# Does "Smart Growth" Matter to Public Finance?

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U.S. Department of Housing and Urban Development Working Paper # REP 06-02; submitted in final form to *Urban Studies*, June 2007

Previous versions of this paper and related research were presented at the 2005 meetings of the North American Regional Science Council in Las Vegas, Nevada; a session of the Fall, 2006 Urban Studies and Planning Seminar Series at the University of Maryland; and the 2007 meetings of the Western Regional Science Association, in Newport Beach, California. Special thanks to Marlon Boarnet, Randy Crane, Bernard Fingleton, Regina Gray, Derek Hyra, Gerrit Knaap, Gordon Mulligan, Darla Munroe, Chris Nelson, Rolf Pendall, Tom Sanchez, Alberto Solé-Ollé, and three anonymous referees for their helpful comments and suggestions and to Justin Fazzari and Farris Shuggi for their invaluable research assistance.

The opinions expressed in this paper are those of the authors and do not necessarily reflect the opinions of the Department of Housing and Urban Development or the U.S. government at large.

Abstract. This paper addresses four fundamental questions about the relationship between "smart growth," a fiscally motivated anti-sprawl policy movement, and public finance: Do low-density, spatially extensive land use patterns cost more to support? If so, how large of an influence does sprawl actually have? How does the influence differ among types of spending? And, how does it compare to the influence of other relevant factors? The analysis, which is based on the entire continental United States and uses a series of spatial econometric models to evaluate one aggregate (total direct) and nine disaggregate (education, fire protection, housing and community development, libraries, parks and recreation, police protection, roadways, sewerage, and solid waste disposal) measures of spending, provides the most detailed evidence to date of how sprawl affects the vast sum of revenue that local governments spend every year.

#### 1. Introduction

During the 2002 fiscal year, the 87,576 local governments in the United States—counting all counties, boroughs, municipalities, townships, school districts, and special districts—channeled over \$1.14 trillion toward the provision of public services. Of this amount, 38.72% (\$441.43 billion) was spent on education services, 11.15% (\$127.07 billion) was spent on social services and income maintenance, 9.22% (\$105.15 billion) was spent on environmental services and housing, 9.05% (\$103.21 billion) was spent on public safety, 5.64% (\$64.32 billion) was spent on transportation services, 4.66% (\$53.11 billion) was spent on administrative services, and 3.85% (\$43.88 billion) was spent paying interest on debt; the remaining 17.71% (\$201.92 billion) was spent on utilities, insurance trusts, and other miscellaneous activities and operating costs (Census of Governments 2005). As shown in Table 1, which lists 2002 population, gross state product, and expenditure patterns by state, across all categories, local governments spent a combined national average of \$3,959 per capita, a value that, in total, represents 10.95% of the gross domestic product.

Although many factors influence the allocation, distribution, and volume of this spending, there is a growing conviction among urban and regional policymakers that the character of the built environment is one of them. Specifically, the kind of low-density, spatially extensive pattern of growth commonly characterized as "sprawl" (Bruegmann 2005) is thought to raise the cost of public services because it fails to capitalize on economies of scale and/or optimize on facility location. On the other hand, more compact modes of development are believed to reduce costs by concentrating residents together and creating locational efficiencies in access and delivery. The thinking is that, because public finance ultimately plays out across geographic space, the dimensions of the development it supports matter in substantive ways.

Based on this reasoning, advocates of "smart growth," a movement that seeks a holistic rethinking of the contemporary approach to land use planning, have advanced policy frameworks that, among other things, specifically emphasize the importance of fiscal health (DeGrove 2005). For example, the State of Maryland's (1998) Smart Growth and Neighborhood Conservation Act establishes "priority funding areas," or specific districts where development is supported via public investment in capital facilities and other needs. Similarly, more established state land use planning mandates in Florida, Oregon, Washington, and elsewhere promote contiguity of growth and concurrency, which requires capacity in necessary infrastructure and services to be in place before development can proceed (see Knaap et al. 2001). What makes the present push for smart growth so striking is that it and its fiscally motivated anti-sprawl policies have been enjoined by states as diverse as Arizona, Maine, Michigan, and Tennessee (Gray 2005). The movement has

also gathered broad-based support at the local level, and, perhaps for that reason, it has produced remarkably consistent land use patterns in communities across the country (Song 2005). In short, on the promise of limiting sprawl and its financial discontents, smart growth has rapidly swept the United States and brought about far-reaching changes in the way that state and local governments plan for development.

But, beyond this political and on-the-ground progress loom difficult questions about the veracity of connections between the built environment and the cost of public services. In particular, there is little empirical evidence that sprawl is more expensive to support and, in fact, research on the issue has produced conflicting results. Moreover, there is no reason to believe that the relationship, if any, applies to all types of expenditures in the same way—it may be, for example, that the influence of the built environment cuts in both directions, raising some costs and lowering others depending on the nature of the service in question. Do low-density, spatially extensive land use patterns cost more to support? If so, how large of an influence does sprawl actually have? How does the influence differ among types of spending? And, finally, how does it compare to the influence of other relevant factors? The answers to these questions are key to understanding how well the anti-sprawl policies of smart growth line up with its objective of promoting fiscal health.<sup>1</sup>

### 2. Background Discussion

### 2.1 Measuring and Explaining Sprawl

Sprawl is defined here as the kind of low-density, spatially extensive pattern of development that has become prevalent throughout the United States over the course of the last 50 years (Fulton et al. 2001; Glaeser and Kahn 2004; Bruegmann 2005; Úlfarsson and Carruthers 2006). The best way—and, at present, virtually the only way—to measure the reach and pace of sprawl nationally is via the USDA's (2001) National Resources Inventory (NRI), which provides estimates of the amount of land in major land use categories at the county level for the years 1982, 1987, 1992, and 1997. A limitation of the NRI is that, at high resolution, it is known to have a wide enough margin of error that reported values for, say, the amount of developed land in a given county, may

<sup>1</sup> Note here that public finance is only one of several core concerns of smart growth, which, in fact, has a very broad quality-of-life orientation. For example, the Smart Growth Network describes the movement as being motivated by ... a growing concern that current development patterns—dominated by what some call "sprawl"—are no longer in the long-term interest of our cities, existing suburbs, small towns, rural communities, or wilderness areas. Though supportive of growth, communities are questioning the economic costs of abandoning infrastructure in the city, only to rebuild it further out. Spurring the smart growth movement are demographic shifts, a strong environmental ethic, growth." more nuanced views of increased fiscal concerns, a n d www.smartgrowth.org/about/default.asp?res=1280.

be imprecise. As a result, the data is not reliable enough to know with certainty that there are "exactly x number of acres of developed land in county i," so some of its documentation cautions against using it at that level. Because this limitation is sometimes viewed as an issue (Burchfield et al. 2006), it is important to be clear that the warning is there mainly to comply with data reporting requirements set forth by the Office of Management and Budget, which is responsible for the quality of information collected and disseminated by the federal government. All of that said, the NRI does an excellent job of capturing how development patterns vary cross-sectionally and longitudinally or, in other words, how land use in county i differs from land use in county j and how land use in county j has changed between two or more points in time, j. Used in this way, the data measures land use representatively, even if individual data points are imprecise in some cases.

To demonstrate the validity of using the NRI for cross-sectional analysis, Figures 1 and 2 compare its (1997) measure of developed land area to the Census Bureau's (2000) measure of urbanized land area<sup>3</sup> in all counties located in the continental United States. Specifically, Figure 1 is a scatter plot that registers acres of developed land on the x-axis and acres of urbanized land on the y-axis and Figure 2 is a histogram of the absolute value of the difference between the two as a percentage of total county land area.<sup>4</sup> Both charts reveal a high degree of correspondence between the two estimates of land use: The trend line fit to the scatter plot has an R<sup>2</sup> of 0.91 and the histogram indicates that, in 80% of the sample, the difference is a value that ranges between just one and five percent of total county land area. Together, Figures 1 and 2 indicate that the NRI data provides a good overall representation of how development patterns vary across the country, at least with respect to another commonly used measure of land use.

Since this comparison is admittedly rather coarse, it is reassuring that other researchers have come to similar conclusions about the ability of the NRI to representatively measure land use. For example, a recent comparison by Irwin and Bockstael (2006) finds that the NRI lines up exceptionally well with land cover data derived from multispectral satellite imagery. The analysis

<sup>&</sup>lt;sup>2</sup> The authors have discussed this directly with NRI staff and the reason for the cautionary statement is that the data has statistical properties that require a level of analytical expertise above-and-beyond that of the public at large in order to use and interpret it properly. A statement by OMB on federal data reporting requirements is available online, in the Federal Register: http://www.whitehouse.gov/omb/fedreg/2006/092206\_stat\_surveys.pdf.

<sup>&</sup>lt;sup>3</sup> The Census Bureau categorizes every census block in the country that has an average population density of 1,000 people per square mile, or about 1.5 people per acre, as urban, so summing the area of these blocks by county yields an estimate of the spatial extent of the built-up area within each county. Note that this measure is based on average population density, not actual land use, and some counties register no urbanized land area at all—in these instances, the NRI's measure of developed land area is correspondingly very small.

<sup>&</sup>lt;sup>4</sup> The histogram is of the values resulting from this calculation: |developed land area – urbanized land area| / total county land area. Note that there are nine counties that do not appear on the histogram because these outliers stretch the figure out too far to be easily readable; in these cases, the differences are 21%, 23%, 25% (× 2), 29% (× 2), 36%, 38%, and 93%.

involves data for just the State of Maryland and uses somewhat larger (multi-county) areas than are of interest here, but the two measures are nearly identical and their close relationship apparently holds across the size-of-place hierarchy, because there is little difference among urban, suburban, exurban, and rural groupings of counties. So, although imperfect, the NRI is consistent with alternative data sources and it remains virtually the only one presently available for comparing land use patterns across the country as a whole.

Returning now to the matter at hand, Figures 3 and 4 illustrate the reach and pace of sprawl in the United States during recent years. Figure 3, which maps changes in aggregate density, measured as the number of people plus jobs per acre of developed land, shows that only about a fifth of all counties (691 out of 3,075) grew more dense between 1982 and 1997. Meanwhile, Figure 4, which maps the proportion of land absorption that took place during the last five years of the whole 15-year timeframe, 5 shows that the trend toward sprawl appears to have accelerated: In nearly half of all counties (1,285 out of 3,075) more than 50% of the overall change in developed land occurred between 1992 and 1997. If the trend were more-or-less constant, the pattern shown on the map would not emerge because the 5-year rate of land absorption would instead be closer to 33%.

The nation's land use has evolved in this way mostly because of population growth combined with rising incomes and falling commuting costs—an early cross-sectional analysis of sprawl found that these basic factors explain nearly 80% of variation in the spatial extent of regions' urbanized land area (Brueckner and Fansler 1983)—but other, more nuanced factors also play a role. In particular, three market failures, the failure of development to internalize (1) the benefits of open space, (2) the social costs of traffic congestion, and (3) the cost of the services that it requires, contribute to a sub-optimal pattern of land use (Brueckner 2000). While each of these is important to understanding sprawl, the third is central to the present analysis because, as a corollary, it suggests that growth would be more dense if it had to pay the full cost of the services needed to support it. In fact, both theoretical (Brueckner 1997; McFarlane 1999) and empirical (Pendall 1999) analyses show that impact fees, which attempt to correct for this problem, promote compact development. So, even though sprawl is largely explained by basic human ecology, it is also fueled by more complicated market failures, at least one of which is linked to public finance. Either way, if the connections between the built environment and the cost of public services are as substantial as many policymakers judge them to be, the trend documented in Figures 3 and 4 suggests that the consequences of sprawl may indeed be quite large.

<sup>&</sup>lt;sup>5</sup> This figure is calculated as the ratio of the change in developed land area during the last five years and the change in developed land area during the entire time period, or  $\Delta_{1992-1997} / \Delta_{1982-1997}$ .

### 2.1 Smart Growth as a Policy Response

Acting on public finance oriented (among other) concerns, a number of states have adopted legislation aimed at limiting sprawl (Carruthers 2002). This began with what is often described as the "first wave" of state land use legislation that evolved out of the environmental movement of the 1960s and 1970s. At the time, the main objective was to create mechanisms for overseeing local decision-making processes, particularly with respect to the conversion of farmland and "developments of regional impact," such as major capital facilities and shopping centers. During the 1980s, the "second wave" of state land use legislation popularized the concept of "growth management," an approach to land use planning that emphasizes the need to accommodate, rather than limit, development through a coordinated effort among local governments. It was during this period that the nationwide conversation first began to shift toward identifying the policy-relevant problems of sprawl and developing specific mechanisms, like concurrency, for addressing them in ways other than restricting growth outright. Finally, the "third wave" of state land use legislation, which emerged in the 1990s, brought "smart growth," with its holistic orientation toward quality of life, to the forefront of urban and regional policy. These frameworks often cast local, rather than state, governments as the agents of land use reform and almost unilaterally cite environmental and/or fiscal motivations for confronting sprawl. The practical appeal of smart growth combined with its on-the-ground success has given it considerable political traction; As of 2005, legislation had been adopted by 20 states<sup>6</sup> and many other initiatives have been implemented independently at the local level (see DeGrove 1984, 1992, 2005 for a complete accounting of the history summarized here).

As opposed to sprawl, the benefits of smart growth for public finance are believed to be at least twofold (Knaap and Nelson 1992). First, advocates often argue that, for many public services, the cost per unit—that is, per person or household—of output is higher for low-density development because it fails to capitalize on economies of scale, which are achieved by concentrating users together. Second, spatially extensive development, whatever the density, is accused of making it difficult to optimize on facility location, especially if it happens in a noncontiguous way. Simply put, the reasoning is that sprawl is inefficient because, other things being equal, the cost of public services is negatively influenced by density and positively influenced by the spatial extent of developed land.

<sup>&</sup>lt;sup>6</sup> Arizona, Colorado, Connecticut, Delaware, Florida, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, Oregon, Pennsylvania, Rhode Island, Tennessee, Utah, Washington, and Wisconsin (Gray 2005).

The rejoinder for years has been that the "harshness" of high-density, compact built environments acts as a countervailing force that, after a point, overrides any financial efficiency they may achieve (Ladd 1998). Central cities, for example, often require large amounts of public investment for things like police protection and roadway maintenance due to their social complexity and economic primacy, which affect how intensively services are used. The reasoning here is that, like other commodities, public services are subject to both economies and diseconomies of scale, with the latter being a consequence of the kind of congestion, disorder, social pathologies, and other problems found in many densely populated areas. However, it is too rarely pointed out that the connection to the built environment in-and-of-itself may not be as strong as it has been made out to be—a paper by Gordon and Richardson (1997) is a good example—because the perspective seems, at times, to conflate the influence of land use with problems that have more to do with the deterioration and strife experienced by many aged, built-up areas of the country. From this line of reasoning, it follows that high-density, compact development patterns may well be less expensive to support and that the "harshness" of these environments is a different issue that must be dealt with separately.

The few empirical analyses of the relationship between the built environment and the cost of public services have, over time, produced results that are consistent with both of the perspectives just described. Research on the first dimension of sprawl, the density of developed land, essentially began with the Real Estate Research Corporation's (RERC 1974) muchmaligned Costs of Sprawl. The study finds that low-density development is as much as twice as expensive to support as high-density development, but it has been extensively criticized for, among other things, its failure to control for other relevant factors (Altshuler and Goméz-Ibáñez 1993). Since then, refinements on the approach have mainly continued to find that low-density land use patterns are more expensive to support, but, unfortunately, most produce few generalizable conclusions due to their site-specific focus (see Frank 1989 and Burchell 1998 for reviews and Spier and Stephenson 2002 for an example). Meanwhile, public finance oriented work by Ladd and Yinger (1991) and Ladd (1992, 1994) finds a u-shaped relationship between the number of people per square mile of county land area and per capita spending and, so, concludes that high-density areas are ultimately more, not less, expensive to support. Last, a study of land use patterns by Carruthers and Úlfarsson (2003) finds evidence that density does lower the cost of many services; the analysis measures density via developed land area, not county land area, but it is primarily a hypothesis testing exercise, so it stops short of attempting to measure the magnitude of the relationship between sprawl and public finance in a detailed way.

Research on the second dimension of sprawl, the spatial extent of developed land, emanates from Lösch-style (1954) locational analysis, where the problem is to optimize on the placement of centralized facilities (see Thisse and Zoller 1983). This has traditionally been done on the basis of accessibility and coverage but other criteria, such as equity—which is accepted by many planners as a normative benchmark of urban form (Lynch 1981)—can also be used (Mulligan 1991, 2000; Farhan and Murray 2006). In the present context, the spatial extent of developed land matters in terms of the number and size of facilities needed to serve a given population, plus in terms of the span of the infrastructure needed to support day-to-day activities and deliver services effectively. But, even though capital improvements planning is central to land use planning (Kaiser et al. 1995), very little work has been done to identify how the spatial extent of developed land affects public finance; instead, this dimension of sprawl is usually just treated as implicit in density. A notable exception is a study by Hopkins et al. (2004), which finds that carefully planned development can save revenue by relying on fewer and larger facilities. The analysis by Carruthers and Úlfarsson (2003) also finds evidence that the spatial extent of developed land increases the cost of many public services but, as with density, no attempt is made to measure the size of the influence. In sum, even though locational analysis has long been used for facilities planning, relatively little is known about how the horizontal dimension of sprawl affects public finance.

# 3. Empirical Analysis

#### 3.1 Modeling Framework

The point of departure for the empirical analysis is a so-called "spillover model" that results from strategic interaction among local governments (Brueckner 1998, 2003):

$$e_i = R(e_j, X_i), \tag{1}$$

where per capita expenditure on public services in jurisdiction i,  $e_i$ , depends on per capita expenditure on public services in surrounding jurisdictions j,  $e_j$ , plus a vector of local characteristics,  $X_i$ . R is described as a "reaction function," (Brueckner 2003, page 177) because it results from jurisdiction i's calculated response to the spending of proximate jurisdictions. Although spillovers can take different forms—for example, due to competition, emulation, and/or other kinds of government behavior—they are treated as a composite here because the focus is squarely on sprawl as a cost factor.

The relationship in equation (1) can be estimated with a spatial lag model (Anselin 1988, 2002), expressed as:

In this equation,  $\omega_{ij}$ ,  $\forall j \neq i$ , represents a set of spatial weights that aggregate public spending by jurisdictions near to *i* into a single composite variable;  $\beta$  represents an estimable parameter that describes how per capita expenditure in jurisdiction *i* is influenced by per capita expenditure in nearby jurisdictions;  $\Gamma$  represents a vector of estimable parameters; and  $v_i$  represents an unobserved, stochastic error term. This modeling framework was originally applied by Case et al. (1993) in a behavioral analysis of state-level spending and is often used in public finance oriented research (see Revelli 2005 for a recent review). Overall, the results of this work show that, because it plays out across geographic space, public finance is subject to systematic spatial dependence.

The present analysis applies the modeling framework just described to examine per capita expenditure on public services, e, by local governments (including state and federal government transfers) at the regional level by using counties as the spatial units, i and j. This adaptation, which is similar to work done by Kelejian and Robinson (1992, 1993), means that each observation generally contains multiple jurisdictions—including the county itself, plus municipalities, school districts, special districts, and, potentially, others—so the spillovers that the analysis captures are really the net of interaction among many entities at multiple tiers of government. It is for this reason that the effect is simply labeled a "composite spillover" and no attempt is made to understand the specific nature of the mechanism/s involved. Even so, the strategic interaction framework is adopted for both theoretical and empirical reasons: First, to recognize the presence of an underlying behavioral model of public finance and second, to avoid an econometric misspecification that does not account for the spatial dependence introduced by various forms of strategic interaction.

Moving on, in addition to the spatially lagged dependent variable, equations (1) and (2) contain a vector,  $X_i$ , representing relevant explanatory variables. The specification of the empirical model originates from early work done by Bergstrom and Goodman (1973) and Borcherding and Deacon (1972) and the choice of specific variables is based directly on more recent work done by Ladd and Yinger (1991), Ladd (1992, 1994), Carruthers and Úlfarsson (2003), Solé-Ollé (2005), and Solé-Ollé and Bosch (2005). Although the specification does not match any of these identically—due to data availability, the different purposes of the analyses, and so on—care was taken to ensure it corresponds to the extent possible. In particular, five

<sup>&</sup>lt;sup>7</sup> Identifying different types of spillovers and their behavioral mechanisms is a complicated venture in-and-of-itself: See, for example, Esteller-Moré and Solé-Ollé (2001), Revelli (2001, 2002, 2003), Bordignon et al. (2003), Lundberg (2006), and Solé-Ollé (2006).

categories of factors, pertaining to the cost of and demand for public services, are hypothesized to influence per capita spending: Built Environment, Political Structure, Growth and Demographics, Sources of Revenue, and Size and Primacy. The first category is measured via the density of developed land, the percentage of county land area that is developed, the median housing value, and the percentage of housing built before 1940; the second category is measured via the per capita number of municipalities and the per capita number of special districts; the third category is measured via the rate of population change, per capita income, the percentage of the population that is white, the percentage of the population that is less than five years old, and the average household size; the fourth category is measured via the percentage of tax revenue that comes from property taxes, per capita federal revenue, per capita state revenue, and per capita long-term debt; and, last, the fifth category is measured via county land area, the ratio of employment to population, and the average government wage, plus dummy variables for metropolitan and micropolitan counties.

Like the specifications used in other research, this specification is oriented around variables measuring the cost of and demand for local government spending. The key cost factors in the model are: The average government wage, a measure of input costs, and the ratio of employment to population, which measures competition in the job market and, also, how intensively services are used by people who may be nonresidents. Other variables measuring costs include what Ladd (1992, page 278) calls "environmental cost factors," such as the density of developed land and the percentage of county land area that is developed, which describe sprawl, the object of this analysis. (Note here that total county land area is held constant, so the percentage of county land area that is developed measures the spatial extent of development or, in other words, the horizontal dimension of sprawl.) The key demand factors in the model are: Per capita income, a fundamental measure of demand, the median housing value, a measure of the median voter's stake in the outcome of public spending (Fischel 2001), and the percentage of tax revenue that comes from property taxes, which measures the tax price for residents, albeit somewhat roughly because other taxes are also paid. Additional variables measuring demand include factors that relate to the preferences of the population, such as the relative number of young children, and the availability of resources, such as intergovernmental revenue and public indebtedness. Across the board, factors that raise costs and demand, like high government wages and high per capita incomes, are expected to positively influence spending while factors that lower them, like weak employment markets and high tax prices, are expected to negatively influence spending.

Given the principles of smart growth, it is expected that sprawl raises the cost of public services because it fails to capitalize on economies of scale and/or optimize on facility location. If this is the case, other things being equal, per capita spending will be negatively influenced by density and positively influenced by the percentage of county land area that is developed. The two fragmentation variables, per capita municipalities and per capita special districts, are included to control for the political geography of local government finance; generally speaking, if the Tiebout hypothesis (1956) is correct, greater fragmentation will lower per capita spending by way of intergovernmental competition. Finally, there is every reason to suspect upfront, as many residents do, that the rate of population growth negatively influences per capita spending because the existing population almost always finances new development (Ladd 1994). This fear, justified or not, is precisely what led to the widespread adoption of local growth controls during the 1970s and 1980s (Glickfield and Levine 1992).

# 3.2 Data and Econometric Specification

The empirical model is used to analyze per capita expenditure by local governments in all 3,075 counties<sup>8</sup> of the continental United States during the 2002 fiscal year (Census of Governments 2005). The geographic scope of the analysis is shown in Figure 5, a map of per capita total direct spending by county. Inspection of the figure quickly reveals two major patterns: Expenditures are clustered by both state and region, including, in the latter case, in a way that spills across state lines. The first pattern suggests that fixed effects should be added to an empirical specification of equation (2) in order to account for unobserved factors common to all counties located within the same state; it also suggests that the model should be estimated in a manner that deals with heteroskedasticity introduced by variation in unobservable characteristics relevant to that level. Even more important, the second pattern reinforces the choice of modeling frameworks because spatial relationships that are not confined by state boundaries are clearly visible, even to the naked eye. As already mentioned, failing to account for this pattern of spatial dependence would produce a misspecified model and, ultimately, biased and inefficient estimates of  $\Gamma$  (Anselin 1992).

