics: A Regional Agenda for Community and Stability.* Washington, DC: Brookings Institution Press.

Peiser, Richard. 1989. Density and Urban Sprawl. *Land Economics* 65(2):192–204.

Popper, Deborah E., Robert E. Lang, and Frank J. Popper. 2001. From Maps to Myth: The Census, Turner, and the Idea of the Frontier. *Journal of American and Comparative Popular Cultures* 23(1):91–102.

Popper, Frank J. 1986. The Strange Case of the Contemporary Frontier. *Yale Review* 76(1):101–21.

Sparks, Edward E. 1902. Irrigation and the American Frontier. *Chautauquan* 8(7):568–79.

Stegner, Wallace. 1982. *One Way to Spell Man*. Garden City, NY: Doubleday.

Torrens, Peter, and Michael Alberti. 2000. *Measuring Sprawl.* Paper presented at the Association of Collegiate Schools of Planning Conference, Atlanta, GA, November 1.

U.S. Bureau of the Census. 1982. *Population Estimates.* World Wide Web page <http://eire.census.gov/popest/archives/state/stts/st8090ts.txt> (accessed February 2001).

U.S. Bureau of the Census. 1997. *Population Estimates.* World Wide Web page <http://eire.census.gov/popest/archives/state/st-99-3.txt> (accessed February 2001).

U.S. Bureau of the Census. 1999. *Current Population Statistics.* Washington, DC.

U.S. Department of Agriculture. 2001. *National Resources Inventory: Highlights.* Washington, DC.

Walker, Francis. 1874. *Statistical Atlas of the United States Based on the Results of the Ninth Census, 1870.* New York: Scribner's.

Walker, Francis. 1875. The First Century of the Republic: Growth and Distribution of the Population. *Harpers Monthly* 51(9):391–414.

Warner, Sam Bass Jr. 1972. *The Urban Wilderness: A History of the American City.* New York: Harper & Row.

Webb, Walter P. 1932. *The Great Plains.* New York: Little, Brown.

Worster, Donald. 1985. *Rivers of Empire: Water, Aridity, and the Growth of the American West.* New York: Pantheon.