The modeling framework described in the preceding section is applied identically (for the sake of comparability) to one aggregate and nine disaggregate measures of public spending: Total direct expenditure, education, fire protection, housing and community development, libraries,

<sup>&</sup>lt;sup>8</sup> The actual number of county equivalents is slightly greater, due to a number of independent cities such as Baltimore, Maryland St. Louis, Missouri, and cities throughout Virginia. These were integrated with appropriate counties when the data was compiled because some data—from the BEA's Regional Economic Information System, for example—is not available at that level, but the entire surface of the continental United States is still represented in the data set.

parks and recreation, police protection, roadways, sewerage, and solid waste management. A description of each measure of spending, taken from the survey form that the Census of Governments uses to collect the data, is provided in Table 2. Table 3 lists the source, units of measurement, and descriptive statistics for all of the continuous variables involved in the analysis; zero values were excluded from the calculations for certain measures of spending because counties where none occurred end up getting dropped in the estimation process. Note that all explanatory variables except for the spatially lagged dependent variable are lagged in time to 1997; this was done in part because the NRI data, which is used for the two measures of sprawl, is available only up until that year. The time lag also makes good practical sense given how the public planning process works, because there is usually a long delay between when expenditure decisions are made and when they are carried out. In order to be consistent, 1997 values of variables collected from decennial census data were estimated by using a time-weighted average of 1990 and 2000 values.

Applying this dataset to equation (2) results in the following structural model of per capita local government expenditure, written in matrix form:

$$e_s^* = \beta_s W e_s^* + \Phi_s + X \Gamma_s + v_s. \tag{3}$$

Here, all notation is the same as above, except that  $e^*$  indicates that per capita public expenditure e is in natural log form (Carruthers and Úlfarsson 2003) and so is its spatial lag,  $We^*$ ; s denotes each of the ten measures of public spending;  $\Phi$  represents a vector of state fixed effects, including one for Washington, DC; and W is a 3,075  $\times$  3,075  $(n \times n)$  row-standardized weights matrix that describes the spatial connectivity of the data set. The weights matrix was created using the center of each county's population—that is, a point, calculated using census tract-level data, identifying where people are concentrated rather than the geographic center—to identify neighbors. In the scheme, each county i is related to all counties j having population centers located within 50 miles of its own population center or, in the 65 cases where the distance is greater than 50 miles, to a single nearest neighbor. The connectivity of the resulting spatial weights matrix is illustrated in Figure 6.

Last, the behavioral underpinning of the model says that proximate counties are influenced by each other, so We is endogenous to e, and equation (3) cannot be properly estimated using ordinary least squares (OLS). That is, because per capita spending in county i depends on per capita spending in counties j and the other way around, there is a "chicken-oregg" problem that must be resolved by choosing an appropriate estimator. The approach used here is a spatial two-stage least squares (S2SLS) strategy developed by Kelejian and Prucha

(1998), which involves first regressing  $We_s$  on X and WX, the spatial lag of X, to produce predicted values of the endogenous variable and then using the predicted values,  $\hat{W}e_s$ , in place of the actual values in equation (3). The only shortcoming of this strategy is that the exogenous variables, X and WX, are not always good predictors of  $We_s$ , so, as a precautionary step, an additional instrument derived from the "three group method"—wherein the instrument is assigned a negative one, zero, or one depending on whether the value of the original variable,  $We_s$ , is in the bottom, middle, or top third of its ordinal ranking (Kennedy 2003)—is included in the first stage regression (see, for example, Fingleton and López-Bazo 2003; Fingleton 2005; Fingleton et al. 2005). Like the alternative, maximum likelihood (ML) estimation, this strategy yields efficient, unbiased parameter estimates, even in the presence of spatial error dependence (Das et al. 2003). Recent examples of other work in the area of public finance that use this estimator as opposed to, or along with, an ML estimator include Esteller-Moré and Solé-Ollé (2001), Revelli (2002, 2003), Baicker (2005), and Solé-Ollé (2006).

#### 3.3 Estimation Results

The S2SLS estimation results for the various structural models are shown in Tables 4 - 7; to better illuminate the spatial component of the analysis, the first of these, the table for total direct spending, also includes results for a model estimated via OLS without the spatial lag. Nearly all of the parameter estimates are statistically significant and the adjusted R<sup>2</sup> values, which range from a low of 0.25 (for the housing and community development equation) to a high of 0.68 (for the roadways equation), show that the models do a good job of explaining how per capita spending varies across the United States, especially given that they were not specifically tailored to the individual types of services. As already noted, the number of observations differs from model-to-model because counties where no spending took place during the 2002 fiscal year were dropped in the estimation process. In addition to the parameter estimates and the values of their corresponding t-statistics, the tables list elasticities,  $\eta_k$ , which were calculated for each of the continuous explanatory variables at the mean values of the regressors using the appropriate set of counties—that is, the calculations were made after accounting for dropped observations, so they reflect only those that were actually included in the individual models. The elasticities are considered in detail in the next section, which applies the findings of the empirical analysis to address each of the four policy questions that were posed in the introduction. For now, working

<sup>&</sup>lt;sup>9</sup> In practice, all of the spatial variables,  $We_x$  and WX were calculated in GeoDa, a program designed for spatial analysis and computation (Anselin 2003; Anselin et al. 2006), then imported into EViews, an econometrics program, with the rest of the data,  $e_x$  and X, where the two-stage least squares (2SLS) regressions were run using panel settings to identify the states as cross-sections for fixed effects and as clusters for White-adjusted standard errors.

down though the list of explanatory variables, the following paragraphs summarize the estimation results in a general way.

To begin with, the spatially lagged dependent variables, We, register positive and highly significant spillover effects in all of the equations. The mediating influence of the strategic interaction is illustrated in Table 4, which includes OLS estimates alongside the S2SLS estimates. Adding the spatial lag to the model and re-estimating it with the appropriate technique lowers the value of most of the parameter estimates, sometimes by a wide margin. For example, compared to the OLS estimates, the S2SLS estimates of the parameters on the two variables measuring sprawl, the density of developed land and the percentage of county land area that is developed, are 15.97% and 5.15% smaller, respectively; on average, the absolute value of the difference in the parameters from the first regression to the second is 10.17%. Because the dependent variables and their spatial lags are both in log form, the parameters on the spatial lags are interpreted as elasticities, so a 1% change, whether positive or negative, in per capita total direct spending in the surrounding region produces a localized ~0.20% change in total direct spending. Of course, the size of this effect varies substantially among the nine disaggregate measures of spending: The elasticity on the spatial lag of per capita spending on police protection (0.3767) is by far the largest and the elasticity on the spatial lag of per capita spending on education (0.1119) is the smallest. Taken as a group, these estimates show that local governments engage in exactly the kind of strategic interaction that motivates the modeling framework, and, just as importantly, that the resulting pattern of spatial dependence in public finance persists even after accounting for the kind of state-level correlation absorbed by the fixed effects.

Next, in the Built Environment category, the parameter on the density of developed land, the first measure of sprawl, carries a negative sign and is statistically significant in the total direct, education, parks and recreation, police protection, and roadways models; it is negative and insignificant in all other cases, except for housing and community development where it is positive and highly significant. The parameter on the second measure of sprawl, the percentage of county land area that is developed (holding county land area constant), is positive and statistically significant in all cases except for housing and community development and solid waste management. Median housing value, a demand factor, and the percentage of housing built before 1940, an additional cost factor, also have a positive influence in most of the equations. The only equation where median housing value negatively influences spending is for housing and community development, a service that is mainly channeled to blighted areas in need of redevelopment and/or where people receive rental subsidies, such as assistance under the Section 8 voucher program (Pendall 2000). Meanwhile, aged development requires higher levels of

spending for rehabilitation and maintenance of physical infrastructure like roadways and sewerage. As explained further below, the results from the two measures of sprawl yield clear evidence that smart growth, with its anti-sprawl policies, matters to public finance: The estimates consistently indicate that high-density, compact development costs less to support than low-density, spatially extensive development. More broadly, these findings represent a large step forward in urban and regional policy evaluation, because they are the most detailed measurements to date of the relationship between the built environment and public finance.

The remaining categories of control variables also reveal important relationships. First, in the Political Structure category, the two fragmentation variables, per capita municipalities and per capita special districts, supply little evidence that intergovernmental competition lowers the cost of public services. In fact, municipal fragmentation apparently increases per capita spending on education and roadways, possibly by exacerbating various locational inefficiencies; likewise, special districts, which have rapidly reshaped public finance over the past several decades (Foster 1997), appear to have a positive, rather than negative, influence. Second, in the Growth and Demographics category, the parameter on the rate of population change is almost always highly significant and negative; the parameter on per capita income is positive whenever significant; the parameter on the percentage of the population that is white is mostly significant, but its sign differs from equation-to-equation; the parameter on the percentage of the population that is less than five years old is mostly insignificant but is very large and positive in the education equation; and the average household size is negative and statistically significant in all but a few of the models. Overall, this category of explanatory variables indicates that rapid population growth negatively influences existing residents' share of spending and that, other things being equal, per capita spending is greater in regions with a high per capita income (at least for select services, like libraries and parks and recreation), a greater proportion of minorities, and younger, smaller families. Third, members of the Sources of Revenue category, which, with the exception of the percentage of tax revenue that comes from property taxes, nearly always have a positive influence when significant, provide insight how local governments finance their spending. In two cases, fire protection and parks and recreation, per capita state revenue carries the perverse (negative) sign and is statistically significant, but these may be spurious correlations—or, it may be that certain state funding comes with strings attached that end up causing communities to divert spending away from these particular services. The tax price is interesting because it positively influences per capita spending on education; although this variable, as a demand factor, is expected to carry a negative sign, the positive sign in this case makes at least tentative sense given the interdependency between school quality and property values (Fischel 2001). Fourth, in the County Size and Primacy category, the parameters on the three cost factors, county land area, the ratio of employment to population, and the average government wage, are always positive when significant and the metropolitan and micropolitan dummy variables show how the different types of spending vary up and down the regional hierarchy. Finally, note that, in order to conserve space, all of the state fixed effects have been suppressed from the tables.

### 4. Policy Evaluation

The introduction to this paper posed four questions about the reasoning behind the kind of fiscally motivated, anti-sprawl policy frameworks that have swept the United States over the past several decades: Do low-density, spatially extensive land use patterns cost more to support? If so, how large of an influence does sprawl actually have? How does the influence differ among types of spending? And, how does it compare to the influence of other relevant factors? The answers to these questions, which are based on the findings of the empirical analysis, yield clear evidence that smart growth matters to public finance.

# 4.1 Do Low-density, Spatially Extensive Land Use Patterns Cost More to Support?

The estimation results listed in Tables 4 - 7 show that the density of developed land has a negative effect on five key measures of local government spending: Total direct, education, parks and recreation, police protection, and roadways. The four disaggregate measures are particularly important because, going in order, they are the first, second, sixth, and third largest of the nine types of spending considered here: On average, they account for 44.95%, 6.33%, 1.45%, and 3.76% of total direct spending. Further, if one-tailed hypothesis tests had been assumed—on the grounds that the direction of influence was anticipated in advance—density would have registered a negative effect on fire protection, libraries, and sewerage, too. Density carries the expected negative sign in the model for spending on solid waste management but it does not come close to being statistically significant, even assuming a more liberal one-tailed hypothesis test. The remaining case, housing and community development, which is positively influenced by density, is sensible, because of the higher cost of land acquisition and construction, among other things, in built-up areas. Next, the spatial extent of developed land, measured as the percentage of county land area that is developed while holding county land area constant, has a positive influence in all but two instances, where it does not approach statistical significance. In sum, the results for these two variables show that, other things being equal, the kind of low-density, spatially extensive development patterns that characterize sprawl cost more to support than the high-density, compact development patterns that the smart growth movement advocates.

The magnitude of sprawl's overall influence on public finance in the United States is estimated by applying the elasticities for density ( $\eta = -0.0136$ ) and percent developed ( $\eta = 0.0246$ ) from the total direct expenditure model to two alternative land use scenarios: The first assumes that all counties nationwide developed in a way that was 25% more compact (more dense and less expansively developed) than they are and the second assumes that all counties in the country developed in a way that was 50% more compact. 10 The dollar values associated with these changes are calculated by obtaining the product of: (1) the relevant elasticity, (2) the relevant percent difference, (3) per capita total direct spending during the 2002 fiscal year, and (4) county population. The first scenario suggests that, if the nation's land use patterns had somehow evolved differently, and development everywhere was 25% more dense, public services would cost, in net, \$3.63 billion less annually; if it were that much less expansive, public services would cost \$6.56 billion less annually. The second scenario suggests that, if development everywhere was 50% more dense, public services would cost \$7.25 billion less annually; if it were that much less expansive, public services would cost \$13.12 billion less annually. Capitalized at 5%—moreor-less the current long-term interest rate that most local governments are subject to-as an approximation of opportunity costs, the annual values from the two scenarios translate into \$72.75 billion and \$131.20 billion (25%) and \$145.07 billion and \$262.40 billion (50%).

Clearly, these numbers are artificial in that they assume a uniformly different outcome of growth throughout the entire country but they nonetheless give a general sense of just how large of an influence sprawl may have had on public finance. That said, the hypothetical savings, especially vis-à-vis the long-term (capitalized) opportunity costs, are nontrivial enough that some places may wish to identify how to better connect financial planning to land use planning: With a population of 88,000 and per capita total direct expenditures of about \$3,200, the average county would annually save \$1.18 million (\$2.36 million) if it were 25% (50%) more dense and \$2.13 million (\$4.27 million) if it were that much less developed. Like before, capitalizing these values shows that the opportunity costs are large: \$23.59 million (\$47.18 million) and \$42.67 million (\$85.33 million) if development was 25% (50%) more compact. In an era of far reaching budget cuts and increased fiscal conservatism among the general public, these figures seem big enough to merit consideration.

<sup>&</sup>lt;sup>10</sup> The average density of all counties in the country is 2.49 people plus jobs per acre of developed land, so, on average, these scenarios imply densities of 3.11 and 3.73 people plus jobs per acre of developed land, respectively; the average proportion of county land area that is developed 8% so, on average, these scenarios imply 6% and 4%, respectively.

# 4.3 How Does the Influence Differ Among Types of Spending?

The elasticities reported for the individual expenditures in Tables 5 – 7 show that the magnitude of sprawl's influence depends on the service in question. The density of developed land has the largest absolute effect on housing and community development ( $\eta = 0.1124$ ); then on roadways ( $\eta = -0.0562$ ); then on parks and recreation ( $\eta = -0.0362$ ); then on education ( $\eta = -0.0345$ ); and then on police protection ( $\eta = -0.0222$ ). So, sprawl lowers the cost of the first of the services affected by density, likely because land and other inputs cost less, but raises the cost of the last four to a decreasing degree. The spatial extent of developed land, meanwhile, has the largest effect on parks and recreation ( $\eta = 0.1048$ ); then on fire protection ( $\eta = 0.0872$ ); then on sewerage ( $\eta = 0.0718$ ); then on libraries ( $\eta = 0.0534$ ); then on police protection ( $\eta = 0.0370$ ); then on roadways ( $\eta = 0.0321$ ); and then on education ( $\eta = 0.0128$ ). In more qualitative terms, this dimension of sprawl has the largest influence on services having centralized facilities that may have to be replicated when they otherwise would not; a more moderate influence on linear infrastructure systems that connect to centralized facilities; and the smallest influence on facilities/services that receive heavy day-to-day use. As a set, the elasticities illustrate that there is wide variation in how public finance is affected by the underlying pattern of land use.

### 4.4 How Does the Influence of Sprawl Compare to the Influence of Other Relevant Factors?

Direct comparison of the various elasticities needs to be tempered by a recognition that they relate different types of explanatory variables, expressed in different units of measurement, to per capita spending. That said, the parameters are, by definition, unit-free metrics and so lend themselves to the kind of general comparison that is of interest here, as long as differences in the nature of what they describe are kept in mind. The column of elasticities listed for the spatial lag model of total direct expenditure in Table 4 shows that the influence of many factors, including the density of developed land ( $\eta = -0.0136$ ) and the spatial extent of developed land ( $\eta = 0.0246$ ), turns on the one-hundredths of a percent mark. Exceptions to this, where the relationships turn on the tenths of a percent mark, are the spatially lagged dependent variable ( $\eta = 0.2039$ ), the percentage of the population that is less than five years old ( $\eta = 0.4065$ ), the average household size ( $\eta = -0.7777$ ), per capita state revenue ( $\eta = 0.1416$ ), and the ratio of employment to population ( $\eta = 0.2836$ ).

The larger an elasticity, the more responsive spending is to changes in the corresponding variable, so, at first glance, the figures reported in Table 4 suggest that, categorically, demographic factors have the largest influence on public spending patterns. This finding is not

surprising, given that people's socioeconomic circumstances are what determines what they demand from their local governments. But, in practice, demographic conditions do not vary too far from their mean, so modest cross-sectional differences end up corresponding to relatively large differences in per capita spending. Consider, for example, that the standard deviation of the average household size is only 8.80% of the mean, whereas, for the density and spatial extent of developed land, the standard deviations are 104.94% and 161.75% of the mean, respectively. In short, factors with little variance register a larger influence, because they rarely, if ever, differ from place-to-place by much. Moreover, compared to other factors that may readily be influenced by public policy-most demographic conditions, such as the number of young children, are not among them—the influence of sprawl is large. In particular, the elasticities on the density and spatial extent of developed land are on the level with those for median housing value ( $\eta$  = 0.0843), the percentage of housing built prior to 1940 ( $\eta = 0.0337$ ), the rate of population change  $(\eta = -0.0251)$ , and most sources of revenue. And, here again, the two measures of sprawl deviate much further from their mean than most of these, which are generally more uniform across the country. So, to answer the question in brief: Compared to other relevant factors, the influence of sprawl is sizable.

### 5. Summary and Conclusion

This paper began by outlining the connections between smart growth and public finance, then opened an investigation into them by: (1) reviewing previous research pertaining to the topic; (2) estimating a series of spatial econometric models for measuring how the built environment and other relevant cost and demand factors influence local service expenditures; and (3) evaluating the nature and extent of the relationship. The results of the analysis link one of the main ideas behind smart growth—namely, that low-density, spatially extensive development patterns are more expensive to support—directly to public finance. While there is a lot of variation in how the density and the spatial extent of development influence different types of services, other things being equal, sprawl, as a cost factor, nearly always raises per capita spending, and the effects translate into large dollar values when summed across the entire country. They are also quite large on a case-by-case basis when capitalized at a conventional long-term lending rate as approximations of opportunity costs. These findings strongly suggest that the reasoning behind fiscally motivated, anti-sprawl smart growth policy frameworks is sound. Several conclusions and directions for future research follow.

Foremost, the results of the analysis link one of the main ideas behind smart growth to public finance via local government spending, an intermediate output, but they do not necessarily extend to the final outputs that residents eventually enjoy. Going forward, a key question that must be addressed is: Do high-density, compact development patterns make any difference for service quality, or do they just make services less expensive to provide? This question is critical for the smart growth movement because it cuts to the core of its holistic, quality-of-life orientation. It is important to remember, for example, that the point of departure for much of the previous research on how development patterns affect public finance was concern for the poor fiscal health and corresponding depravity that the 1960s, 1970s, and 1980s visited upon many built-up areas of the United States (Ladd and Yinger 1991). Public finance in-and-of itself is closely related to quality-of-life (Gyourko and Tracy 1989, 1991) but, ultimately, it is the low crime rates, good schools, and other tangible outcomes of local government spending that influence where people choose to live (see, for example, Bayoh et al. 2006). For this reason, to the extent that it can ensure that public services are delivered both cost effectively and at a high level of quality, smart growth stands to play a major part in determining places' comparative advantage.

In addition, given its holistic orientation, further evaluations of smart growth should examine its ability to actually achieve more desirable living conditions. The land use reform movement that produced most of the contemporary anti-sprawl policy frameworks was led, at first, by an environmental awakening (Popper 1981) and, later, by critical thought regarding the extent to which development patterns actually serve the best interests of their inhabitants (Calthorpe 1993; Duany et al. 2000). Recent work by Song and Knaap (2003, 2004) shows that people place a premium on housing located in "neo-traditional," or "new urbanist," developments, suggesting that a distinct market for smart growth may have emerged. Whether this is simply a product of aesthetics or of a more complex blend of architectural, environmental, fiscal, and other factors remains an open question, though. The need to resolve the issue is brought into stark relief by the fact that, even though urban and regional policymakers are responsible for shaping settlement patterns into what they somehow "ought to be," they have so far advanced few defensible criteria for favoring one outcome over another (Talen and Ellis 2002). Lynch's (1981) classic work, Good City Form, delineates a set of very specific normative criteria-vitality, sense, fit, access, control, efficiency, and justice-for evaluating alternative modes of land use, but policymakers have too often failed to rigorously connect smart growth, or any of its goals, to a framework of this sort. The results presented here indicate that sprawl is not efficient from the standpoint of public finance but, with further research, other criteria, such as

equity and justice, may turn out to be important as well. Lynch's framework holds great promise for helping to advance the cause of smart growth because it provides a source of structure for analyzing land use policies in terms of the quality-of-life benefits they are meant to produce.

Each of these conclusions is highly general because the analysis presented in this paper focuses on aggregate, county-level patterns of public spending. It is not clear that the findings would apply in exactly the same way on a community-by-community basis, so readers should be cautious about interpreting the results in that way. That is, the analysis observes the relationship between sprawl and public finance at the county level, not at the municipal or neighborhood levels, where the principals of smart growth are normally applied. Counties can contain literally hundreds of individual governmental entities-Cook County, Illinois, where Chicago is located, had 539 general and special purpose governments in 2002—so a great deal of heterogeneity lies beneath the surface of the results presented here. Determining whether or not, and just how, the financial consequences of sprawl play out across more localized areas requires further research using individual jurisdictions as the unit of analysis. It may be, for example, that that the size of jurisdictions and the size of the regions they are embedded in are important mediating factors. Similarly, the overall trajectory of growth through time may also make a difference, especially in instances where large areas are often committed to development via comprehensive planning, zoning, and other forms of land use planning before they are actually filled in (Carruthers and Mulligan 2007). In future research, these and other important jurisdiction-level issues deserve careful thought and analysis.

Finally, as an extension of this need for more locally oriented work, the nature of the strategic interaction registered by the empirical models should be investigated further. Specifically, a procedural goal of many smart growth programs is to promote cooperation among local governments as a means of meeting broader societal objectives (Carruthers 2002). Theoretical research (Haughwout 1997, 1999) and applied policy analysis (Orfield 1997, 2002) alike show that, in the case of public finance, there is a great deal of fiscal interdependency within regions and that cooperation, rather than competition, can produce net benefits for all of those involved. Determining how the spillovers captured by the kind of spatial reaction functions estimated here reconcile with this "regionalist" view would also require with the use of disaggregate, jurisdiction-level data, plus, at the very least, discriminating among different forms of interaction in order to more precisely represent the motivations and behavior of individual governments. Although a project like this would be highly involved, particularly if it were done for the entire country, taking the step would add great depth to the study of smart growth by better integrating it with theory of local government behavior. In the end, such an approach is

necessary in order to develop a full understanding of the complex ways in which smart growth matters to public finance; in the meantime, this paper has taken key steps in that direction.

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Table 1. 2002 Population, Gross State Product, and Local Government Expenditures by State

				Evnonditure						Evnenditure	
State	Population	GSP (\$ mil.)	Total (\$ mil.)	Per Capita	Percent GSP	State	Population	GSP (\$.mil.)	Total (\$ mil.)	Per Capita	Percent GSP
SO	287,984,799	\$10,412,244	\$1,140,082	\$3,959	10.95%	MO	5,681,045	\$187,090	\$17,266	\$3,039	9.23%
ΑF	4,480,139	\$123,763	\$14,642	\$3,268	11.83%	MT	910,395	\$23,913	\$2,262	\$2,485	9.46%
ΑK	640,699	\$29,741	\$3,051	\$4,762	10.26%	出	1,726,753	\$60,571	\$7,769	\$4,499	12.83%
. AZ	5,438,159	\$173,052	\$20,404	\$3,752	11.79%	Š	2,167,867	\$82,389	\$9,055	\$4,177	10.99%
AR	2,706,606	\$71,221	\$6,123	\$2,262	8.60%	Æ	1,274,666	\$46,106	\$3,493	\$2,740	7.58%
CA	34,988,088	\$1,363,577	\$181,512	\$5,188	13.31%	Z	8,576,089	\$377,824	\$31,826	\$3,711	8.42%
8	4,498,407	\$181,246	\$19,363	\$4,304	10.68%	M	1,855,400	\$53,414	\$5,397	\$2,909	10.10%
CJ	3,458,382	\$167,235	\$11,211	\$3,242	6.70%	ž	19,164,755	\$802,866	\$123,857	\$6,463	15.43%
DE	805,767	\$46,991	\$2,127	\$2,640	4.53%	NC	8,312,755	\$301,254	\$28,577	\$3,438	9.49%
DC	564,624	\$67,176	\$7,832	\$13,871	11.66%	S	633,571	\$20,007	\$1,766	\$2,787	8.82%
FL	16,677,860	\$522,340	\$61,756	\$3,703	11.82%	ЮН	11,404,651	\$385,657	\$42,720	\$3,746	11.08%
В	8,581,731	\$307,443	\$30,960	\$3,608	10.07%	Q X	3,487,076	\$95,343	\$9,384	\$2,691	9.84%
H	1,234,401	\$43,806	\$2,077	\$1,683	5.74%	S.	3,522,342	\$115,113	\$13,916	\$3,951	12.09%
Ω	1,343,973	\$38,276	\$3,743	\$2,785	6.78%	PA	12,324,415	\$424,820	\$43,527	\$3,532	10.25%
ij	12,586,839	\$486,182	\$51,384	\$4,082	10.57%	R	1,069,550	\$37,040	\$2,894	\$2,706	7.81%
Z	6,154,739	\$203,296	\$20,687	\$3,361	10.18%	SC	4,102,568	\$122,274	\$12,374	\$3,016	10.12%
Y	2,934,340	\$97,810	\$9,928	\$3,383	10.15%	SD	760,368	\$25,826	\$2,011	\$2,645	7.79%
KS	2,712,454	\$89,875	\$60,6\$	\$3,354	10.12%	Z	5,790,312	\$191,394	\$21,128	\$3,649	11.04%
ΚX	4,088,510	\$121,633	\$66,6\$	\$2,445	8.22%	Ϋ́	21,722,394	\$775,459	\$77,108	\$3,550	9.94%
ΓA	4,475,003	\$134,360	\$13,523	\$3,022	10.07%	Ы	2,336,673	\$73,646	\$7,599	\$3,252	10.32%
ME	1,296,978	\$39,027	\$3,386	\$2,611	8.68%	VT	616,274	\$19,419	\$1,616	\$2,622	8.32%
Æ	5,442,268	\$202,840	\$17,682	\$3,249	8.72%	٧A	7,286,061	\$288,840	\$24,033	\$3,298	8.32%
ΜA	6,411,568	\$287,191	\$25,035	\$3,905	8.72%	WA	6,066,319	\$233,971	\$26,875	\$4,430	. 11.49%
Σ	10,039,379	\$347,014	\$39,489	\$3,933	11.38%	<b>^</b>	1,804,529	\$45,259	\$3,980	\$2,206	8.79%
Z	5,023,526	\$199,271	\$22,200	\$4,419	11.14%	WI	5,439,137	\$189,508	\$22,077	\$4,059	11.65%
MS	2,866,349	\$68,550	\$8,000	\$2,791	11.67%	ΜĂ	499,045	\$20,326	\$2,365	\$4,739	11.63%
Source	Sources: Bureau of Economic Analysis (2002, 20	omic Analysis (200		006) and Census of Governments (2005)	ments (2005).						

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Table 2. Public Expenditure Variables	
Variable	Description
Total Direct Expenditures	Sum of direct expenditures, including salaries and wages
Education	Expenditures on local schools.
Fire Protection	Expenditures incurred for fire fighting and fire prevention, including contributions to volunteer fire units.
Housing and Community Development	Expenditures on urban renewal, slum clearance, and housing projects.
Natural Resources	Flood control, soil and water conservation, drainage, and any other activities for promotion of agriculture and conservation of natural resources.
Libraries	Expenditures on libraries.
Parks and Recreation	Expenditures on parks and recreation, including playgrounds, golf courses, swimming pools, museums, marinas, community music, drama, celebrations, zoos, and other cultural activities.
Police Protection	Expenditures on municipal police agencies, including coroners, medical examiners, vehicular inspection activities, and traffic control and safety activities.
Roadways	Expenditures for construction and maintenance of municipal streets sidewalks, bridges and toll facilities, street lighting, snow removal, and highway engineering, control, and safety.
Sewerage	Expenditures for construction, maintenance, and operation of sanitary and storm sewer systems and sewage disposal plants.
Solid Waste Management	Expenditures on street cleaning and the collection and disposal of garbage.
Source: Census of Governments, form F-28, 2005 Annual Survey	Annual Survey of Local Government Finances.

Table 3. Source, Units, and Description of Continuous Variables

		OHIES		INTOGRATI			Diminal Deviation
Per Capita Total Direct	COG, REIS		3,220.77	2,970.36	23,676.37	227.93	1.362.98
Per Capita Education	COG, REIS	s.	1,449.76	1,357.08	6,935.84	44.79	480.60
Per Capita Fire	COG, REIS	&\$	49.31	38.44	1,442.15	0.05	51.57
Per Capita Housing	COG, REIS	<b>~</b>	53.08	35.06	870.33	0.04	63.57
Per Capita Libraries	COG, REIS	· •	20.43	15.04	356.51	0.02	22.84
Per Capita Parks	COG, REIS	S	47.68	31.22	1700.40	0.07	66.63
Per Capita Police	COG, REIS	, <del>sà</del>	120.94	108.79	1200.66	09'0	75.84
Per Capita Roadways	COG, REIS	<b>.</b>	205.34	154.61	1914.18	0.13	175.55
Per Capita Sewerage	COG, REIS	<del>∨</del>	19.19	50.93	1164.47	0.10	71.03
Per Capita Solid Waste	COG, REIS	<b>6</b>	46.43	38.89	990.33	0.01	42.31
Density	NRI, REIS	*	2.49	2.04	64.26	0.04	2.61
% Developed	NRJ, COG	· %	0.00	0.04	1.00	00.00	0.13
Median Housing Value	Census	S	85,634.15	76,521.00	759,966.00	5,174.65	45,962.78
% Housing >1940	Census	%	0.20	0.16	0.61	00.0	0.13
Per Capita Municipalities	900	# (1,000s)	0.30	0.17	4.09	00.00	0.38
Per Capita Special Districts	COG, REIS	# (1,000s)	0.53	0.22	14.44	0.00	.88.0
Population Change	COG, REIS	%	90.0	0.05	0.77	-0.39	0.08
Per Capita Income	REIS	<b>∽</b>	22,716.03	22,051.55	78,125.29	5,498.18	5,131.32
% White	Census	%	98.0	0.92	1.00	0.05	0.16
% <5 Years Old	Census	%	0.10	0.10	0.18	90.0	0.01
Average Household size	Census	#	2.66	2.62	5.38	0.83	0.23
% Property Tax	900	%	0.79	0.82	1.00	0.16	0.16
Per Capita Federal Revenue	COG, REIS	\$	79.38	45.70	5,038.61	0.00	163.14
Per Capita State Revenue	COG, REIS	• <del>5</del>	1,033.36	953.99	7,415.72	0.00	439.59
Per Capita Long-term Debt	COG, REIS	<b>~</b>	1,917.46	1,072.07	12,2810.20	0.00	4,950.10
County Land Area	900	# (1,000s ac)	00'919	396.00	12,841.00	10.00	836.00
	REIS	%	0.38	0.37	2.93	80.0	0.14
Average Wage of Government Job	REIS	€9	27,614.64	26,528.16	61,626.56	14,534.40	5.840.15

Table 4. OLS and S2SLS Estimates of Total Direct Equation

	OLS			200		
				979F3		
	Estimated Parameter	Elasticity	t-value	Estimated Parameter	Elasticity	t-value
Constant	7.59E+00 ***		42.06	6.06E+00 ***		18.29
Spatial Lag	•	•		2.04E-01 ***	0.2039	5.93
Built Environment	•					
Density	-6.49E-03 ***	-0.0162	-2.51	-5.45E-03 **	-0.0136	-2.10
% Developed	3.05E-01 ***	0.0259	5.97	2.89E-01 ***	0.0246	5.59
Median Housing Value	1.15E-06 ***	0.0985	6.18	9.85E-07 ***	0.0843	5.28
% Housing <1940	1.97E-01 ***	0.0384	2.72	1.73E-01 ***	0.0337	2.40
Political Structure						
Per Capita Municipalities	3.98E-02 n/s	0.0119	1.49	2.79E-02 n/s	0.0084	1.04
Per Capita Special Districts	5.68E-02 ***	0.0299	4.06	5.53E-02 ***	0.0291	4.13
Growth and Demographics						
Population Change	-4.88E-01 ***	-0.0295	4.37	-4.15E-01 ***	-0.0251	-3.76
Per Capita Income	1.88E-06 *	0.0427	1.64	1.60E-06 11/s	0.0363	1.39
% White	-1.18E-01 *	-0.1008	-1.84	-1.16E-01 *	-0.0993	-1.86
% <5 Years Old	4.31E+00 ***	0.4470	5.85	3.92E+00 ***	0.4065	5.36
Average Household size	-2.85E-01 ***	-0.7588	4.45	· -2.93E-01 ***	<b>-0.7777</b>	4.66
Sources of Revenue						
% Property Tax	2.27E-01 ***	0.1790	3.52	1.96E-01 ***	0.1545	3.04
Per Capita Federal Revenue	1.31E-04 *	0.0104	1.73	1.28E-04 *	0.0102	1.69
Per Capita State Revenue	1.33E-04 ***	0.1374	3.36	1.37E-04 ***	0.1416	3.49
Per Capita Long-term Debt	1.71E-05 ***	0.0328	11.98	1.70E-05 ***	0.0326	11.73
County Size and Primacy						
County Land Area	2.85E-05 ***	0.0176	3.80	2.49E-05 ***	0.0154	3.54
Employment Ratio	7.62E-01 ***	0.2898	6.87	7.46E-01 ***	0.2836	6.64
Average Government Wage	-1.25E-06 <sup>n/s</sup>	-0.0345	-0.83	-1.23E-06 11/s	-0.0340	08.0
Metropolitan	-2.92E-02 **	1	-2.25	-2.55E-02 **	•	-2.00
Micropolitan	8.22E-03 n/s	•	0.61	1.00E-02 n/s	•	0.76
u			3,075			3,075
Adinsted R <sup>2</sup>			09.0	5.		0.61

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; \*\*\* denotes two-tailed hypothesis test significant at p < 0.01; \*\* denotes two-tailed hypothesis test significant at p < 0.10; \*\* denotes two-tailed hypothesis test significant at p < 0.10; \*\* denotes two-tailed hypothesis test not significant.

Table 5. S2SLS Estimates of Education, Fire Protection, and Housing and Community Development Equations

Table 3: 3232.3 Estimates of Education, the Florethon, and Housing and Community Development Equations	non, rine riotection, and	nousing and	Communic	y Developineni Equation	2				
	Education	;		Fire Protection			Housing and Community Development	nity Develo	ment
	Estimated Parameter	Elasticity	t-value	Estimated Parameter	Elasticity	t-value	Estimated Parameter	Elasticity	t-value
Constant	5.40E+00 ***	•	18.30	3.80E+00 ***		7.07	6.26E+00 ***		8.76
Spatial Lag	1.12E-01 ***	0.1119	3.08	2.23E-01 ***	0.2235	4.01	1.97E-01 ***	0.1970	3.58
Built Environment									
Density	-1.39E-02 ***	-0.0345	-6.07	-1.27E-02 n/s	-0.0318	-1.64	4.22E-02 ***	0.1124	2.91
% Developed	1.50E-01 ***	0.0128	4.08	1.02E+00 ***	0.0872	5.88	2.92E-01 n/s	0.0276	1.34
Median Housing Value	9.49E-07 ***	0.0813	4.57	4.87E-07 n/s	0.0418	0.70	-2.80E-06 ***	-0.2463	-3.37
% Housing < 1940	-1.56E-01 *	-0.0303	-1.81	5.34E-01 **	0.1039	2.41	2.83E-01 n/s	0.0549	0.81
Political Structure				-					
Per Capita Municipalities	4.89E-02 **	0.0147	1.99	-1.01E-01 n/s	-0.0304	-1.22	-3.78E-01 ***	-0.1028	-2.56
Per Capita Special Districts	3.56E-02 ***	0.0186	3.62	3.71E-02 n/s	0.0193	1.09	1.15E-01 **	0.0526	2.05
Growth and Demographics	•								
Population Change	-3.96E-01 ***	-0.0240	-3.29	-1.33E-01 n/s	-0.0081	-0.39	-9.97E-01 **	-0.0594	-2.12
Per Capita Income	9.96E-07 n/s	0.0226	1.24	8.93E-06 **	0.2029	2.38	-2.59E-06 n/s	-0.0590	-0.43
% White	-5.81E-02 n/s	-0.0496	96.0-	-1.20E-01 n/s	-0.1025	-0.71	-1.81E+00 ***	-1.5376	-7.42
% < 5 Years Old	6.33E+00 ***	0.6561	9.41	1.38E+00 11/s	0.1426	0.71	$-1.50E+00^{n/s}$	-0.1547	-0.44
Average Household size	-1.36E-01 **	-0.3606	-2:37	-5.92E-01 ***	-1.5753	4.57	-9.02E-01 ***	-2.3975	-3.69
Sources of Revenue				•		٠.			
% Property Tax	4.29E-01 ***	0.3391	8.44	-1.16E+00 ***	-0.9120	4.56	-2.43E-01 n/s	-0.1903	-0.84
Per Capita Federal Revenue	4.44E-05 11/s	0.0035	1.27	2.33E-04 ***	0.0186	3.03	1.06E-03 ***	0.0853	3.46
Per Capita State Revenue	2.32E-04 ***	0.2399	5.44	-2.14E-04 ***	-0.2214	-3.43	6.99E-05 n/s	0.0718	69.0
Per Capita Long-term Debt	-6.35E-07 n/s	-0.0012	-0.84	3.46E-06 11/s	0.0067	08.0	-6.57E-06 n/s	-0.0131	-1.28
County Size and Primacy									
County Land Area	1.16E-05 **	0.0072	2.45	6.05E-05 **	0.0374	1.96	4.42E-05 n/s	0.0262	1.23
Employment Ratio	1.81E-01 **	0.0690	3.30	1.80E+00 ***	0.6841	6.34	1.86E+00 ***	0.7240	5.29
Average Government Wage	2.26E-06 n/s	0.0624	1.63	7.04E-06 nds	0.1946	1.39	-3.35E-06 n/s	-0.0940	-0.41
Metropolitan	-1.11E-02 <sup>n/s</sup>	•	-0.99	2.89E-01 ***		5.32	1.73E-01 ***		2.61
Micropolitan	-3.14E-05 n/s	-	0.00	3.32E-01 ***	-	7.55	5.91E-02 n/s		0.92
u			3,071			3,056			2,564
Adjusted R <sup>2</sup>			0.51			0.42			0.25

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; \*\*\*\* denotes two-tailed hypothesis test significant at p < 0.01; \*\*\* denotes two-tailed hypothesis test significant at p < 0.05; \*\* denotes two-tailed hypothesis test not significant.

Table 6. S2SLS Estimates of Libraries, Parks and Recreation, and Police Protection Equations

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	Libraries			Parks and Recreation			Police Protection		
	Estimated Parameter	Elasticity	t-value	Estimated Parameter	Elasticity	t-value	Estimated Parameter	Elasticity	t-value
Constant	7.52E-01 n/s		1.62	7.09E-01 n/s		1.24	3.76E+00 ***		12.21
Spatial Lag	1.63E-01 ***	0.1628	3.06	2.60E-01 ***	0.2598	5.34	3.77E-01 ***	0.3767	9.17
Built Environment	٠.								
Density	$-1.25E-02^{n/s}$	-0.0320	-1.59	-1.44E-02 **	-0.0362	-2.30	-8.91E-03 *	-0.0222	-1.76
% Developed	6.02E-01 ***	0.0534	2.80	1.22E+00 ***	0.1048	6.38	4.36E-01 ***	0.0370	4.27
Median Housing Value	2.25E-06 ***	0.1966	2.77	1.91E-06 **	0.1649	2.51	1.13E-06 ***	0.0968	2.91
% Housing < 1940	4.60E-02 n/s	0.0088	0.14	1.82E-01 n/s	0.0354	. 0.65	1.60E-01 n/s	0.0312	1.28
Political Structure									
Per Capita Municipalities	-3.10E-01 ***	6980.0-	-2.89	-2.01E-01 *	-0.0592	-1.91	-7.96E-02 *	-0.0239	-1.91
Per Capita Special Districts	6.81E-02 **	0.0332	2.04	-2.58E-02 n/s	-0.0133	-0.41	2.94E-02 <sup>n/s</sup>	0.0155	1.16
Growth and Demographics	-								
Population Change	-3.27E-01 n/s	-0.0204	-1.04	-9.34E-01 **	-0.0568	-2.33	-4.08E-01 **	-0.0247	-2.53
Per Capita Income	8.84E-06 *	0.2013	1.81	1.20E-05 ***	0.2734	2.65	1.20E-06 n/s	0.0273	0.63
% White	3.98E-01 *	0.3401	1.87	9.48E-01 ***	0.8101	5.19	-3.32E-01 ***	-0.2836	4.
%<5 Years Old	8.91E-01 n/s	0.0923	0.36	2.96E+00 <sup>n/s</sup>	0.3066	1.55	1.44E+00 n/s	0.1495	1.35
Average Household size	-1.74E-01 <sup>n/s</sup>	-0.4625	-1.08	-1.53E-01 n/s	-0.4071	-1.20	-4.58E-01 ***	-1.2183	-5.91
Sources of Revenue								•	
% Property Tax	3.37E-01 n/s	0.2662	1.21	-7.73E-01 ***	-0.6099	-3.37	4.01E-01 ***	-0.3171	-3.82
Per Capita Federal Revenue	9.35E-05 <sup>n/s</sup>	0.0075	06.0	1.88E-04 *	0.0150	1.67	-2.82E-05 <sup>m/s</sup>	-0.0022	-0.54
Per Capita State Revenue	-3.96E-05 n/s	-0.0412	09.0	-1.68E-04 ***	-0.1740	-2.71	5.83E-05 **	0.0602	2.14
Per Capita Long-term Debt	1.41E-05 ***	0.0269	3.59	6.19E-06 *	0.0121	1.81	6.60E-07 ms	0.0013	0.33
County Size and Primacy									
County Land Area	8.10E-05 ***	0.0511	2.58	1.16E-04 ***	0.0721	3.97	1.44E-05 ms	0.0089	1.20
Employment Ratio	1.60E+00 ***	0.6151	5.24	2.67E+00 ***	1.0197	7.19	1.01E+00 ***	0.3837	6.54
Average Government Wage	2.15E-06 <sup>n/s</sup>	0.0299	0.34	3.76E-06 ns	0.1042	0.63	5.03E-06 **	0.1389	2.06
Меtropolitan	$4.23E-02^{n/s}$	•	0.81	1.53E-01 ***		3.09	8.95E-02 ***	ı	3.94
Micropolitan	-6.19E-02 n/s	.,	-1.08	1.46E-01 ***		3.12	5.04E-02 ***	•	2.81
u			2,818		33	3,012		•	3,075
Adjusted R <sup>2</sup>			0.34		-	0.46			09.0

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; \*\*\* denotes two-tailed hypothesis test significant at p < 0.05; \* denotes two-tailed hypothesis test significant at p < 0.05; \* denotes two-tailed hypothesis test significant.

Table 7. S2SLS Estimates of Roadways, Sewerage, and Solid Waste Management Equations

Post (1. 3232.3 Latinates of Modeways, Sewerage, and Solid Waste Management Equations	Postinge, and sollo	waste Man	agement Eq	uations					
	Noadways			Sewerage			Solid Waste Management	nent	
	Estimated Parameter	Elasticity	t-value	Estimated Parameter	Elasticity	1-value	Estimated Parameter	Elasticity	t-value
Constant	3.18E+00 ***		8.47	3.78E+00 ***	,	7.01	3.39E+00 ***		5.51
Spatial Lag	1.90E-01 ***	0.1898	5.23	1.45E-01 ***	0.1448	2.84	3.06E-01 ***	0 3064	6.16
Built Environment						i		1000	
Density	-2.25E-02 ***	-0.0562	-3.29	-1.58E-02 n/s	-0.0399	-1.64	-8 85E-03 n/s	-0.0022	°
% Developed	3.78E-01 **	0.0321	5.09	8.33E-01 ***	0.0718	4 49	2 66F-01 n/s	0.000	1 41
Median Housing Value	1.35E-06 ***	0.1155	2.76	2.36E-06 ***	0.2035	3.82	3 87E-07 n/s	0.0227	0.42
% Housing < 1940	5.97E-01 ***	0.1164	3.75	7,40E-01 ***	0 1451	3 30	3.11E-01 ns	0.0603	1.07
Political Structure						2	2.115-01	0.000	1.07
Per Capita Municipalities	2.45E-01 ***	0.0738	4.66	-1.16E-01 n/s	-0.0347	-1.49	-2 52F-01 ***	-0.0750	-3 17
Per Capita Special Districts	9.42E-02 ***	0.0497	3.23	-6.45E-03 <sup>11/5</sup>	-0.0033	5 9	7.47F_02 **	0.0376	1 00
Growth and Demographics						•		0.00	1.70
Population Change	-3.77E-01 *	-0.0227	-1.66	-5.50E-02 n/s	-0.0033	-0.16	-1 35F+00 ***	-0.0812	73 04
Per Capita Income	8.92E-07 n/s	0.0203	0.32	1.51E-06 n/s	0.0344	0.35	-5.07E-06.n/s	-0.0012	1 17
% White	5.18E-01 ***	0.4428	3.63	-1.22E-01 n/s	-0 1046	L 0.73	-2 81E-01 n/s	0 2307	2 2
% < 5 Years Old	3.72E+00 ***	0.3857	2.65	-4.29E+00 **	-0.4435	-2 32	_1 26F_01 n/s	0.130	2 7
Average Household size	-2.86E-01 ***	-0.7610	-3.62	-1.77E-01 "s	-0.4712	-1.21	_5 04E-01 ***	-1 3409	2 86
Sources of Revenue						i i		COLCUI	76.90
% Property Tax	1.35E-01 n/s	0.1067	0,76	-6.92E-01 ***	-0.5456	-2.68	-5 44F-02 n/s	-0.0429	25
Per Capita Federal Revenue	1.36E-05 n/s	0.0011	0.27	1.09E-04 n/s	0.0087	1.21	-1.15E-04 n/s	00000	2.5
Per Capita State Revenue	1.24E-04 ***	0.1283	2.64	3.64E-05 n/s	0.0377	0.59	8 31F-05 n/s	0.0000	25.1
Per Capita Long-term Debt	6.95E-06 ***	0.0134	2.91	5.89E-06 n/s	0.0114	1.37	1 91E-06 n/s	0.0037	970
County Size and Primacy								200.0	2
County Land Area	4.79E-05 ***	0.0296	3.13	5.26E-05 ***	0.0327	2.44	8.33E-05 ***	0.0500	2.40
Employment Ratio	7.66E-01 ***	0.2916	4.87	1.56E+00 ***	0.5946	3.59	1 49E+00 ***	0.5674	£13
Average Government Wage	-1.67E-06 n/s	-0.0461	-0.51	$-5.58E-06^{\text{in/s}}$	-0.1545	-1.18	6.14E-07 n/s	0.0170	0.10
Metropolitan	-1.49E-01 ***		4.56	2.07E-01 ***	•	4.13	-9.22E-02 **		-1 94
Micropolitan	-1.19E-01 ***	,	-5.08	2.41E-01 ***	•	6.65	3.34E-02 n/s	•	0.68
. · ·		m	3,056		2.	2.979		2	2 995
Adjusted R <sup>2</sup>			0.68		•	0.36			0.31
									17.5

Adjusted K\*

Notes: All models were estimated using White-adjusted standard errors clustered by state; all state fixed effects have been suppressed to conserve space; \*\*\* denotes two-tailed hypothesis test significant at p < 0.01; \*\* denotes two-tailed hypothesis test significant at p < 0.10; \*\* denotes two-tailed hypothesis test not significant.

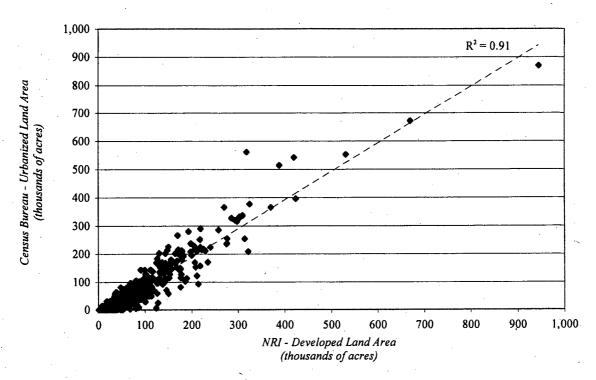


Figure 1. The NRI Measure of Developed Land Versus the Census Bureau's Measure of Urbanized Land

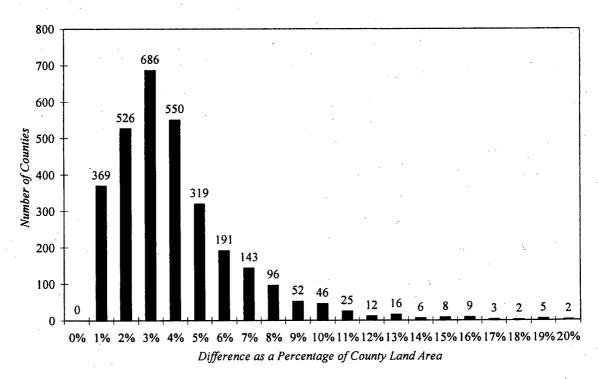


Figure 2. Absolute Value of the Difference Between Acres of Developed Land (NRI) and Acres of Urbanized Land (Census) as a Percentage of County Land Area

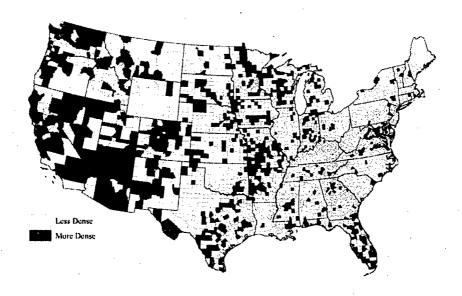


Figure 3. Change in Density, 1982 – 1997

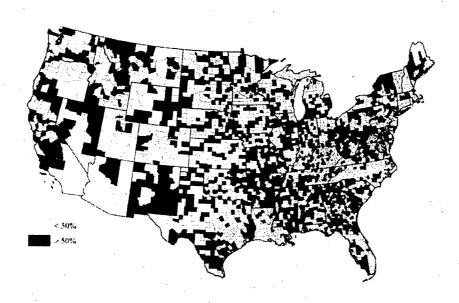


Figure 4. Percent Land Absorption, 1992 – 1997

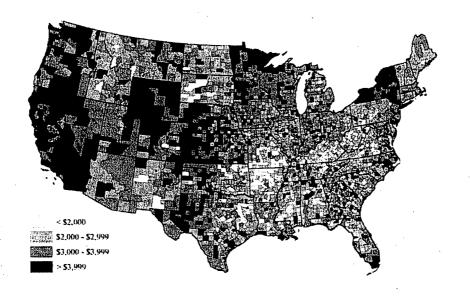


Figure 5. Per Capita Total Direct Expenditure, FY 2002

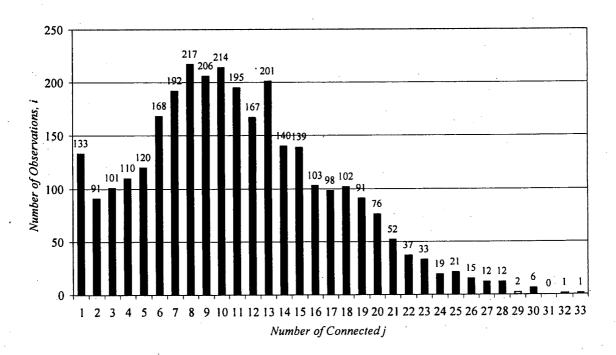
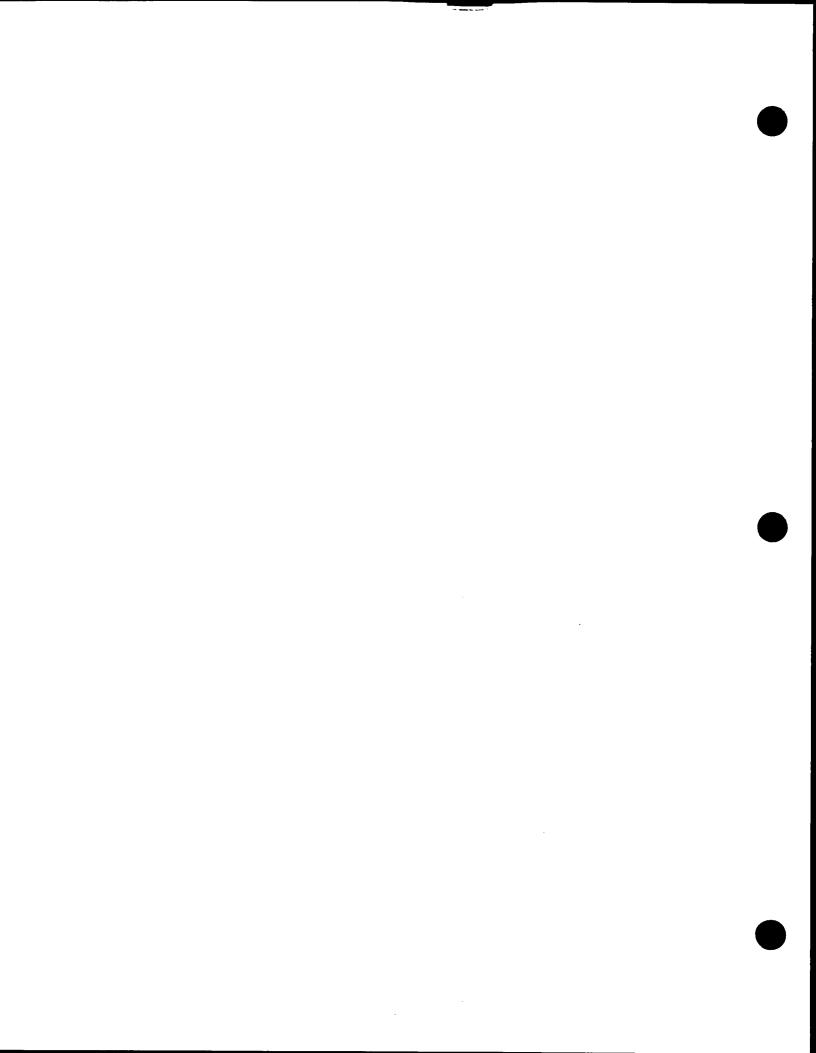
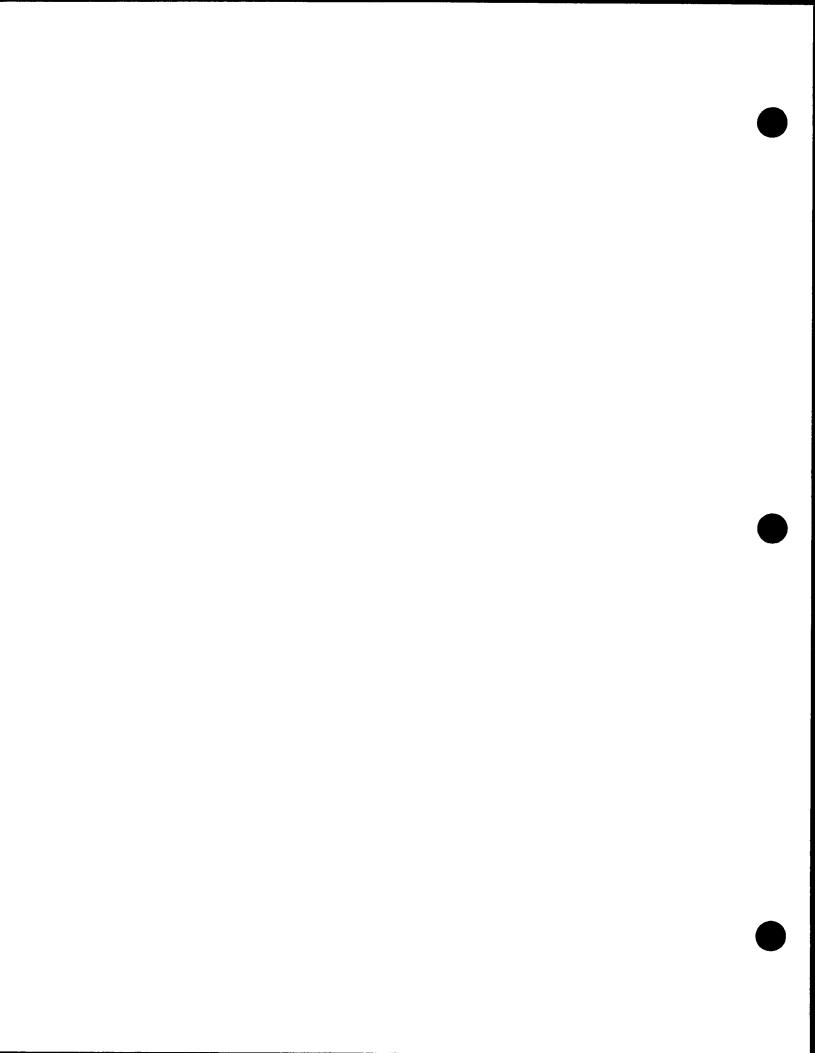
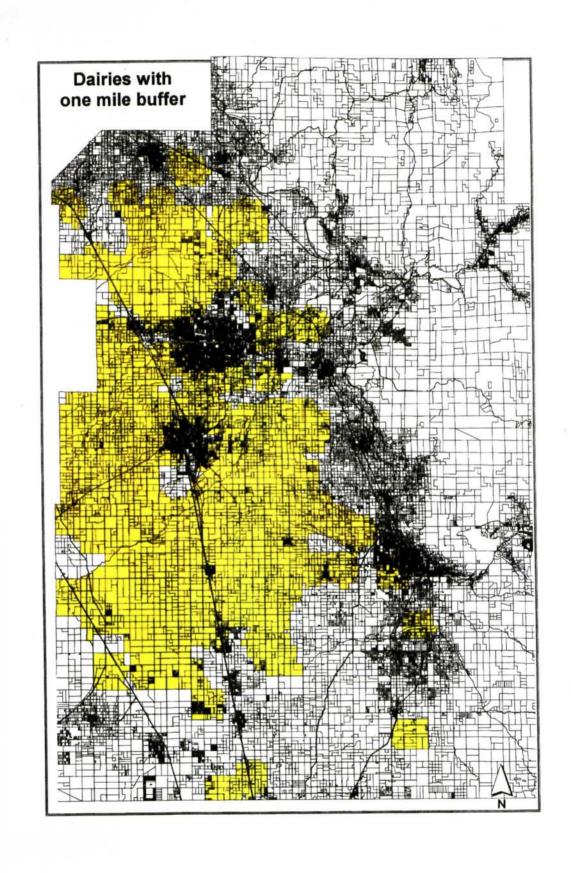
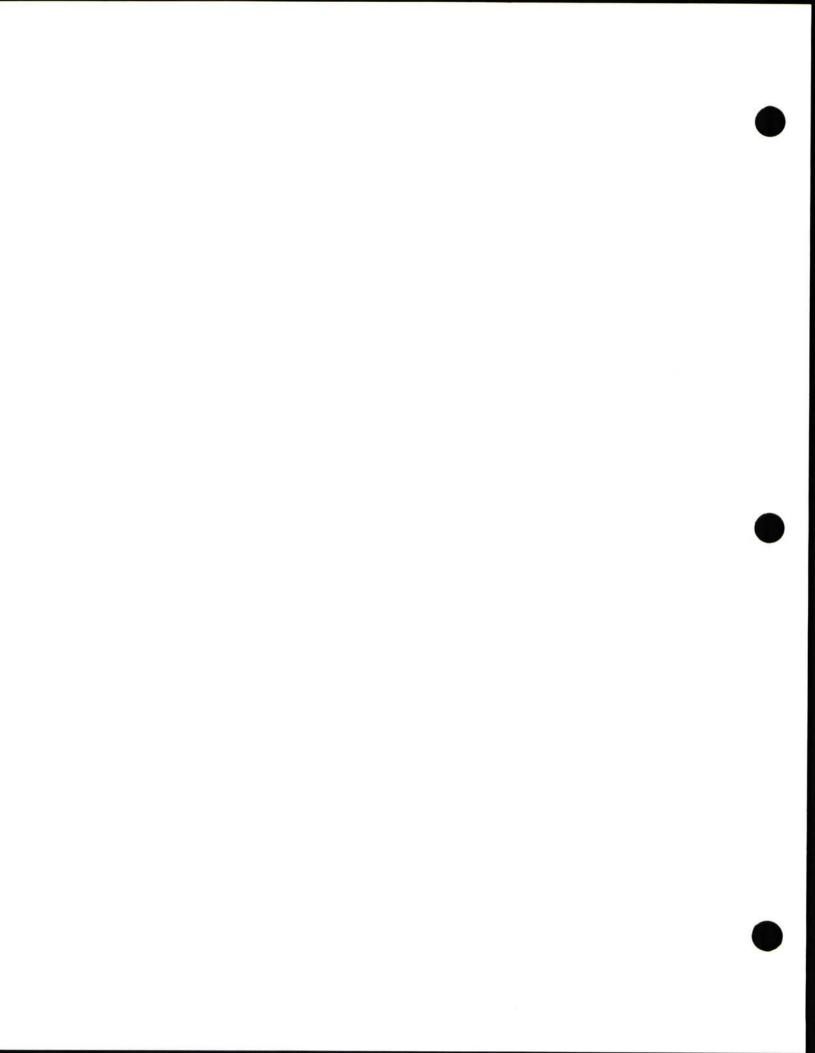


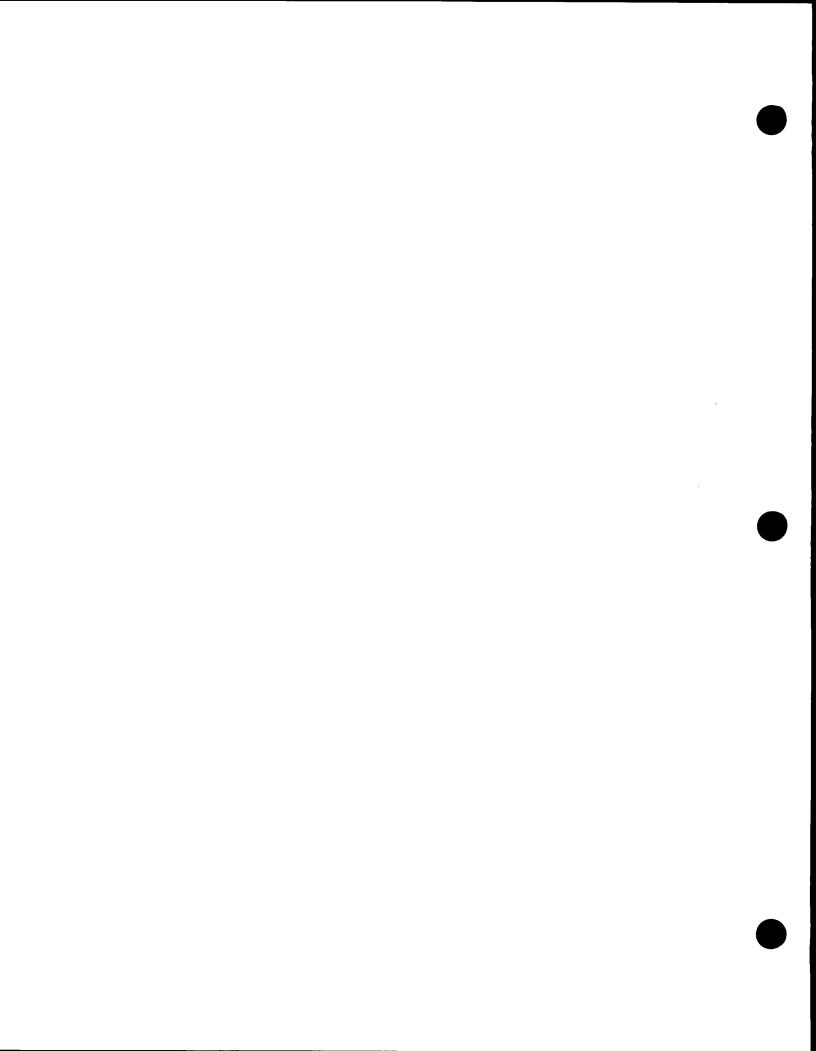
Figure 6. Connectivity of  $W_{ij}$ 











#### **MEMORANDUM**

**TO: GABRIEL ROSS** 

FROM: MARK S. KIELTY, PLANNING & BUILDING DIRECTOR

**DATE: MARCH 13, 2008** 

# SUBJECT: PROJECTS WITHIN THE CITY OF TULARE'S DEVELOPMENT BOUNDARY

- 1. Cartmill Crossings North Annexation of approximately 132 acres into an approximately 1.1 million square feet of regional retail and service uses (including a 237,000 sq. ft. Super Wal-Mart) at the northeast corner of Cartmill Avenue and St. Rt 99 Pending
- 2. Motor sports center located east of the Agri-Center between Laspina Street and Turner Drive. Development of 751 acres into:
  - 55.54 acres anchor retail commercial
  - 79.96 acres agri-business technology park
  - 13.89 acres hotel/motel
  - 11.98 acres hotel/conference center
  - 67.96 acres retail/office
  - 12.29 acres race track mixed-use retail
  - 12.32 acres lifestyle retail
  - 3.06 acres mini storage
  - 141.07 acres speedway
  - 102.50 acres drag strip
  - 22.90 acres multi-level parking structure
  - 3.09 acres condominium
  - 10.87 acres amusement center/retail
  - 47.70 acres RV park/resort
  - 14.67 acres police sub-station/fire/community center
  - 3.60 acres law enforcement training center
  - 13.28 corporate yard
  - 21.27 acre ponding basin
  - 94.44 acres public right-of-way
  - 15.08 acre tram
  - 3.25 acre public right-of-way Ag center road

Pending project

3. South I Street Specific Plan - Annexation of 458 acres providing for expansion of the industrial area for industrial-manufacturing users that have larger land requirement (20-40 acres); provide addition areas for smaller users (1-10 acres), take advantage of the Industrial trunk sewer line in Paige Avenue and take advantage of rail access line along South I Street and State Route 99. Project is located adjacent to and south of the City of Tulare, south of Bardsley Avenue,

between Pratt and South I Streets, and north and approximately ½ mile south of Paige Avenue.

M-1 96 acres
M-2 266.6 acres
R-M-2 (Urban) 7.8 acres
R-1-5 (Suburban) 75.4 acres
Railroad ROW 12.1 acres
Pending project

4. Annexation of 292.35 acres and pre-zoning property to M-1 (light industrial) for primarily warehouse/distribution uses. It is projected that future development of the site could include 22 to 30 buildings, totaling approximately 4,150,000 square feet covering approximately 35 to 40 percent of the site. Individual buildings would be 100,000 to 400,000 square feet. It is estimated that build-out would occur over the next 10 to 20 years. At total build-out, the industrial development could employee approximately 3,500 employees. Project is located south of Hosfield Road, on the west and east sides of South Laspina Street and also known as APN's 191-240-012, 191-220-004, 191-210-025 & 026. The site is located on USGS 7.5 minute quadrangle in Township 20S, Range 24E, Section 36.

# City of Visalia

## Memo

To:

**Gabriel Ross** 

From:

Brandon Smith, AICP, Senior Planner

CC:

Michael Olmos, AICP, Assistant City Manager

Date:

March 18, 2008

Re:

Pending Projects within the City of Visalia's Urban Development Boundary

Per your request, the following projects are in progress within the City of Visalia's Urban Development Boundary:

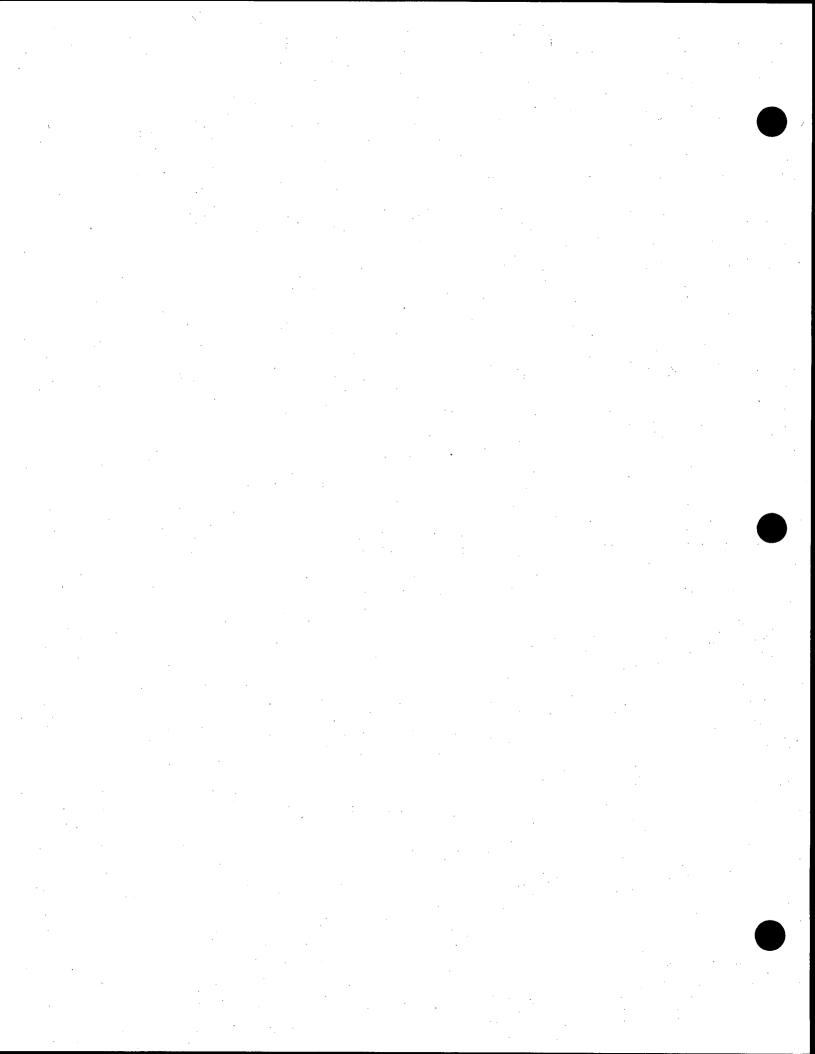
- 1. Vargas and Doe Annexations Annexation of 640 acres with Heavy Industrial pre-zoning for primarily warehouse/distribution uses. As of February 2008, the Vargas Annexation (480 acres) has been completed and the Doe Annexation (160 acres) is still pending annexation. The site is currently vacant and had not yet been developed. It is projected that future development of the site could accommodate 6,700,000 square feet of industrial space based on 25% site coverage. Minimum parcel sizes for this area would be 10 acres. It is estimated that build-out would occur over the next 20 years. The project is located north of Riggin Avenue (Avenue 312), on the west and east sides of Plaza Drive (Road 80).
- 2. Visalia Unified School District Annexation Annexation of 160 acres for the purpose of establishing a campus to accommodate several school facilities. The campus would include a high school, middle school, supporting uses such as a stadium and performing arts center, and approximately 10 acres of ancillary commercial uses. The property currently is designated for Urban Reserve but would be zoned for Quasi-Public and Commercial uses upon annexation. It is estimated that build-out would occur over the next 10 years, with annexation occurring in 2008. To date, the annexation has not been reviewed or approved by the City Council. The project will also require an amendment to the City's Urban Development Boundary to include the site. The project area is located on the northwest corner of Akers Street and Riggin Avenue.
- 3. Lowery Ranch Annexation A 580-acre area proposed as a master-planned neighborhood with mixed-density housing, a five-acre neighborhood commercial center, a nine-acre elementary school, and parks. It is projected that the project area upon full development could support approximately 2,200 dwelling units. A majority of this area is outside of the City limits and would require annexation prior to development. The property currently is designated for Residential land uses. Annexation is estimated to occur in the next 1 to 3 years, with build-out occurring over the next 10 to 15 years. The project area is located between Akers Street (Road 100), Avenue 320, Demaree Street (Road 108), and Riggin Avenue.

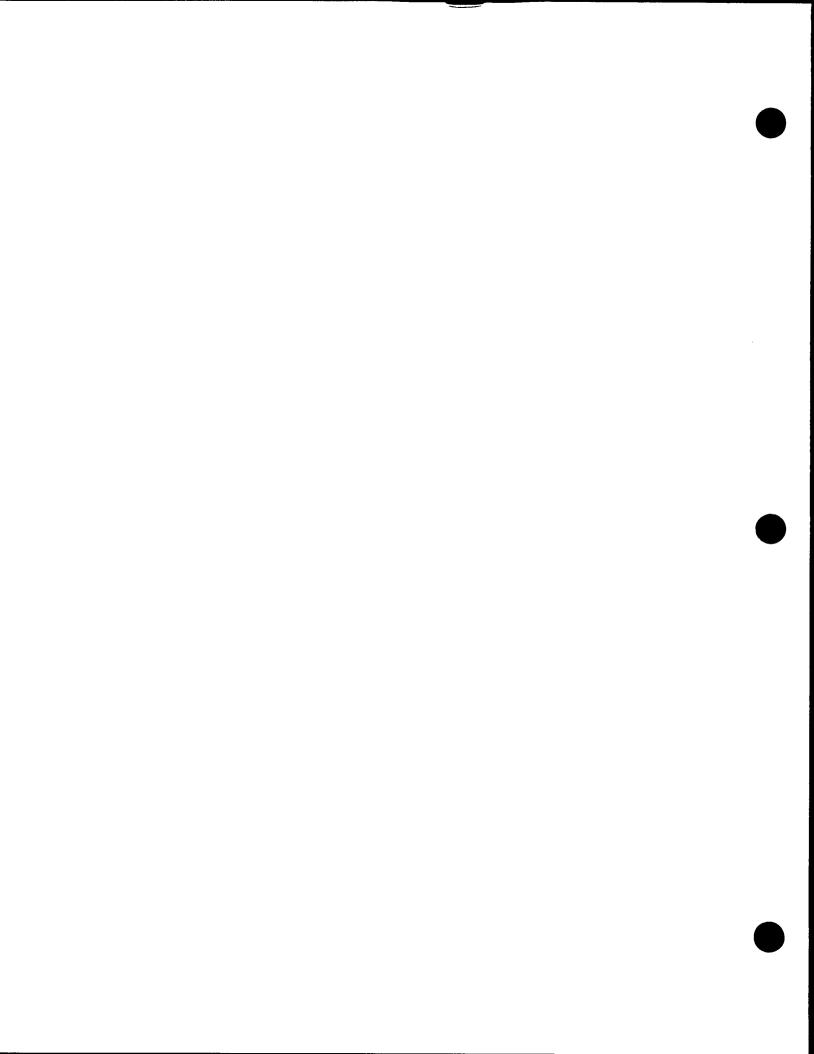


- 4. Hill Annexation Annexation of 130 acres for the purpose of developing a low-medium density residential neighborhood with a possible addition of a commercial center along Dinuba Boulevard. The property currently is designated for Residential land uses. It is estimated that build-out would occur over the next 10 years, with annexation occurring in 2008. The project area is located east of Dinuba Boulevard (State Route 63) and south & west of the St. John's River, ¼ mile north of Riggin Avenue.
- 5. Southeast Area Specific Plan An 850-acre area identified for the development of a mixed-use neighborhood utilizing traditional neighborhood design concepts. It is projected that the project area upon full development could support between 4,200 to 5,100 dwelling units, approximately 50 acres of retail and commercial services, and approximately 50 acres of civic buildings, schools, and other public buildings. The area would include approximately 430 acres of developable land, 200 acres of green space, and 220 acres for streets and alleys, and would develop in multiple several phases over the next 20 years. A majority of this area is outside of the City limits and would require annexation prior to development. The site is currently pre-zoned for Residential, Commercial, and Park land uses, but would require rezoning to redistribute the land sues. The project area is located between Santa Fe Street, Lovers Lane, Caldwell Avenue, and Avenue 272.
- 6. East Downtown Strategic Plan A 175-acre area which will complement the adjacent Central Business District by expanding economic activities and providing residential and civic uses within an urban framework. It is projected that the project area upon full development could support approximately 1,000 additional dwelling units, approximately 1,152,000 sq. ft. of commercial and office space including a new Civic Center, and over 15 acres of open space. The Strategic Plan was adopted by the City Council in 2005, and will be implemented over the next 20 years. Within this timeframe a series of development actions are needed to support the strategic plan's implementation and transition of the area from its current service commercial uses to an extension of the downtown. These actions will include land acquisition, public infrastructure, and phasing of development sites. Currently the property is inside the City limits and is zoned for Service Commercial uses. The project area is located between Bridge Street, Murray / Goshen Avenues, Ben Maddox Way, and Mineral King Avenue.

#### City of Dinuba Projects

- Residential (current final maps) since 1/1/06
  - Bel Aire Court 28 lot PUD, 8 lots developed
  - Viscaya 364 lot PUD, 26 lots developed
  - Parkside 129 lot subdivision, 20 lots developed (has been active
  - Stony Creek 11 lots, 3 developed
  - Murfield, Phase 1 119 lot subdivision, 60 lots developed (has been very active)
  - Lincoln-McKinley 15 lot subdivision, 2 lots developed
  - Marquis Homes 41 lot PUD, 4 lots developed
  - Tierra Vista 44 lot subdivision, infrastructure being installed
  - North Park Apartments 80 units, just completed
- Total single family building permits issued since 1/1/06 365
- Total multi-family building permits issued since 1/1/06 96
- Total single family lots available for development (not including misc. infill) 628
- Total multi-family units approved for development (not including misc. infill) 137
- Approved residential tentative maps 14 with a total of 956 lots
- Residential maps under review 5 with a total of 405 lots
- Commercial/Industrial (approved/permitted projects, status) since 1/1/06
  - Alta/Nebraska 1/5 acre gas and convenience store inactive/planning
  - Red Rock Plaza 6 acre strip commercial, built out
  - Red Rock Shell 1.5 acre gas and convenience store, nearing completion
  - Walgreen's drugs completed
  - Stony Creek Commercial 7.5 acres fully improved
  - Applebee's inactive/planning
  - JMM warehouse 1 acre infill, completed
  - JRW office/warehouse 2 acre infill inactive/planning
  - Rite-Aid #2 nearing completion
  - Carl's Jr. completed
  - Holiday Inn Express November 2008 completion
  - Long John Silver / KFC nearing completion
  - Dinuba center 2 acre strip commercial (Starbucks, Jamba Juice, Game Stop, Subway, Sally's, Verizon), nearing completion
  - IHOP plan review
  - Treviño Building 1/3 acre Downtown office, commercial infill completed
  - Panda Express nearing completion
  - Burger King building permit issued
  - Patterson Logistics 150,000 sf distribution center expansion (100 employee)
  - Northwest pad at Wal-Mart 16,000 sf strip center, plan review





TRANSIT COOPERATIVE RESEARCH PROGRAM

SPONSORED BY

The Federal Transit Administration

# TCRP Report 39

# The Costs of Sprawl—Revisited

Transportation Research Board National Research Council

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#### TRANSIT COOPERATIVE RESEARCH PROGRAM

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# Report 39

# The Costs of Sprawl—Revisited

ROBERT W. BURCHELL
NAVEED A. SHAD
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HILARY PHILLIPS
Center for Urban Policy Research
Rutgers University

ANTHONY DOWNS
The Brookings Institution

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TERRY MOORE DAVID HELTON MICHELLE GALL ECONorthwest

Subject Areas
Public Transit

Research Sponsored by the Federal Transit Administration in Cooperation with the Transit Development Corporation

TRANSPORTATION RESEARCH BOARD
National Research Council

NATIONAL ACADEMY PRESS Washington, D.C. 1998

#### TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in TRB Special Report 213—Research for Public Transit; New Directions, published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), Transportation 2000, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA; the National Academy of Sciences, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

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#### **TCRP REPORT 39**

Project H-10 FY'95 ISSN 1073-4872 ISBN 0-309-06306-X Library of Congress Catalog Card No. 98-61200

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Price \$62.00

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Published reports of the

#### TRANSIT COOPERATIVE RESEARCH PROGRAM

are available from:

Transportation Research Board National Research Council 2101 Constitution Avenue, N.W. Washington, D.C. 20418

and can be ordered through the Internet at http://www.nas.edu/trb/index.html

Printed in the United States of America

### **FOREWORD**

By Staff Transportation Research Board TCRP Report 39 will be of interest to individuals involved in ongoing discussions and debates about urban sprawl and its effects. This report is a literature review that represents the culmination of the first phase of TCRP Project H-10, "The Costs of Sprawl—Revisited." The report was prepared by Rutgers University's Center for Urban Policy Research, in conjunction with The Brookings Institution, Parsons Brinckerhoff Quade and Douglas, Inc., and ECONorthwest. Urban sprawl is a topic that interests urban planners, economists, environmentalists, sociologists, transportation professionals, policymakers and public officials, academics in many fields, and the general public.

Regardless of the focus of any particular debate or discussion on urban sprawl, most such discussions attempt to define sprawl and address whether it is "good" or "bad." Consequently, Chapter 1 of Section I of TCRP Report 39 provides a working definition of sprawl and its associated costs. The next chapter provides historical discussion, dating back to the early 1920s when zoning acts were initially developed, and to the 1950s when the term "sprawl" entered the planning literature. As indicated by the title of this research project, the seminal 1974 report The Costs of Sprawl, prepared by the Real Estate Research Corporation, serves as a springboard for this research effort.

Section II of the report contains the Literature Synthesis. This section systematically presents the literature on sprawl in chapters that focus on the following major areas of impact:

- Public/private capital and operating costs,
- Transportation and travel costs,
- Land/natural habitat preservation.
- Quality of life, and
- Social issues.

Throughout this section, the research team discusses the literature and identifies the extent to which there is agreement and disagreement about the premises and conclusions.

Section III of the report presents annotations of studies, organized in chapters that focus on the same five major impact areas as Section II.

While this report will not resolve the debate on the benefits and costs of urban sprawl, it provides an important repository of information for the debaters.

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## **PREFACE**

In 1974, the Real Estate Research Corporation published a three-volume study entitled The Costs of Sprawl. The study consisted of an Executive Summary, Detailed Costs Analysis (Volume I), and Literature Review/Bibliography (Volume II). It encompassed more than one thousand pages. From the time of its publication until today, it has been regarded by the social science community as one of the most significant critiques of sprawl and among the most influential studies ever undertaken. The Costs of Sprawl has been cited in countless environmental and planning reports and journals; it has been reviewed—both positively and negatively—by more than one hundred journals and magazines; and it has been presented as the seminal study on growth impacts to numerous Congressional committees and bodies. The Costs of Sprawl was funded jointly by the U.S. Council on Environmental Quality, the Department of Housing and Urban Development, and the Environmental Protection Agency.

The Costs of Sprawl, like no other study before, sought to isolate both density and location of development as significant contributors to the costs of development.

The study analyzed six hypothetical new communities of 10,000 dwelling units each, from high density (19-20 units per acre) to intermediate density (3-4 units per acre); from communities with high levels of planning and design to those lacking significant planning. The study analyzed impacts on infrastructure, housing, transportation, energy, environmental, and quality of life costs of sprawl (Real Estate Research Corporation [RERC] 1974).

Although The Costs of Sprawl was influential, it was also flawed. The analyses of community types allowed unit size and number of occupants to vary, and the savings attributed to different community types were actually a function of the differing size (and types) of units and numbers of people found there. The absence of sprawl was not the reason for the savings; smaller units and fewer people to service were the cause of the savings. Yet, even though these shortcomings were uncovered, the direction of the findings so paralleled past and current intuitive feelings that the study continues to be used twenty-five years later as one of the most cogent arguments against sprawled development patterns.

Why such interest in sprawl? Although Americans like their single-family residences, automobiles, and suburban lifestyles, there is a nagging feeling that both the aesthetics of how communities develop and the efficiency of movement within and between them could be improved. In addition, buried down deep is a recognition that Americans are wasteful in their consumption of manmade (infrastructure) and natural (land) resources, and that their development choices are selfish in terms of impacts on central cities and the populations within them. But first it must be shown to the citizenry at large that there is a problem, because life is good and "If it ain't broke, don't fix it." Is suburban sprawl different from an alternative form of development? Is it less efficient? Does it cause resources to be needlessly consumed? Is there an alternative? What do those who have studied this issue say? How substantively strong is the evidence they bring to bear?

The study that follows is a detailed examination of most of the information that can be assembled on both sprawl and its costs in an effort to answer the above questions. The monograph views the costs of sprawl (with lower-case letters) as investigated in a variety of types and forms of about 500 studies. These studies vary between those that: (1) focus specifically on sprawl, and those that deal with suburban or exurban development; (2) are highly quantitative, involving modeling or econometric analyses, and those that are qualitative and purely descriptive; (3) concern the "harder" or physical/engineering aspects of sprawl, and those that substantively involve "softer" or quality of life/social issues; (4) are primary analyses and break new ground, and those that are secondary analyses of the works of others that add very little; and (5) vilify sprawl and see no positive effects, and those that champion

the development form as purely and unequivocally "American" with few, if any, negative impacts.

With regard to the latter, this assemblage of material identifies and provides evidence for both negative and positive impacts of sprawl in each of five impact categories. These are: (1) public and private capital and operating costs; (2) transportation and travel costs; (3) land/natural habitat preservation; (4) quality of life; and (5) social issues.

The work contained in this monograph is divided into three sections and thirteen chapters. Section I contains two chapters that provide an introduction to, and an historical overview of, sprawl's "growth." Chapter One contains an introduction to the concept of sprawl, including its defining traits; Chapter Two highlights significant events in the evolution of the sprawl literature. Section II is a synthesis of the literature of sprawl's impacts: To what degree can the impact be recognized, and what is its relation to sprawl? It divides sprawl's impacts—more than 40 in total, two-thirds negative and one-third positive—into the above five impact categories. The first five chapters of this section discuss each of the above categories of impacts. The sixth chapter in this section presents in summary form information from the previous chapters both quantitatively and qualitatively. Section III individually annotates approximately one-quarter of the sprawl literature. Again, this section is broken down into five chapters according to the five sprawl impact categories.

The review of the sprawl literature is designed to be historical, substantive, comprehensive, and integrative. Presented in this way, the reader will be drawn into the argument about sprawl from its origins to the present.

# SECTION

## INTRODUCTION

The literature review that follows is an analysis of the writings and studies concerning a pattern of land development in the United States termed "sprawl." Sprawl is the spread-out, skipped-over development that characterizes the noncentral city metropolitan areas and nonmetropolitan areas of the United States. Sprawl is one- or two-story, single-family residential development on lots ranging in size from one-third to one acre (less acreage on the West Coast), accompanied by strip commercial centers and industrial parks, also two stories or less in height and with a similar amount of land takings (Ewing 1997).

Sprawl occurs on a micro basis in almost every county of the United States (although it occurs in significant amounts in only about one-fifth of the nation's 3,200 counties). Sprawl also occurs in Western and Eastern European, Latin American, and Asian countries in response to increased affluence and

growing dependence on the automobile as the preferred method of intra- and intermetropolitan travel. Most United States counties that contain sprawl have it in its residential form—i.e., low-density residential development in rural and undeveloped areas. Some counties are characterized by nonresidential sprawl, commercial and industrial development with floor-area ratios less than 0.2 located in the same types of areas (Burchell and Shad 1998).

Sprawl is the spread-out, skipped-over development that characterizes the non-central city metropolitan areas and non-metropolitan areas of the United States. — Ewing 1997

Sprawl occurs, in part, because local governments in the United States encourage this form of development via zoning and subdivision ordinances which, in turn, reflect the desires of a large share of their citizenry. This type of

development is favored by the general public because it (among other factors):

- dilutes congestion while accommodating unlimited use of the automobile;
- distances new development from the fiscal and social problems of older core areas;
- provides a heterogeneous economic mix;
- 4) fosters neighborhoods in which housing will appreciate;
- fosters neighborhoods in which schools provide both education and appropriate socialization for youth;
   and
- 6) requires lower property taxes to pay for local and school district operating expenses than locations closer in. (Burchell 1997a)

Sprawl is so well-accepted by the public that the AAA-rated locations for both residential and nonresidential development are increasingly farther out rather than closer in, and more rather than less segregated by type of land use (Gordon and Richardson 1997a). Gated communities, farmettes, research parks,



Large regional malls, initially located along undeveloped highway interchanges, stimulate rapid additional surrounding development.

Source: Constance Beaumont, NTHP.

law offices, medical groups, megahardware and home improvement stores, theatrical and comedy clubs, new and used car lots, and restaurants all now seek peripheral locations in pursuit of their markets. The move to the far reaches of the metropolitan area began with single-family subdivisions; shopping centers and garden apartments sprang up next; then research and industrial parks; then restaurants and entertainment facilities; and finally, discounters of every form.

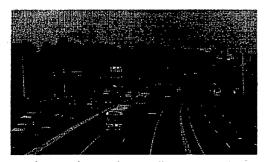
The unique aspect of all this development is that few entities have ever failed because their outward locational decisions were in the wrong direction. Occasionally, a retailer or a residential development has gone under because an exit on the interstate or beltway wasn't developed as planned, but rarely has an economic entity failed in the United States because it was developed too far out.

The move to the far reaches of the metropolitan area began with single-family subdivisions; shopping centers and garden apartments sprang up next; then research and industrial parks; then restaurants and entertainment facilities; and finally, discounters of every form.

The newest and soon-to-be one of the most successful airports in the United States is 33 miles from the city of Denver; a taxi ride from the airport baggage claim to the downtown Hyatt costs \$40. Is this an anomaly? No. Cincinnati's new airport is so far from the downtown that it is not even in the same state! Both airports have already drawn nonresidential development and are now drawing residential development to their edges. Both are tens of miles from the nearest existing development of these types. But neither can justify its location solely on flight pattern interference with residential environments. Instead, the locations were chosen for exactly the same reason other land use locations are chosen: an abundance of land was available, and it

was both relatively inexpensive and easy to assemble.

If sprawl is so desirable, why should the citizens of the United States accept anything else? The answer is that they no longer can pay for the infrastructure necessary to develop farther and farther out in metropolitan areas. In the state of South Carolina, if sprawl continues unchecked, statewide infrastructure costs for the period 1995 to 2015 are projected to be more than \$56 billion, or \$750 per citizen per year for the next twenty years. In addition to a massive infrastructure conservation program and the adoption of numerous technological cost savers, funding infrastructure in this state could require an increase in the gasoline tax of 2¢/gallon; an increase in the state sales tax of 0.5%; an increase in property taxes of 12.5%; the tolling of all interstates at 30-mile intervals; impact fees on residential and nonresidential development of \$2,000 per unit and per 1,000 square feet, respectively; and a mandatory 10 percent set-aside for infrastructure in all state, county, municipal, and school district general funds and intergovernmental transfer revenues (Burchell 1997b).



Despite massive road expenditures, I-395 in Arlington, Virginia, slows to a gridlock during rush-hour traffic.

Source: Virginia Department of Transportation.

The big-ticket item in all infrastructure projections is roads. In South Carolina, roads are expected to cost \$25 billion, almost half of the total \$56 billion infrastructure budget. In South Carolina,

roads will cost 2.5 times what will be spent on primary, secondary, and higher education infrastructure; three times what will be spent on health infrastructure, including all hospitals, institutions, and all water-sewer treatment systems; ten times what will be spent on public safety, administration, and justice infrastructure; fifteen times what will be spent on environmental protection infrastructure; and twenty-five times what will be spent on all cultural and recreational infrastructure.

Dually supporting and underutilizing two systems of infrastructure—one that is being abandoned in and around central cities and close-in suburbs, and one that is not yet fully used in rural areas just beginning to be developed—is causing governments to forgo the maintenance of much infrastructure and the provision of anything *other* than growth-related infrastructure. The United States, in other words, is funding road infrastructure by:

- 1) not funding all infrastructure;
- 2) not *fully* funding developmental infrastructure;
- 3) not repairing or replacing most-types of infrastructure; and
- 4) not taking advantage of the technological improvements in rehabilitation, repair, and provision of infrastructure that could be passed on to taxpayers as savings.

Still, by no means is an alternative to the current pattern of land development the panacea. If South Carolina were to switch to compact development and managed growth measures to curtail spread development, the state would be able to save only about 10 percent of the projected \$56 billion infrastructure costs, or approximately \$5.6 billion. This is because about 40 percent of public infrastructure costs are not growth-related, and only about two-thirds of the remainder is *new* growth-related. When

development pattern savings are applied to the appropriate portion of new growth-related infrastructure costs, therefore, the saving is only 12–15 percent.

On the other hand, increasing the gasoline tax by 2¢/gallon in South Carolina, would have raised only \$56 million in new revenues statewide—one one-thousandth of the total required infrastructure costs—and one one-hundredth of the amount that potentially could be saved by altering land development patterns (Burchell 1997b).

In sum, most of the American public is not unhappy with the current pattern of development in metropolitan areas—it simply can no longer afford it. Thus, the primary concern about sprawl development, at a time when the average American is satisfied with its outcome, is cost. And costs need to be measured not just in terms of capital improvement but also in terms of resource depletion. Land in the United States is being consumed at triple the rate of household formation;

automobile use is growing twice as fast as the population; and prime agricultural land, forests, and fragile lands encompassing natural habitats are decreasing at comparable reciprocal rates (Landis 1995).

In sum, most of the American public is not unhappy with the current pattern of development in metropolitan areas—it simply can no longer afford it.

As a result, the professional transportation and city planning communities are beginning to look at sprawl to determine whether an alternative to this growth pattern can be conceived, and even more importantly, whether it makes sense to pursue an alternative pattern of growth. Does any alternative pose a viable option to current methods and forms of metropolitan development? A significant literature has developed in this area and is overviewed in this section.

#### **CHAPTER**



## **DEFINING SPRAWL**

Sprawl, in its broadest sense, has long been an American zeitgeist. Alexis de Tocqueville, touring the United States in the early 1800s, observed "no urban growth boundaries," but rather marveled at "America ... where everything is in constant motion ... and where no boundaries were set to the efforts of man." Today's sprawl is the frontier of long ago; it is akin to the post-war suburb—both of which have been extolled as defining American influences.

John Delafons, Fellow at the Harvard/MIT Joint Center in 1961, chose as a research topic a comparison of British and American land-use controls. His work, *Land Use Controls in America*, provides an insightful look at the growth of the U.S. "system" of controls from 1920 to 1960 by an outsider who came from a country with a very formal system of land-use controls.

Delafons describes the U.S. system of master planning, zoning, and subdivision control as heavily influenced by a "prairie psychology." He explains that U.S. development patterns are characterized by:

- a) a supply of land which is viewed as virtually unlimited:
- b) land that is open to all and property ownership rights that are encouraged and protected by the U.S. Constitution;
- c) economic forces that are barely understood and should not be tampered with:
- d) development professionals who prepare land for development and do not question whether the land should be developed (i.e., they make sure utilities are in place and feeder roads have been planned for); and
- e) a basic distrust of elected and appointed officials, so that all procedures are codified and development that qualifies under these procedures does so "as of right," with minimal public review. (Delafons 1962)

U.S. development controls, he claims, are "static" and thus lack the ability to control tempo (timing) and sequence (which location first) of development.

Development is free to wander and to take place incrementally in jurisdictions in the United States because existing land use

controls allow this to happen (Delafons 1962).

Many agree with Delafons' insight. Although some view contemporary development patterns as a reflection of the invisible but sure hand of the market (Gordon and Richardson 1997a), the unbridled movement outward of leapfrog, low-density development is increasingly being viewed as an American ill (Richmond 1995). Sprawl has taken on both a pejorative as well as a descriptive connotation, an intermixing that makes a balanced discussion, which attempts to disentangle the costs and benefits of sprawl, difficult.

U.S. development controls are "static" and thus lack the ability to control tempo (timing) and sequence (which location first) of development.

The shift to the suburbs has, of course, been manifest for more than half a century. In 1940, only 15 percent of the United States population resided in the suburbs (defined as metropolitan areas outside of central cities). As the millennium approaches, about 60 percent of the population is counted as suburban. Even the most vehement critics of sprawl recognize that suburban and exurban growth patterns have been and will continue to be inescapable development forms in the United States. The recent population increase of some 20 million people per decade is likely to continue for at least the next quarter-century. As a result, there will continue to be skippedover development in rural and undeveloped areas. It would be totally unrealistic to expect even a moderate share of growth to occur solely in already built-up neighborhoods in cities or in close-by inner suburbs. Even the suburbs are being bypassed now by development seeking locations at the fringe of

metropolitan areas (Nelson and Sanchez 1997).

## A WORKING DEFINITION OF SPRAWL

Density, or more specifically, low density, is one of the cardinal defining characteristics of sprawl. But density has to be set in context; cross-cultural and place-oriented differences factor into the definition of sprawl. Densities in the United States overall are roughly onetenth what they are in Western Europe; in turn, Western European density is much lower than that of Japan and only a fraction of what is found in such locations as Hong Kong and Indonesia (Jackson 1985). And in all of the above locations. suburban densities are lower than the densities of central cities. Sprawl is not simply development at less-thanmaximum density; rather, it refers to development that, given a national and regional framework (i.e., suburbs in various locations of the United States), is at a low relative density, and one that may be too costly to maintain.

Sprawl refers to a particular type of suburban peripheral growth. It refers to development that expands in an unlimited and noncontiguous (leapfrog) way outward from the solidly built-up core of a metropolitan area. In terms of land-use type, sprawl includes both residential and nonresidential development. Residential development contains primarily single-family housing, including significant numbers of distant units scattered in outlying areas. Nonresidential development includes shopping centers, strip retail outlets along arterial roads, industrial and office parks, and free-standing industrial and office buildings, as well as schools and other public buildings.

These different types of land uses are, for the most part, spatially segregated from one another. The components of this development are individually located in small subdivisions in zoning districts. Within each district, usually only one type of use is permitted—e.g., single-family residential, shopping centers, strip commercial, industrial, or office parks.

Another of sprawl's distinguishing traits is its consumption of exurban agricultural and other frail lands in abundance; these are the types of land found at the periphery of development. The loss of agricultural acreage takes place in significant amounts because it often is the cheapest land available for development. Fragile environmental lands are swallowed up because they are part of the otherwise developable tracts. These tracts would not be developed if the environment was adequately protected.

Under sprawl conditions, there is almost total reliance upon the automobile as a means of accessing the individual land uses. Seventy years ago, the streetcar was the most popular form of transportation to the suburbs. Nowadays the automobile is the most efficient means of accessing sprawl's outward extension and skipped-over development. For seven-day-a-week business and recreational use, including both at-peak and off-peak use, nothing can match the automobile for cost, efficiency, and versatility—at least in the short term.

Some analysts also include the small developer and a lack of integrated landuse planning as important aspects of suburban sprawl, and point to the relatively small residential subdivisions and nonresidential site plans created by individual developers operating independently of each other within the zoning districts of the 10,000 local governments found throughout the United States. The legal framework within which

sprawl occurs is fragmented into numerous relatively small units, separately controlled by discrete local governments with unique rules and regulations. These localities have different fiscal resources per capita (assessed valuation of residential and nonresidential properties). Some are quite wealthy; others have limited ability to pay for local services. The poorer localities are at a severe disadvantage when competing for development.



The automobile has replaced the streetcar, stimulating sprawl development. *Source*: Minnesota Historical Society.

Still, it must be stressed that sprawl is almost impossible to separate from all conventional development. Even though one may be able to comprehend what appears to be a better method of development, it is difficult to translate that method into practice.

Some components of sprawl are not easily measured. For example, although it is possible to track residential single-family and nonresidential commercial and retail development taking place at low densities in the United States, accessed by automobiles in rural and undeveloped areas, this is the point at which almost all tracking stops. Measures of leapfrog development or development that is spatially segregated are virtually impossible. Measures of how much development is being delivered by small

developers in local jurisdictions is achievable but generally unproductive.

Finally, although a measure of gross residential density (number of dwelling units divided by area of jurisdiction) is available from several sources and can provide some indication of land taken per developed unit, the gross measure often masks the actual land takings of individual new developments.

On the other hand, there is little evidence to suggest that conventional development in a given location is anything other than leapfrog, segregated, and land-consuming. Thus, sprawl development can be characterized with some certainty as low-density residential and nonresidential intrusions into rural and undeveloped areas, and with less certainty as leapfrog, segregated, and land-consuming in its typical form.

## A WORKING DEFINITION OF THE COSTS OF SPRAWL

The "costs" of sprawl have been talked about for decades, often without a full understanding of what these costs are and to what level they should be assigned. In the original RERC (1974) Costs of Sprawl study, costs were calculated in six different substantive areas and assigned to three different levels: infrastructure and transportation costs were assigned to the community, housing and quality-of-life costs to the individual, and energy and environmental costs to both the community and to society as a whole (RERC 1974). This is a characteristic of the sprawl literature which is only beginning to be addressed at the end of a twenty-five-year observation period. The work of Sam Seskin of Parsons Brinckerhoff and Terry Moore of ECONorthwest on full-cost accounting of transportation costs is breaking new

ground in viewing the totality of costs of public policy decisions (Parsons Brinckerhoff and ECONorthwest 1996). Their work is the exception. Most costaccounting efforts assign sprawl costs to either the easiest or the most common level of measurement.

For definitional purposes, the "costs" of sprawl are the resources expended relative to a type, density, and/or location of development. These "costs" involve physical, monetary, temporal, and social/psychological resources. They involve costs to the individual, to the community, and to society. Most of the costs specified to date are physical or monetary, although occasionally social costs (e.g., the loss of upward mobility) or psychological costs (e.g., the loss of sense of community) are documented.

There is little evidence to suggest that conventional development in a given location is anything other than leapfrog, segregated, and land-consuming.

The "benefits" of sprawl are mirror images of costs. They involve resource gains due to type of development pattern and include categories of gain similar to those of losses stated above. This might involve a temporal gain in suburb-to-suburb travel time because most residences and jobs are now both suburban, or monetary gains due to reduced housing costs also from building farther out, or social gains such as the ability to achieve homeownership, again due to location in more distant places.

Costs and benefits are reported in the form that the primary research provides. In almost all cases, these are *costs* at the *community* level as opposed to costs at the individual or societal levels, or benefits at any level.

#### **CHAPTER**



## HISTORICAL OVERVIEW

Sensitivity to the consequences of sprawl-like settlement predates the coining of the term. The 1929 Regional Plan of the New York Metropolitan area, for instance, warned of a steady decrease in farms and open-space acreage in the region and underscored the need for settlement patterns that encouraged "the face to face association that characterized the old village community" (Regional Plan 1929, 23 and 216). At the same time, the Regional Plan spoke approvingly of "many carefully planned outer subdivisions with good features" (Regional Plan 1929, 1).

Concern about sprawl-like patterns of development was appropriate at this time. The Standard Zoning Enabling Act (1922), drafted under the aegis of Secretary of Commerce Herbert Hoover, the Standard City Planning Enabling Act (1928), and the legalization of zoning that resulted from the 1926 Supreme Court decision (Euclid v. Amber Realty) unleashed a barrage of "model" zoning and planning-enabling legislation across the United States. Euclidean zoning of segregated land uses and the emergence of the automobile began to establish the first

distant "suburbs" throughout the United States.

It was not until roughly the late 1950s and early 1960s, however, that sprawl as a planning term entered the literature. The land development pattern it depicted was typically criticized. Herbert Gans in *The Levittowners* described Levittown development of the 1950s as "residents living in a sea of cell-like structures on a



Levittown, Pennsylvania: post-World War II suburbia.

Source: Carl Byoir and Associates (New York).
Courtesy American Planning Association.

remote potato farm with cars spilling out of every street" (Gans 1967). In 1956, a Canadian planning study described urban sprawl as "scattered building development" that had led to "inconveniences in the placement of public and business facilities" (Lower Mainland Regional Planning Board 1956). A year later, William H. Whyte, describing urban sprawl as leapfrog, scattered development, spoke of it as "a problem that had reached national proportions" (Whyte 1957).

The political and social climate of the period, however, provided definite financial incentives for building homes in the suburbs in the form of federally insured low-cost mortgages. This period also witnessed the massive federally subsidized expansion of U.S. highways (1956 Interstate Highway Act), including the establishment of the interstate system. The new roadway system, together with the growth in accessible, low-cost mortgages, helped push development far beyond the nation's central cities (APA 1997). Relatively few people seriously challenged this new pattern of growth in the outlying areas or questioned the changes in central cities brought about by multi-lane freeways.

Others soon entered the discussion, however. Marion Clawson, in 1962, described sprawl as a "lack of continuity in expansion," and noted it was both fostered by, and contributed to, land speculation (Clawson 1962). Similar literature of the period, including Lessinger (1962), Harvey and Clark (1965), and Bahl (1968) viewed sprawl as characterized by such features as lowdensity, scattered, and leapfrog patterns. Harvey and Clark (1965) identified the three cardinal traits of sprawl as lowdensity, ribbon, and leapfrog development.

Even at this early stage, pundits acknowledged the difficulty in defining the term sprawl. Writing in 1972, David McKee and Gerald Smith observed that:

Urban sprawl is rather difficult to define. In some circles the term is thought to be synonymous with suburbia. Certainly the problem exists in suburbia but suburbia itself is not the problem. Some equate sprawl with expansion. But this type of definition is not too helpful. (McKee and Smith 1972, 181-182)

McKee and Smith went on to describe sprawl in four forms: 1) very low-density development (i.e., two- to five-acre zoning); 2) ribbon-variety development extending along access routes; 3) leapfrog development; and 4) a "haphazard intermingling of developed and vacant land" (McKee and Smith 1972). The authors claimed that sprawl aggravated suburban problems (e.g., automobile dependence and the high cost of services and infrastructure) and also deleteriously affected cities by depressing real estate values, among other things.

The political and social climate of the period provided definite financial incentives for building homes in the suburbs.

Discussion of sprawl's effects transcended economics. Although the 1973 Rockefeller Brothers Task Force publication, *The Use of Land*, did not speak of sprawl per se, it concluded that the dominant pattern of "unrestrained, piecemeal urbanization" was leading citizens to ask how such growth affected their "quality of life" (Reilly 1973, 33). In a similar vein, *The Language of Cities* and the *Encyclopedia of Community Planning and Environmental Management* defined sprawl, respectively, as:

the awkward spreading out of the limbs of either a man or a community. The first is a product of bad manners, the second of bad planning. Sprawl is a byproduct of the highway and automobile, which enabled the spread of development in all directions. As

builders scramble for lots to build on, the journey to work is lengthened and green spaces are consumed by gas stations and clutter. (Abrams 1971, 293-294)

the uncontrolled growth of urban development into previously rural areas. Sprawl refers to a mixture of land uses occurring in an unplanned pattern. Urban sprawl has been strongly criticized as an unattractive and inefficient use of land and resources, causing excessive infrastructure costs related to extending utilities to remote areas. It has also been accused of eliminating environmentally important open space while leapfrogging developable parcels. (Schultz and Kasen 1984, 378-379)

## THE FIRST STUDIES ON THE COSTS OF SPRAWL

In the 1960s, professional research began to be undertaken in numerous areas relevant to the study of sprawl. Examples of this early research include Innovation Versus Tradition in Community Development (ULI 1963), which looked at the effects of development patterns on road lengths; Howard County Study (Howard County 1967), which considered comparative, countywide costs of roads. utilities, schools, and open space under sprawl versus more planned scenarios; Urban Form and the Cost of Public Services (Kain 1967), which considered public service costs at varying densities; Planned Residential Environments (Lansing 1970), which looked at how different overall development patterns influence trip generation rates and distances; Total Energy Demonstration (HUD 1972), which measured likely savings in energy consumption in planned communities; and The Relationship of Land Use and Transportation Planning to Air Quality Management (Hagevik 1972),

which examined how development planning affects air pollution on a regional basis. Although not articulated, the substantive foci in analyzing sprawl versus alternatives—namely, the issues of transportation, infrastructure, public service costs, and land and environmental issues—were already being formulated.

Many of these early studies were referenced by the bellwether study, *The Costs of Sprawl*, authored by the Real Estate Research Corporation in 1974. As summarized by RERC:

This analysis presents a complete and internally consistent set of estimates for direct costs and adverse effects resulting from prototypical housing types and land development patterns at neighborhood and community levels. Six neighborhood prototypes-differing in housing type and density—are analyzed, along with six community prototypes which represent different degrees of community-wide planning. ... Stated in the most general form, the major conclusion of this study is that, for a fixed number of households, sprawl is the most expensive form of residential development in terms of economic costs, environmental costs, natural resource consumption, and many types of personal costs. (RERC 1974, 2-7)

The Costs of Sprawl did not explicitly define the term "sprawl." As a matter of fact, those close to the study indicate that the term appeared as an afterthought in the title and summary of findings and was not used explicitly elsewhere in the study. The analysis of six community-level growth patterns within the study implied that sprawl development had at least two major traits: low average residential density (3 units or less per net residential acre), and a lack of overall planning at either the regional or community level. RERC did not define sprawl's specific

density characteristics, nor did it define its residential and nonresidential components.

RERC considered approximately 20 individual effects (see Table 1). As seen in Table 2, these costs can be grouped into four overall categories encompassing:

- 1) public-private capital and operating costs:
- 2) transportation and travel costs;
- 3) land and natural habitat preservation; and
- 4) quality of life.

Not considered in *The Costs of Sprawl*, and not part of its research charge, was any examination of sprawl's social effects, such as its impacts on cities.

The RERC study evoked a flood of commentary—much praise as well as some criticism. Two of the better known criticisms were articulated by Altshuler (1977) and Windsor (1979). Among other points, Altshuler argued that RERC underestimated the demand for services by higher-density development and commingled the effects resulting from high density and smaller-unit size. Windsor, in parallel, criticized RERC for not disentangling density from other factors, and among other shortfalls, argued that RERC ignored the benefits of sprawl, such as its "response to consumer preference" for single-family detached homes. These early points of opposition on the costs/benefits of sprawl are still present twenty years later and can be seen in the recent exchanges between Gordon/Richardson and Ewing on the subject (Gordon and Richardson 1997a; Ewing 1997).

Although the findings of *The Costs of Sprawl* dominated the literature for some time, new analyses continued to be published. Examples include David Popenoe's (1979) depiction of sprawl as

low-density, scattered strip development, which focused on its adverse sociological implications. In 1981, David Mills described sprawl as scattered, leapfrog development, and discussed how it both abetted and resulted from land speculation.

Not considered in The Costs of Sprawl, and not part of its tesearch charge, was any examination of sprawi's social effects, such as its impacts on cities.

## BURCHELL/LISTOKIN AND TISCHLER ON FISCAL IMPACTS

During the time period between the first and interim studies on the capital costs of growth, the national work of Robert W. Burchell/David Listokin of Rutgers University and Paul Tischler in fiscal impact analysis, or the examination of the operating costs of growth, came to the fore. From the early 1970s to the late 1980s, numerous studies were undertaken on the municipal and school district costs of growth. Burchell and Listokin were participating authors in Housing Development and Municipal Costs (Sternlieb 1975) and coauthored The Fiscal Impact Handbook (1978) and The Practitioner's Guide to Fiscal Impact Analysis series (1980, 1985). Paul Tischler, a private consultant, undertook studies throughout the country using the MUNIES and FISCALS models developed by him and others.

The fiscal impact studies sought to preview for a community, county, or school district the impact of projected development on future educational and noneducational public service demands. Burchell and Listokin offered an average costing approach built on regional and statewide demographic multipliers for the demand for public services, and average

historical costs for the costs of public services. Burchell and Listokin balanced the calculation of costs with revenue calculations in three categories; property tax, non-tax, and intergovernmental transfers. This was termed the Per Capita Multiplier fiscal impact technique, which became the method used in creating their fiscal impact hierarchy and the basis of their Development Impact Assessment Handbook (Burchell, Listokin, and Dolphin 1994). Burchell and Listokin found that most conventional residential development negatively impacted the host service provider, whereas open space development and nonresidential development broke even or positively impacted the host service provider. These studies paid little attention to explicit capital costs except that ongoing debt service was a component of operating costs.

Paul Tischler used a marginal costing approach in most of his fiscal impact analyses. In MUNIES and FISCALS, a great deal of time was spent gathering both site-specific data and information on excess or deficient service capacity locally. Tischler actually termed a component of his overall fiscal impact analysis a "level of service analysis." The Tischler studies involved detailed calculations of how a specific community with a particular set of financial conditions would respond if growth were to take place immediately.

Paul Tischler headed the economic committee of the American Planning Association from 1980 to 1990. Tischler generally reached the same conclusions on the fiscal impacts of residential development, open space, and nonresidential development as did Burchell/Listokin. Conventional residential development was generally found to be fiscally negative, open space or undeveloped land to be break-even, and

nonresidential development to produce positive fiscal impacts. Tischler and Associates was involved in costs of growth studies in numerous locations nationally and has also been involved in alternative development and impact fee studies.

These two groups, with different approaches and different audiences, found generally the same conclusions on the fiscal attributes of various types of land uses. They established for the planning and land development fields a solidification of opinion on the future public costs of residential and nonresidential development.

#### THE INTERIM STUDIES: MANAGED GROWTH COSTS IN CALIFORNIA; THE COSTS OF SPRAWL IN FLORIDA (DUNCAN AND FRANK)

In the early 1980s, in response to the rampant development of the 1970s, growth control ordinances began springing up in California and Florida cities. These included Davis (CA), Petaluma (CA), and Boca Raton (FL). Before one or more of these ordinances were challenged and set aside, initial inquiry concerned their potential impact on local housing costs. If growth were curtailed through building permit or population caps or through adequate public facilities ordinances, would these factors contribute to increased housing costs? Almost everyone looking at these issues concluded that growth control ordinances did increase local housing costs (Katz and Rosen 1987; Schwartz et al. 1981, 1989). Further, excessive growth management through protracted permitting processes, including fiscal impact analysis, coastal zone management procedures, natural resource inventories, and other mechanisms, was also found to increase housing costs (Parsons 1992).

# TABLE 1

# REAL ESTATE RESEARCH CORPORATION (RERC 1974a) THE COSTS OF SPRAWL: SUMMARY OF FINDINGS

			ine costs	OF SFRAN	HE COSIS OF STANKE. SOUTHERN	NI OF FEMDENGE	NGO			
	Co	Community	Prototypes	(10,000 un	units)	Nei	Neighborhood 1	Prototypes	(1,000 units,	(3)
	-MOT	Low-	Sprawl	Planned	High-	Single-		Townhouse	Walk-up	High-rise
Category	density	density	Mix	Mix	density	family	family	Clustered	Apartment	Apartment
	Sprawl	Planned	:		Planned	Conventional	Clustered			
INFRASTRUCTURE					Capital	costs per unit				
Recreation	\$ 268	\$ 297	\$ 268	\$ 297	\$ 297	\$ 220	\$ 274	\$ 274	\$ 252	\$ 203
Schools	4,538	4,538	4,538	4,538	4,538	5,354	5,354	4,538	4,538	1,646
Public Facilities	1,662	1,626	1,645	1,622	1,630	-				
Roads/streets	3,797	3,377	3,235	2,708	2,286	3,080	2,661	2,111	1,464	801
Utilities	6,197	4,744	3,868	3,323	2,243	5,483	3,649	2,369	1,579	958
Infrastructure	16,462	14,582	13,556	12,487	10,995	14,137	11,938	9,292	7,833	3,628
Subtotal		•	•	•	•		:	•	1	
Construction/Other	34,994	34,398	23,728	23,266	17,711	34,774	34,320	17,967	13,449	17,088
Total Unit Costs	\$ 51,456	\$ 48,981	\$ 37,283	\$ 35,753	\$ 28,706	\$ 48,911	\$ 46,258	\$ 27,259	\$ 21,282	\$ 20,696
Public Proportion	19%	12	% 24%	16%	18%	15%	15%			
Public Costs.	\$ 9,777	5. 5.878	8,948	5.5720	\$ 5,167	7,1337	\$ 6,939 \$ 5,452	25:07	\$ 5,321	\$ 2,6
OPERATING			Annual	Nonresidential	Operating	and Maintenance Co	Costs per Unit (in year	year 10)		,
Operating Costs	\$ 2.111	\$ 2.067	\$ 1.965	\$ 1.937	\$ 1.873	\$ 1.721	\$ 1.720	\$ 1.388	\$ 1.319	\$ 548
Public Proportion		51	% 61\$				61%			
aPublic Costs	\$ 1,203	\$ 1,054	\$ 1.199	\$ 1,065	1,065 \$ 1,030	<b>-\$</b> 1,153 <b>\$</b> 1,	152	\$ 999	\$ 76	\$
LAND					Land Require	Land Required (for 10,000 units)	(s			
Total Acres	ΑΝ	¥	ž	ž	NA NA	2000	4000	3000	2000	1000
Developed Acres	4,590	4,113	2,780	3,040	2,173	¥	Ź	Ź	Ž	ž
Vacant, Improved	•							٠		
Acres	459	206	278	152	109	¥	₹	¥	Ž	ž
Vacant, Semi-										•
improved Acres	951	617	1,390	456	326	¥	¥.	¥	ž	¥
Vacant, Unimproved						•				
Acres	1	1,064	1,552	2,352	3,392	¥	₹	₹		<b>≨</b>
Total Vacant Acres	1,410	1.887	3,220	2,060	3,827	NA.	×	N	¥.	NA.
ENVIRONMENT				Principal		Environmental Impacts (for 10,000	3			
Non-auto Air	1,420	1,420	1,034	1,034	808	1,420	1,420	951	738	644
Pollutants										
Sewage Effluent	4.5					4.5	4.5			4.5
Water Use	1,170	1,100	910		160	1,205	1,059	913	730	639
Non-auto Energy Use	2,355	2,355	1,750	1,750	1,400	2,398	2,398	1,595	1,232	1,056
Notes: All dollar figures are per dwelling unit in 1973 dollars.	s are per dwell	ing unit in 19	73 dollars.		b Lbs.	b Lbs. per day.			-	

All dollar figures are per dwelling unit in 1973 dollars.

NA = Not applicable

not not applicable in Includes construction cost of the unit and other expenses such as land

<sup>c</sup> Billion liters per year.

<sup>d</sup> Million gallons per year.
<sup>e</sup> Billion BTU's per year.

TABLE 2
REAL ESTATE RESEARCH CORPORATION (RERC 1974) THE COSTS OF SPRAWL:
SUBSTANTIVE AREAS OF INOUIRY

Topics Considered By RERC (1974)	Public- Private	Transportation and Travel	Land and Natural	Quality of Life
· · · · · · · · · · · · · · · · · · ·	Capital and	Costs	Habitat	-
	Operating		Preservation	
	Costs			
Capital and Operating Costs		•		
Capital				
<ul> <li>Recreation</li> </ul>	X	• .		
<ul> <li>Schools</li> </ul>	X			
<ul> <li>Public Facilities</li> </ul>	. X			•
• Utilities	X	•		
Road/streets		X		
Operating	X			
Land Requirements				
<ul> <li>Total acres</li> </ul>	•		X	
<ul> <li>Developed acres</li> </ul>			<b>X</b>	
<ul> <li>Vacant, improved/semi-</li> </ul>		•		•
improved acres			X	
<ul> <li>Vacant unimproved acres</li> </ul>		•	X	•
Principal Environmental Impacts				
Nonauto air pollutants	•			X
Sewage effluent		• •	• •	X
Nonauto energy use				X
Water use				X

By the late 1980s, two important costs of sprawl studies were undertaken in Florida. James Duncan, a consultant working for the Florida Department of Community Affairs, studied the capital infrastructure requirements of sprawl (scattered) versus compact development forms. Duncan found that various forms of scattered development could be as much as 70 percent more costly than equivalent forms of compact development (Duncan et al. 1989).

A colleague, James Frank of Florida State University, in research conducted for the Urban Land Institute, updated several early (1950s and 1960s) isolated costs of Various forms of scattered development could be as much as 70 percent more costly than equivalent forms of compact development.

sprawl studies with 1987 data and prices, and assembled their results. His findings were similar to Duncan's: "contiguous" development was 45 percent less expensive for roads, water, and sewer than "leapfrog, far-out" development (Frank 1989). The Duncan and Frank studies are cited throughout the costs of sprawl literature.

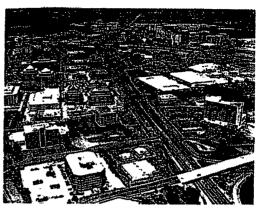
# CHARACTERIZING SPRAWL: CRABGRASS FRONTIERS AND EDGE CITIES

Kenneth Jackson's Crabgrass Frontier: The Suburbanization of the United States, published in 1985, received much acclaim. Although sprawl per se was not mentioned in this monograph, numerous traits attributed by Jackson to the "crabgrass frontier" were clearly sprawllike in character. These attributes were:

- 1) low residential density and the absence of sharp divisions between town and country
- 2) the socioeconomic distinction between the center and the periphery
- 3) a lengthy journey to work in terms of distance and time.

Jackson attributed the permanence of the crabgrass frontier to physical as well as political factors (e.g., that America was land-rich and had fragmented local governments). He also noted its problems (e.g., high local public service costs and increased automobile dependence) as well as its benefits (high level of housing amenity and individual open space).

Approximately six years after the publication of Crabgrass Frontier, journalist Joel Garreau published Edge City: Life on the New Frontier (portions of the book were actually in print before this time). Unique to Garreau's work was the concentration on peripheral nonresidential clusters brought together at suburban junctures of major beltways and axial interstate roads. These "edge cities" formed a new kind of metropolis because nonresidential development was soon joined by high-density residential development to form relatively selfsustaining urban clusters at edges of builtup areas. These clusters were unique; no more than fifty existed in the United States, and they represented sprawl at an urban scale (Garreau 1991).



Tyson's Corner in Fairfax County, Virginia, the prototypical "edge city."

Source: County of Fairfax (Virginia), Office of Comprehensive Planning.

During the early part of the 1980s, in a country with a newly refound admiration for capitalism, and in the latter part of that decade, in a recession that paid the price for earlier deficit spending, the literature on sprawl was relatively quiescent. The trend has reversed itself in the 1990s; as will be seen, there has been an outpouring of studies. These studies are reviewed in Section II of this report by substantive area. To give a sense of the current literature—and the current definition of sprawl and its alleged costs and benefits—a sampling is discussed here.

These "edge cities" formed a new kind of metropolis.

# SPRAWL AND CITIES: DOWNS, RUSK AND BARNETT

In his 1994 book, New Visions for Metropolitan America, Anthony Downs adopted a broader approach for defining sprawl that primarily referred to density but included some other characteristics as well. Downs, building on an earlier work, Stuck in Traffic (Downs 1992), defined sprawl as encompassing five major elements:

- 1) low-density, primarily singlefamily residential settlement (without any numerical density specified)
- 2) heavy dependence upon private automotive vehicles for all types of travel
- 3) scatteration of job locations widely across the landscape in mainly low-density establishments (also without any numerical density specified)
- 4) fragmentation of governance authority over land uses among many relatively small localities
- 5) widespread reliance on the filtering or "trickle down" process to provide housing for low-income households.

New Visions for Metropolitan America proposed a basic method for analyzing sprawl—i.e., comparing its results to the results that might arise from alternative forms of metropolitan growth. Downs described a way of formulating alternative outcomes through an analysis of the basic traits of different growth strategies. Downs's approach is incorporated and described in more detail later in Section II.

As is apparent, even the most current literature on sprawl tends to *describe* its attributes rather than *quantify* them. Very few quantified analyses of sprawl's impacts or relationships to other variables appear anywhere in the literature. As a result, few studies have mathematically or statistically linked sprawl to other conditions or metropolitan traits.

A limited attempt at quantification was put forth in the 1993 work by David Rusk in *Cities Without Suburbs*. He calculated an "index of elasticity" that measured the ability of cities to extend their boundaries to encompass surrounding urbanized development. "Elasticity" is essentially the same as annexation, i.e., movement

outward from the city center (sprawl) without the creation of new political jurisdictions. Rusk claims that cities with high indices of elasticity are superior to those with low indices of elasticity, in terms of income distribution, racial integration, population growth, and economic development. The best cities are "elastic" cities, he claims, and applies his index both to cities themselves as well as their metropolitan areas.

Rusk himself did not perform mathematical or statistical analyses relating the variables just described, but three reviewers of his book did. John P. Blair, Samuel R. Staley, and Zhongcai Zhang (1996) used multiple regression employing measures of growth and economic welfare over the period 1980-1990 as independent variables, against Rusk's index of elasticity as the dependent variable. These reviewers concluded that Rusk's index of elasticity had statistically significant effects of the expected types on *city* employment,

The most current literature tends to describe sprawl's attributes rather than quantify them.

population, poverty, and per capita income growth and significant effects of the expected types on metropolitan-area population and employment growth—but not of the expected types on metropolitanarea per capita income or poverty growth. However, even where the regression equations identified statistically significant effects, they had low R<sup>2</sup>s (low explanatory power), an outcome that indicated that other unspecified variables were possibly not included in the regression equation. An implication of this analysis was that either Rusk's index of elasticity is not a useful indicator of sprawl or the indicator itself, due to its construction, inherently produced low levels of explanation.

City-suburban relationships were also considered by Jonathan Barnett in his 1995 book, *The Fractured Metropolis*. This analysis of metropolitan area trends was strictly narrative and advanced the thesis that U.S. metropolitan areas were splitting into "old cities" and "new cities." Barnett proposed that future growth be redirected into the "old cities." Much of his work was skewed toward physical design and planning; it favored compact development over sprawl and encouraged commercial development within, and the creation of urban growth boundaries around, older metropolitan cities.

# SECOND GENERATION STUDIES ON THE COSTS OF SPRAWL

Research into methods to address the costs of sprawl and a study of the underlying data have been undertaken at both the Center for Urban Policy Research at Rutgers University and at the University of California—Berkeley. Starting in the early 1990s, Rutgers University researchers, led by Robert W. Burchell, began to quantify the relative impacts of alternative patterns of development. One or two years later, under John D. Landis, similar efforts were undertaken at the Institute of Urban and Regional Development at Berkeley. Both research organizations have looked at the prospective impacts of alternative development patterns. Both research organizations developed comprehensive land-use models to carry out these analyses (Burchell 1992a, 1992b; Landis 1994, 1995).

Costs were defined primarily in terms of resource consumption at the community level. Sprawl was defined as skipped-over, low-density residential and nonresidential development.

The Rutgers effort involved an analysis of the differing effects of "trend development" (sprawl-like) and "planned development" (compact form with managed growth attributes) in New Jersey. The results obtained are shown in Table 3. This Rutgers study was preceded by similar work for the State of Maryland as part of its original attempt at a Growth Management Act. Significant efforts to confine sprawl to the Baltimore-Washington corridor have been undertaken in Maryland.

Sprawl is defined as skipped-over, low-density residential and nonresidential development. — Burchell 1992a: Landis 1994

The New Jersey and Maryland analyses were followed by similar studies for Lexington, Kentucky (Burchell and Listokin 1994b), the Delaware Estuary (Burchell and Moskowitz 1995), and the States of Michigan (Burchell 1997a) and South Carolina (Burchell 1997b). Research is also currently underway, at Rutgers, for the State of Florida as part of its *Eastward Ho!* initiative, a development plan aimed at keeping a large share of future development east of Route I-95 in five southern counties. In all instances,





Florida's *Eastward Ho!* initiative hopes to avert this potential future.

Source: Tim Reilly, Sunshine: The Magazine of South Florida.

TABLE 3 **BURCHELL (1992)—NEW JERSEY IMPACT ASSESSMENT:** SUMMARY OF IMPACTS OF TREND VERSUS PLANNED DEVELOPMENT

	Growth/Development Impacts	Trend Development	Planned Development	Trend Ver Planned Deve	
			•	Difference	%
I.	POPULATION GROWTH (persons)	520,012	520,012	0	0
II.	HOUSEHOLD GROWTH (households)	431,000	431,000	0	0
III.	EMPLOYMENT GROWTH (employees)	653,600	653,600	0 \	Ó
IV.	INFRASTRUCTURE A. ROADS (\$ millions) Local State Total Roads  B. UTILITIES—Water (\$ millions) C. UTILITIES—Sewer (\$ millions) Total Utilities  E. SCHOOLS (\$ millions)	\$2,197 727 \$2,924 \$ 634 \$6,790 \$7,424	\$1,630 595 \$2,225 \$ 550 \$6,313 \$6,863 \$5,123	\$567 132 \$699 \$ 84 \$477 \$561	25.8 18.2 23.9 13.2 7.0 7.6 3.3
	F. ALL INFRASTRUCTURE (sum of A-E in \$ millions)	\$15,644	\$14,211	\$1,433	9.2
V.	LAND CONSUMPTION				
	A. Overall Land (acres)	292,079	117,607	174,472	59.7
1	B. Frail Lands (acres)	36,482	6,139	30,343	83.2
	C. Agricultural Lands (acres)	108,000	66,000	42,000	38.9
VI.	House Price	0:00 560	01/0.1/0	010.405	6 1
1	A. Median Cost per Unit (1990 \$)	\$172,567	\$162,162	\$10,495	6.1
	B. Housing Index (higher is more affordable)	118	126	8	6.7

Source: Robert W. Burchell 1992a, b

**TABLE 4 BURCHELL (1992-1997) FINDINGS OF SAVINGS OF COMPACT GROWTH VERSUS CURRENT OR TREND DEVELOPMENT** 

	Lexington, KY and		South	New
Area of Impact	Delaware Estuary	Michigan	Carolina	<b>Jersey</b>
I. Public-Private Capital and Operating				
Costs				
1. Infrastructure Roads (local)	14.8-19.7%	12.4%	12%	26%
2. Utilities (water/sewer)	6.7-8.2%	13.7%	13%	8%
3. Housing Costs	2.5-8.4%	6.8%	7%	6%
4. Cost-Revenue Impacts	6.9%	3.5%	5%	2%
II. Land/Natural Habitat Preservation	•			
1. Developable Land	20.5-24.2%	15.5%	15%	6%
2. Agricultural Land	18-29%	1 <b>7.4%</b>	18%	39%
3. Frail Land	20-27%	20.9%	22%	17%

Source: Robert W. Burchell 1992-1997

polar development patterns are contrasted—i.e., "current" or "trend" growth is measured against "compact," or "planned" growth. The exact nomenclature in the studies is unimportant; what is important are the differing land-use configurations and their impacts, which are related below:

Current, or trend, development is historical development in an area. The land-use literature describes this type of development as skipping over existing development; land-consumptive and inefficient use of available land at or near the core of the metropolitan area; and requiring significant accompanying infrastructure in the form of roads, water and sewer lines, public buildings, and the like. Compact, or a more managed, type of development attempts to direct growth to already existing locations of development while preserving yet-to-be developed areas. Nationally, the land-use literature portrays compact development as more efficient in its land-use patterns and thus less land-consumptive. Accordingly, it often requires somewhat less development infrastructure. Compact development is also viewed as not limiting or restricting population or employment growth at the county, regional, or state levels. (Burchell 1997a, A-1)

Burchell developed a series of quantitative models relating to land consumption, road, transit, water/sewer infrastructure, fiscal impacts, housing cost, and quality of life to examine the relative effects of alternative development patterns.

Application of these models across the aforementioned jurisdictions indicated comparable order-of-magnitude findings. For instance, a shift away from sprawl to compact growth was projected by Burchell to reduce water/sewer utility infrastructure costs by 8 percent in New Jersey, 7 percent in Lexington, 8 percent in the Delaware Estuary, 14 percent in

Michigan, and 13 percent in South Carolina. Table 4 summarizes the array of findings from the various Burchell studies (1992-1997). Table 5 groups the effects of sprawl, some dozen in all, into five overall categories.

The Berkeley effort employed the California Urban Futures (CUF) model of the San Francisco Bay Area to tabulate land consumed under three scenarios: (a) "business as usual"; (b) "maximum environmental protection"; and (c) "compact cities." These scenarios were differentiated, respectively, by (a) not restricting development either within the city or within unincorporated areas; (b) applying a range of environmental restrictions to both locations, but not restricting growth per se; and (c) restricting growth to acknowledge some environmental limitations and countywide minimum population projections. The two latter alternatives showed considerable overall land savings, particularly sensitive environmental land savings relative to the business-as-usual scenario. Total land saved in scenarios b and c was 15,000 and 46,000 acres, respectively. Scenario b saved nearly 60,000 acres of prime agricultural land, 10,400 acres of wetlands, and 2,800 acres of steep-sloped land; Scenario c saved 28,000 acres of prime agricultural land, 10,400 acres of wetlands, and 8,000 acres of steep-sloped lands (Landis 1995).

In a series of relatively current articles in *Environment and Planning Behavior*,
Landis discussed the development and use of the second generation of the California Urban Futures Model. These articles were less about sprawl and land savings and more about urban modeling; still they suggested a framework for understanding and predicting the land-and habitat-taking effects of sprawl.

# STUDIED REACTIONS TO SPRAWL—LUTRAQ (OREGON) AND CONCURRENCY (FLORIDA)

In the late 1980s and early 1990s, sprawl growth on the northwestern and southeastern coasts of the United States resulted in two different reactions—both supported by so-called "friends" organizations. In the first case, the organization was the 1000 Friends of Oregon, in the second case, the 1000 Friends of Florida.

In the early 1990s, growth in the Portland region was believed to hinge on the construction of a Western Bypass around the city. An alternative plan was sought to try to accommodate growth without the need for more highways. Sam Seskin of Parsons Brinckerhoff, leading a team of researchers in the Land Use
Transportation Air Quality simulation (LUTRAQ), compared the transportation

impacts of a transit-oriented development (TOD) plan to the impacts of a preferred Bypass alternative. The LUTRAQ alternative shifted the location of 65% of new residential units and 78% of new jobs to locations within walking distance of light rail or bus transit lines by reconfiguring expected development into a series of mixed-use centers. The alternative showed a reduction in vehicle miles traveled and a reduction of the use of the automobile (Davis and Seskin 1997). Portland voters responded by approving a \$1 billion rail line along which TOD will occur, and Seskin received an American Planning Association award for the research effort.

Subsequent analyses produced by Genevieve Giuliano, however, found only small gains associated with nonautomobile mode shares and very small reductions in vehicular travel. Equally

TABLE 5
BURCHELL (1992-1997) ANALYSIS OF TREND VERSUS PLANNED
DEVELOPMENT: SUBSTANTIVE AREAS OF INQUIRY

Topics Considered By	Public-Private Capital and Operating	Transportation and Travel	Land and Natural Habitat	Quality	Social
Burchell (1992-1997)	Costs	Costs	Preservation	of Life	Effects
Water/sewer infrastructure	X .				33
<ul> <li>School capital facilities</li> </ul>	X			•	
<ul> <li>Housing cost</li> </ul>	X				
<ul> <li>Fiscal impacts</li> </ul>	X		•		
• Roads		X	9		
<ul> <li>Transit</li> </ul>		X			
Land capacity			X		
<ul> <li>Agricultural lands</li> </ul>	,		X		
<ul> <li>Frail lands</li> </ul>			X		
<ul> <li>Quality of life</li> </ul>	•	*		X	
<ul> <li>Intergovernmental</li> </ul>				X	
coordination					•
<ul> <li>Effects on urban</li> </ul>					$\mathbf{x}$
and rural centers					

Source: Robert W. Burchell 1992-1997

distressing, the magnitude of investment in transit services needed to be quite large to achieve the resulting changes in mode shares. The LUTRAQ study unintentionally demonstrated the limits of making large investments in transit to influence travel patterns (Giuliano 1995b).

In Florida, meanwhile, the reaction to sprawl was to limit development if it could not be shown that sufficient public facilities would be in place at the time that development occurred (Florida Growth Management Act 1985). This procedure, termed "concurrency," included both mandatory (transportation) and voluntary (schools) components. At first, those distant from the scene thought that the procedure was responsible for shutting down growth in the state. After the dust from the housing recession of the late 1980s settled, however, those originally opposed to concurrency reluctantly agreed that it had channeled growth effectively. In the meantime, those who originally favored concurrency vehemently opposed it because roads were being built and widened and new schools were being constructed (albeit at developer cost) too far from the locus of existing development. Growth was slowed, but it also was accommodated in locations where it should not have been (Mofson 1997).

# AT WHAT SCALE IS MEASUREMENT TO TAKE PLACE? URBAN FORM AND TRANSPORTATION

At about the same time that Burchell and Landis were looking at development form and its effect on resource consumption, two other important considerations began to emerge. The first was the scale at which transportation impacts were being viewed; the second was the effect of transportation on urban form, and vice versa. In other

words, while attempting to define the indicators of sprawl and more compact forms of development and their resulting impacts, it became apparent that one needed to specify at what level impacts were being measured—individual, community, or societal. Almost all studies to date have been undertaken with impacts specific to the community level. But Sam Seskin from Parsons Brinckerhoff, and Terry Moore from ECONorthwest, began pursuing the issue of "full" costs of transportation, attempting to view the costs of transportation decisions at the individual and societal scales as well as at the community level. They determined, for instance, that although using an automobile was efficient at the individual and community scales, it was expensive at a societal scale (air pollution). Although transit was efficient at individual and societal scales, it was expensive at a community scale (the cost to deliver transit). And walking, although efficient at community and societal scales, was expensive at an individual scale (the cost of the individual's time) (Parsons Brinckerhoff 1996; Moore and Thorsnes 1994).

Seskin and Moore shifted the inquiry to issues of the impact of urban form on transportation, and vice versa. The urban form impacts on transportation were much as expected. Seskin and Moore determined that sprawl development could be served well only by the automobile; much more compact development led to transit solutions. Mixed-use development enabled walking and biking. Transportation impacts on urban form were not quite a mirror image of the first, however. Significant use of the automobile led to unlimited spread development. Transit presence brought users who also needed an automobile: mixed-use development promoted foot and bicycle use, but an automobile was still required. Land use can affect

transportation mode and vice versa, but American society today remains heavily dependent upon the automobile (Parsons Brinckerhoff and ECONorthwest 1996).

## CERVERO AND TRANSPORTATION ACCESSIBILITY MEASURES

One of the most widely published academics in the field of transportation planning is Robert Cervero, from the University of California at Berkeley. Ever since his first book, Suburban Gridlock, was published in 1986, Cervero has been solidly represented in the landuse/transportation literature. His latest book, The Transit Metropolis (1998), deals with transit-oriented cities. Cervero has done important sprawl work relating a jobs-housing "imbalance" to expanding commutes (Cervero 1996), and Bay Area growth trends of job decentralization to increased VMT per worker (Cervero and Wu 1996). Other aspects of his work involve (1) suburban congestion as well as measures for its relief (Cervero 1986, 1991a); (2) the role of suburban activity centers as alternatives to sprawl, and commuting patterns within these centers (Cervero 1989, 1991b, 1996); and (3) the feasibility of transit in suburban locations-i.e., the required density and implementation costs (Cervero 1994a, 1994b).

Cervero's latest contributions from a sprawl perspective are two papers he coauthored on suburban accessibility: (1) a 1997 paper co-authored by Timothy Rood and Bruce Appleyard, entitled "Job Accessibility as a Performance Indicator: An Analysis of Trends and their Social Policy Implications in the Bay Area"; and (2) a 1996 paper co-authored by Kara Kockelman, entitled "Travel Demand and the 3Ds: Density, Diversity, and Design." In these papers, Cervero and his colleagues show through factor and regression analyses the effect of current development patterns on employment

accessibility. They try to document, in other words, how well transportation serves employment markets. In the first article, Cervero finds that current sprawl development patterns have the largest impact on severely poor neighborhoods because they separate jobs from job seekers. Minorities are particularly disadvantaged, because even with equal education, vehicle availability, and accessibility, blacks still had disproportionately high unemployment rates.

# Current sprawl development patterns have the largest impact on severely poor neighborhoods.

In Cervero's second article, he looks at what can be done. He measures the effects of density, diversity, and design on accessibility, and finds that compact mixed-use, pedestrian-friendly designs can reduce vehicle trips, vehicle miles traveled, and the use of the automobile. Density, he concludes, affects business trips; diversity affects both work and nonwork trips, but has less of an effect than density; and design affects primarily nonwork trips. He upholds the views of the new urbanists-somewhat, because he shows that sensitive land design and building arrangements can reduce travel distances and alter modes of travel.

# THE BANK OF AMERICA STUDY: BUSINESS EMBRACES THE ANTI-SPRAWL MOVEMENT

In 1995, four groups—Bank of America, California Resources Agency, Greenbelt Alliance, and Low-Income Housing Fund—published a study on sprawl that quickly came to be known as the Bank of America Study. Those who champion land development alternatives to sprawl point to this study, the work of one of the private sector's most influential members, as a landmark. If the banks finally realize that sprawl can no longer be tolerated, recognition of the impacts of differing

land development patterns on society's resources has indeed hit the big time.

The Bank of America study summarized changes in population, demographics, and employment that had taken place over the two decades prior to 1990. It also referenced a land-use pattern that had taken place during this same period of time and termed it "sprawl." Sprawl was characterized by decentralized employment centers and residential tracts accessed almost exclusively by the automobile. These decentralized locations were safe and cheap places in which to locate and had plucked all fiscal and physical benefits from the central city. Further, the study noted that the trend toward sprawl was aided and abetted by the federal subsidies given to the automobile.

If the banks finally realize that sprawl can no longer be tolerated, recognition of the impacts of differing land development patterns on society's resources has indeed hit the big time.

The Bank of America report was criticized for its inability to adequately interpret the long-standing criticisms of RERC's (1974) The Costs of Sprawl report. The Bank of America study seemed to buy into many of the arguments that favored the antisprawl position without an adequate look at contrary evidence. Nonetheless, those who championed the study as a summary of the ills of sprawl used the Bank of America imprimatur to promote the position that the business community, at long last, was calling for managed growth to conserve national resources.

# IS SPRAWL LIKED OR DISLIKED BY THE GENERAL PUBLIC? FANNIE MAE VERSUS "VISION PREFERENCING" SURVEYS

A question discussed and debated in a number of circles is whether Americans like their current development patterns. Often, those responding have difficulty making the distinction between shelter and location, and between both of these and way of life.

There is a popular literature that rates places on such indices as cost of living, public safety, climate, job growth, transportation accessibility, and access to cultural and recreational amenities (Savageau and Boyer 1993). Clearly, suburbs in the Southeast and Southwest fare better on this rating scale than cities in the Northeast and North Central regions of the country, or, for that matter, rural areas in any location. An economics literature looks at the determinants of worker migration, identified as job availability, good climate, and lower housing costs (Duffy 1994; Greenwood et al. 1991; Roback 1988; Rosen 1979). Psychological reasons for moving often parallel the economic determinants: physical (safety), physiological (economic), belongingness (sense of place), and personal satisfaction (cultural and recreational amenities) (Zinam 1989). Again, suburban locations appear to do better than urban locations on both of the above sets of criteria.

Americans are asked about their environments through two basic devices: a national, annual, in-person, in-home Fannie Mae survey of owners and renters on their housing (Lang and Hornburg 1997) or an occasional, professionally administered "visual preferencing" survey on their environments (Nelessen 1994).

Eighty percent of Americans contacted in the first survey identified the traditional single-family home with a yard as the ideal place to live. To afford it, they would rather live farther out than take a second job, tie up savings, put children in day care, or incur heavier debt. Finally, they would rather occupy an average house in a good neighborhood than a good house in an average neighborhood (Fannie Mae 1994).

Respondents often have difficulty making the distinction between shelter and location, and between both of these and way of life.

Visual preferencing surveys are typically employed by planners and architects to test sentiment for a redirection in current development patterns and forms (Nelessen 1994). These surveys contrast the current versus an alternative development pattern and architecture and ask those surveyed to pick between the two. Often it is hoped by those who administer these surveys that the alternative development pattern will be chosen and, accordingly, localities will develop residential and residential areas in a different way (Calthorpe 1993). Most of those who experience this exercise of choice opt for the alternative, which typically shows a denser, more traditional residential village center and less spreadout residential subdivisions and strip commercial developments (Nelessen 1994).

The results of most of the two surveys on consumer preference and sprawl indicate that people feel comfortable with their current housing and its suburban location but also think that sprawl has an ugly look and that suburbs are becoming increasingly congested. Whether people would change their housing type (singlefamily), form (single-lot subdivision), or location (suburbs) to achieve a different "look" or "feel," or to be free from congestion, remains a crucial question.

# AN UNUSUAL FINDING: THE CITY IS IMPORTANT TO THE REGION; THE USUAL FINDING: PEOPLE DON'T CARE

The United States has had a love—hate relationship with its cities for at least fifty years. This has taken two forms. The first is inquiry into the continued importance of the central city; the second is whether or not people will choose to live and work there.

In the mid-1990s, two articles rekindled interest in, and attempted to quantify the importance of, the central city to its surrounding area. One was written by Elliot Sclar and Walter Hook in 1993. "The Importance of Cities to the National Economy"; the other was written by Keith Ihlanfeldt in 1995 and entitled "The Importance of the Central City to the Regional and National Economy." At a time when most scholars viewed the central city's role in the region and nation as not critical and one of declining value. Sclar/Hook and Ihlanfeldt breathed new life into the debate on the role and future of the central city with the following arguments:

- In most metro areas, the higherpaying jobs are found in the central city.
- In the metro areas of the 100 largest U.S. cities, half of suburban families had at least one worker employed in the central city.
- Sixty-seven percent of suburban residents surrounding the 100 largest U.S. cities depend on the city for major medical care; 43 percent have a family member attending an institution of higher learning there.
- Cities provide low-cost housing for low-wage workers employed in—and necessary for—the activities of suburbs.
- The overall appeal of a region is influenced by conditions prevailing within its central city.

Sclar and Hooks argued that the United States subsidizes suburbs through homeownership income tax deductions and by federal/state cost-sharing of highway construction. Continued subsidization will cause increasing auto dependence, and a further channeling of most infrastructure expenditures to road building, at the expense of education operating costs. According to the authors, the United States ranked lowest among the seven most industrialized nations in percent of GNP that supported education.

Ihlanfeldt found that central cities possess certain "agglomeration economies" (the benefits of scale) that will sustain their primacy in a region. These include communications, labor, and producer concentrations. Moreover, financial services such as investment banking, commercial banking, legal auditing, and actuarial services were provided primarily by central city firms to suburban markets, and in many cases to world markets. According to Ihlanfeldt, these activities were not likely to be taken on by suburban firms, because few suburban firms have the appropriate scale to conduct them.

The United States subsidizes suburbs through homeownership income tax deductions and by federal/state cost-sharing of highway construction.

The second issue regarding urban areas was whether upwardly mobile households will continue to reside there. In the 1970s, the United States experienced significant movement of jobs and residents to exurban or rural areas. During this period of time, non-metropolitan areas were the locations of the fastest relative employment and household growth (Sternlieb and Hughes 1983). During the 1980s, there was stabilization, if not growth, of metropolitan areas. Buoyed by significant immigration and a slowing of metropolitan to non-metropolitan

outmigration, metropolitan areas were beginning to grow (Gordon, Richardson, and Yu 1997; Nelson et al. 1995, 1997). According to Peter Gordon, recent Bureau of Economic Analysis (BEA) Regional Economic Information System (REIS) data indicate that the trend is once again toward outer areas; indeed, over the last six years, outward metropolitan movement is almost as pronounced as it was during the 1970s. Gordon et al. finds that the one constant in all of this has been strong suburban growth, with parallel rural growth tilting the scale to outward movement, and even stronger suburban growth with reduced declines of urban areas tilting the scale toward inward movement. The consistency of the suburban component of this trend and renewed non-metropolitan growth (the outward movement) do not bode well for the future of the central city. Gordon and his colleagues conclude, citing additional data from the Economic Census CBD file, that:

The location decisions of households are influenced less by workplace accessibility than by availability of amenities, recreational opportunities, and public safety. In addition, the locations of firms are clearly becoming more footloose under the influence of the information revolution, just at a time when core agglomeration diseconomies (pollution, congestion, crime, fiscal instability, etc.) appear to be outweighing the original agglomeration economies that pulled people and economic activities together. In this view, the central cities are not coming back any time soon (Gordon, Richardson, and Yu 1997)

The suburban component and renewed non-metropolitan growth (the outward movement) do not bode well for the future of the central city.

# THE VALUE OF OPEN SPACE AND FARMLAND: THE FARMER AND CONSERVATIONIST AS PLAYERS IN THE SPRAWL ARGUMENT

In the latter part of the 1980s and the early 1990s, the American Farmland Trust (AFT) began a series of studies to discourage the conversion of farm tracts to sprawled residential subdivisions. Not only was farmland ideal for developers because it was flat, it also was, for the most part, the cheapest land available. The percentage of farmland being lost in the United States was many times the percentage growth of household formation. The analyses of the AFT. called "Cost of Community Services," presented detailed case studies of the cost/revenue superiority of farmland to other types of land uses. Studies were undertaken in Massachusetts, Connecticut, Pennsylvania, Virginia, and the Midwest, and are heavily cited today. The conclusions drawn always demonstrate this group's advocacy and point to farmlands as a fiscal benefit to communities in which they are located. Regardless of methodology, the studies achieve their goal of representing farmland not merely as fiscally neutral but as fiscally positive. "Smart" communities should not want to lose this net revenue producer to other forms of development (especially residential), which would be more costly (AFT 1992b).

Growing out of this new attention to farmland was the recognition that farmers, as owners of this land, were often opposed to growth management (and thus prosprawl) and needed to be brought into the negotiation process. Otherwise, they would sell their land to developers before it could be acquired via public purchase or through some type of transfer of development rights. Farmers prevented passage of the original Maryland Growth Management Act and threatened to do the

same to the New Jersey State Plan if their real estate interests could not be protected. In Maryland, it appeared that the farmers could not be assuaged, and the Growth Management Act¹ failed. In New Jersey, farmers were appeased at the eleventh hour with a promise from the New Jersey State Planning Commission that their development rights would be purchased at a price somewhere between crop and real estate value, and the planning statute passed.

Randall Arendt, influenced by living in both walkable and planned open space communities in New Jersey as a child, and seeing these concepts implemented in England as an adult, built upon Ian McHarg's Design with Nature (1969) in an attempt to make current development patterns greener. In three of his latest books, Rural by Design (1994b), Conservation Design for Subdivisions (1996), and Growing Greener (1997), he provides convincing evidence that open space adds to the value of surrounding real estate and to the quality of life of those who live within it. Arendt sees the combination of compact development and open space as leading to interconnected networks of green space (Arendt 1994b). An area-wide, interconnected greenway can extend open space and wildlife benefits to the larger region. Further, successful control of sprawl will retain the "traditional character" of communities (Arendt 1996).

The Sierra Club, among other conservationist groups, is actively campaigning against sprawl. Its 65 chapters and 450 groups are challenging sprawl at the grassroots level in communities across America (Sierra Club 1998).

Maryland ultimately passed a diluted version of the original act and has adopted a variety of "smart growth" procedures.

# THE MECHANICS OF PAYING FOR SPRAWL: IMPACT FEES, TAKINGS, AND PROPERTY RIGHTS

In order to pay for sprawl and not impact current residents, local governments have turned to economists and land-use attorneys to devise a system of assigning a share of new required public service infrastructure to new owners of developed property. These mechanisms are termed impact fees, developer exactions, or proffers and are based on the rationale of charging development costs to those who have caused them. Impact fees are calculated by determining the specific costs that one new unit of residential development or 1,000 square feet of nonresidential development will cause in roads, water/sewer, public buildings (schools and municipal), and other capital infrastructure. Impact fees, developer charges, or whatever moniker they are known by, are currently the fastestgrowing source of municipal revenues. Principal players in this group are James Nicholas of the University of Florida and Christopher Nelson of the Georgia Institute of Technology (Nelson 1988; Nicholas et al. 1991). Nicholas has constructed impact fee schedules in numerous counties and municipal jurisdictions: both Nicholas and Nelson have significant academic and professional publications in this area.

In order to pay for sprawl and not impact current residents, local governments have turned to a system of assigning a share of new required public service infrastructure to new owners of developed property. These mechanisms are termed impact fees.

The issue with impact fees specifically, and growth management strategies generally, is that these mechanisms presuppose government capacity to regulate land. This amounts to a taking and thereby affects individual property rights. Although most of these techniques have been upheld, when they become overly aggressive, they are subject to judicial review.

This gets to what land-use attorneys describe as the "black hole" of takings jurisprudence. Until recently, a severe test of a taking has been applied. A land-use regulation is a taking if it: (1) does not substantially advance a legitimate state interest; or (2) denies an owner all economically viable use of his or her property. Post-1990, there appears to be an easing of this test that favors property owners. Charles Siemon (Siemon 1997), Robert Freilich (Freilich and Peshoff 1997), and Jerold Kayden (Young 1995) are recurringly involved in litigation concerning these issues or in designing land-use regulations to avoid such litigation. Suburban development ordinances that require payment for costs or link "social" objectives to the development of real property will be tested by the courts. To pay for sprawl, local governments have become quite inventive at both deriving fee schedules and in locating property owners to whom the costs can be assigned. Much as other forms of payment for sprawl are drying up, if governments are not careful, so too will these mechanisms.

# SPRAWL'S CRITICS AND THE NEW URBANISTS

In 1993, a study conducted for the Chesapeake Bay Program defined sprawl as "residential development at a density of less than three dwelling units per acre" (CH2M Hill 1993). This definition did not have a "locational component" and was a modification of a definition presented in an earlier draft—i.e., "developments having gross development

densities of less than three or four dwelling units per acre or minimum lot sizes of at least one-quarter of an acre, and frequently of at least one acre." The latter definition had been criticized by Uri Avin (1993) for including properties with too high a density; it could be applied to many existing, close-in subdivisions in both Maryland and Virginia. On the other hand, in California, sprawl is currently taking place on 9,000-square-foot lots; obviously the upper-level density cutoff varies considerably by region.

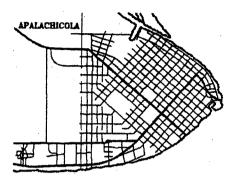
Sprawl, and more generally, suburbanization, were condemned in a polemical book by James Kunstler (1993). The title of the book, *The Geography of Nowhere: The Rise and Decline of America's Man-Made Landscape*, conveys his message. The strident tone of the message is reflected by the following statement:

We have become accustomed to living in places where nothing relates to anything else, where disorder, unconsciousness, and the absence of respect reign unchecked. (Kunstler 1993)

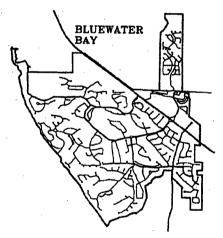
Peter Calthorpe's book The Next American Metropolis, published in 1993, offered a method for determining population densities in an idealized form of modern settlement. He presented a scheme for clustering housing and other improvements around transit stops at specified densities which could, in turn, be used to compute overall densities for ideal future metropolitan settlements. His scheme involved creating Transit Oriented Developments (TODs) around stations in a system of radial fixed-rail transit lines emanating from a region's major downtown. This approach quantified aspects of an alternative form of future growth. However, Calthorpe did not present any method of measuring the costs and benefits of sprawl, nor of the

alternative form he suggested. Neither did he present any database to use in carrying out such measurements.

# Traditional Urban Grids



# Contemporary Suburban Networks



Street patterns of neo-traditional versus typical suburban neighborhoods.

Source: Florida Department of Community Affairs.

Calthorpe is a "new urbanist," part of an urban design movement called "neotraditionalism." Neo-traditionalism calls for the development of neighborhoods that resemble those of the past—i.e., with grid street patterns, fronted by proximate single-family houses with porches, sidewalks, alleys, and other traditional features. The elements returned to neighborhood design include mixed uses,

the grid-based street structure, higher densities, pedestrian circulation, and transit use. The elements removed include single uses, cul-de-sacs, low densities, and automobile-dominated neighborhood access.

The neo-traditionalists, led by Andres Duany, and joined by Elizabeth Plater-Zyberk (1995), Anton Nelessen (1994), Peter Calthorpe (1993), and others, view current development patterns (sprawl) as driven by engineering standards and, accordingly, devoid of the capacity for human interaction. Neo-traditionalism is often proposed as a design alternative to sprawl, even though developments incorporating this type of design can be found in sprawl locations. Nelessen's vision preferencing analyses are sometimes cited by those who oppose sprawl as evidence that the American public is ready for this type of design. The Duany-led new urbanists propose that the new urban-like grids replace the current sprawl-like suburban networks.

# MORE SPRAWL CRITICS— "TRUSTS" AND "OLD FRIENDS"

A critique of strip commercial development, and sprawl in general, permeates the current literature of the National Trust for Historic Preservation (NTHP) and its leadership (NTHP 1993; Moe 1996). At a 1995 conference on "Alternatives to Sprawl," Richard Moe, president of the National Trust, defined sprawl as low-density development located on the outer fringes of cities and towns that is "poorly planned, land-consumptive, automobile-dependent development designed without regard to its surroundings." He described two types:

"sellscape" retail development frequently spurred by major discount chains such as Wal-Mart and K-Mart, occurring along major arteries and at highway interchanges; and "spread out" residential development, usually consisting primarily of single-family detached houses, located on the edges of existing communities or "leapfrogging" into previously undeveloped areas. (Moe 1996, 3)

In a later work, Changing Places: Rebuilding Community in the Age of Sprawl, Moe and Carter Wilkie (1997) indicated that sprawl was causing communities to be dysfunctional and diminishing a sense of connections between people. The authors suggested that if sprawl were tested by a truly "free" market, far less sprawl would occur on private financing alone. They proffered that sprawl developers captured benefits for themselves while everyone else in the community bore the costs. Both authors called for better land-use planning and more creative reuse of older urban and suburban areas.

# Commercial strip development is a manifestation of nonresidential sprawl.

A more comprehensive view of the components of sprawl was offered in Henry Richmond's 1995 book, Regionalism: Chicago As An American Region. Richmond's conceptualization of sprawl included eight components:

- 1) low residential density;
- 2) unlimited outward extension of new development;
- 3) leapfrog development;
- 4) spatial segregation of different land uses:
- 5) decentralized land ownership;
- 6) primacy of automobile transportation;
- 7) fragmentation of governmental land use authority; and
- 8) disparity in the fiscal capacity of local government.

Richmond, former director of 1000 Friends of Oregon and a participant in the LUTRAO simulation study, offered a wide-ranging critique of sprawl and included numerous carefully culled statistics supporting his allegations. Many of his criticisms are drawn from the subject of his continued research—the Chicago metropolitan area. His criticisms form the basis for his definition of sprawl. In defining sprawl, however, Richmond does not present specific alternative forms of growth, either conceptually or in terms of quantified analysis. Instead, he continues to propose an agenda of specific policy actions that would encourage a regional approach to managing future growth. His analysis, therefore, does not provide either a method for measuring the costs of sprawl or a specific alternative development form that would provide a better outcome.

# SPRAWL EVENTS: LINCOLN INSTITUTE/GEORGIA CONSERVANCY CONFERENCES

In the spring of 1995, the Lincoln Institute of Land Policy hosted two important conferences on sprawl. The first took place in Washington, DC, and was cosponsored by the National Trust for Historic Preservation and The Brookings Institution. This conference brought all the national actors on sprawl together in a debate format. Sprawl's good and bad attributes were debated before a national audience. This was the first appearance of the defenders of sprawl. Peter Linneman from the University of Pennsylvania and Peter Gordon from USC proved to be strong supporters of the free-market merits of continued suburbanization.

So successful was the conference in drawing national attention to the sprawl issue, as well as in drawing attention to the institutions that sponsored the conference, that the Lincoln Institute held

derivative conferences in two locations— Florida and California. Even though no debate was scheduled, again the issue was raised: How bad is sprawl? Gordon, joined by colleague Genevieve Giuliano, provided a strong and cogent argument in favor of sprawl and presented findings contrary to the research of Seskin (LUTRAO), Landis (California Futures Studies), Burchell (Rutgers Modeling Studies), and Downs (New Visions for Metropolitan America). The savings gleaned from LUTRAO were described as minimal, and the land/infrastructure savings of the California Futures and Rutgers studies were trivialized. Downs was also criticized for assigning causes of central city decline to sprawl that could not be defended.

In 1996 and 1997, at the annual meetings of the Georgia Conservancy, sprawl was again the topic of consideration. Like the National Trust, the Georgia Conservancy shifted its focus slightly from historic preservation and was making a major substantive thrust at curbing urban sprawl. These conferences, which again attracted national spokespersons on the manifestations and costs of sprawl, were not a debate, but rather represented a summation on the ills of sprawl. The Atlanta region was growing at a rate of 55,000 jobs per year, and the economy was in such a boom period that growth was flooding the arterials in and around the city. Sprawl needed to be contained, and the conferences were the beginning steps in an attempt to create a mood for regional growth management. However, even though some sentiment for growth was apparent, the consensus was that political jurisdictions in Georgia were a long way from being able to implement, even on a regional scale, the most elemental of growth management techniques (a growth boundary).

# THE SPRAWL DEBATE: EWING VERSUS GORDON—IN PRINT AND IN PERSON

The debate over sprawl was brought front and center in two "point" and "counterpoint" articles in the Journal of the American Planning Association. The point article by Peter Gordon and Harry W. Richardson (1997a) critiqued the arguments and evidence frequently presented in favor of compact development (i.e., energy, transportation, and infrastructure efficiencies) and argued that the decentralized suburban pattern of development, in fact, offered many advantages, including reduced travel times and lower housing costs, as well as higher consumer satisfaction. In counterpoint, Reid Ewing (1997) made a strong case for the adverse effects of sprawl (as opposed to the benefits of compactness). Ewing pointed to increased infrastructure costs. increasing travel distances, and significant amounts of developable and lost fragile lands as the adverse effects of sprawl.

For the purposes of this review, the authors' respective definitions of terms bear note. For Ewing, sprawl was defined both by a series of three characteristics— (1) leapfrog or scattered development; (2) commercial strip development; and (3) large expanses of low-density or singleuse developments—as well as by such indicators as low accessibility and lack of functional open space (Ewing 1997). Gordon and Richardson did not specifically define sprawl (nor compactness, for that matter). Instead, they referenced sprawl's various traits. Sprawl was alternatively denoted by Gordon and Richardson as low-density, dispersed, or decentralized development, whereas compactness was associated with higher densities and a downtown or central-city spatial pattern versus a

polycentric (or dispersed) spatial pattern (Gordon and Richardson 1997a, 95).

Adverse effects of sprawl include increased infrastructure costs, increasing travel distances, and significant amounts of developable and lost fragile lands.

Although the point-counterpoint authors addressed more than 15 different subjects in discussing sprawl and its alternatives, the subjects can be grouped into five broad areas, as shown in Table 6.

The debate moved from print to person in a forum held at the University of California—Berkeley in late November 1997. Both Ewing and Gordon had significantly increased the weaponry used to support their individual positions.

Ewing began the session with points of mutual agreement and spun out a longer list than most expected. These included that: (1) the market for transit was limited; (2) infrastructure costs were higher for sprawl development initially but could diminish over time with infill; and (3) automobile costs as a function of suburban residence were high, but few alternatives to this mode of travel and its costs existed. Ewing and Gordon continued to disagree about whether resource consumption (energy, land) differences under sprawl and compact development in light of national and global resources were sufficiently significant to cause concern, and whether the traffic consequences of sprawl (excessive travel and roadway congestion) could be argued away in terms of either current or future methods of resolution (higher travel speeds, congestion pricing). The session was narrowly focused on primarily transportation issues and never really dealt with social or quality of life issues of sprawl.

TABLE 6
EWING AND GORDON-RICHARDSON IN PRINT SUBSTANTIVE AREAS OF INQUIRY

Author	Topics Considered By Authors	Public- Private Capital and Operating Costs	Transportation and Travel Costs	Land and Natural Habitat Preservation	Quality of Life	Social Effects
Ewing (1997)	• Infrastructure costs	X				
<b>(</b> ,	Public service costs	x	•			•
	• Transit		X			
	<ul> <li>Vehicle miles traveled</li> </ul>		x			
	Loss of resource lands	•		x		
	• Energy consumption				X	
	Psychic and social costs				X	
	Impact on central cities					<b>X</b> .
	Infrastructure and operating efficiency	X				
	• Transit	•	x			
Gordon and Richardson (1997a)	Economical resource allocation	x				
	• Congestion		x			
	<ul> <li>Open space and agricultural land</li> </ul>			x		
	Energy glut				X	
	<ul> <li>Density preferences</li> </ul>				x	
	Downtown impacts					X
	• Equity					. <b>x</b>

# CONTINUATION OF SPRAWL PRINT—HOUSING POLICY DEBATE AND THE URBAN LAWYER SYMPOSIA

One of the leading housing journals, Fannie Mae's Housing Policy and Debate, and a respected legal journal, The Urban Lawyer, both published symposia on sprawl. Several of the individual articles bear mentioning, but an important first point is that both housing and urban legal journals have come to recognize that suburban sprawl is an important topic for inclusion in their journals. This is significant. Both of the journals have had special issues on homelessness, exclusionary zoning, affordable housing, the economies of cities, the spatial mismatch of the poor in cities and available jobs in suburbs, and so on. Neither journal strays far from housing and urban problems. Thus, implicit in the publication of the two special issues on sprawl is the notion that at least some component of sprawl impacts on housing issues and quality of life. Sprawl does not only potentially cause excess resources to be expended in providing public infrastructure or, similarly, contribute to the loss of special lands and habitats. Sprawl does not only chain users to a single source of transportation for access to residential and employment opportunities. Sprawl has significant social and quality-of-life effects as well.

Suburban sprawl is an important topic for inclusion in housing and urban legal journals.

In *The Urban Lawyer* compilation of articles, Robert Freilich traced significant suburbanizing periods and methodically viewed their impact on central cities. Sprawl, he noted, is the force that distills the city's economic base, and it is orchestrated by suburban land-use controls that promote exclusion (Freilich

and Peshoff 1997). Charles Siemon pointed to the very limited number of techniques available to implement growth management and the difficulty of using them without encroaching upon property rights (Siemon 1997).

In the Housing Policy Debate articles, Robert Lang pointed to the voracity of sprawl and terms it suburbanization that was thriving and would not be shelved. Lang further commented that it was not productive to refer generically to nonresidential sprawl as "edge cities," a very limited phenomenon whose time may be past. To Lang, sprawl epitomizes current market preference, and its direction is clear—a continuing outward thrust from its urban core (Lang and Hornburg 1997). William Fischel of Dartmouth also proffered in the special issue of Housing Policy Debate that too much growth management could cause housing markets to diminish. According to Fischel, if you continue to castigate sprawl, you may turn around and not find any growth (Fischel 1997).

The upshot of this debate was that whereas at one time sprawl had only a solid line of inquiry detailing its costs; there was now a growing line of inquiry detailing its benefits.

If you continue to castigute sprawl, you may turn around and not find any growth.

# YET ANOTHER CONFERENCE: CONTROLLING SPRAWL IN THE LAND OF BARRY GOLDWATER

In the summer of 1998, in Phoenix, Arizona, the sprawl debate continued, this time in a conference sponsored by the Drachman Institute of the University of Arizona and the Fannie Mae Foundation. By now, the agenda and faculty had predictable topics and representations: Chris Nelson (Georgia Institute of Technology), Gary Pivo (University of Arizona), and John Holtzclaw (Sierra Club) were there to plead the case against sprawl. Peter Gordon (University of Southern California), Genevieve Giuliano (University of Southern California), and Robert Lang (Fannie Mae) countered with the benefits and normalcy of market-driven development.

The polarized positions of forum speakers left little room for anything other than agreeing to disagree. Armed with data to bolster their cases, speakers clung steadfastly to their agendas. In the few instances where the data were similar, these data were interpreted as consistent with diametrically opposed positions. The sprawl-anti sprawl positions hardened.

While established players echoed nowfamiliar refrains, several new players entered the debate. The strongest of these favored the pro-sprawl position. Robert Bruegmann, an urban historian (University of Illinois), spent considerable time debunking the myth that sprawl development patterns are either uniquely American or associated with the growth of the automobile. According to Bruegmann, sprawl was spawned in the nineteenth century by the horse and buggy and later by streetcars. Suburban-type neighborhoods were actually found throughout Europe in the nineteenth century, having nothing to do with either American cultural norms or the appearance of its automobile. Bruegmann sees the new urbanists as adding little but design innovations to sprawled locations, while mouthing the platitudes of the new community advocates of the 1970s (Bruegmann 1998).

The negative side of the Portland, Oregon growth boundary was clearly articulated

by Jerald Johnson, an economic consultant from that city. According to Johnson, the Portland urban growth boundary has succeeded in both increasing density and containing growth, but even more so, it has caused housing prices to rise. Johnson presented information indicating that housing prices in the city of Portland had increased at multiples of the level of density increases. Portland is becoming a victim of its own success. Housing demand and prices are high in a community noted for outward growth restraints and attention to quality of life (Johnson 1998).

Controlling free market development is a difficult sell in the Southwest, yet the importance of desert lands preservation was clearly articulated at this conference. In a state known for its creativity in siphoning off Colorado's water to reclaim the desert, there was recognition that development had to be contained and the more valuable parts of the desert inventoried and preserved.

# RESPONDING TO THE CHARGE: REGIONAL COOPERATION AND REGIONAL/STATEWIDE PLANNING

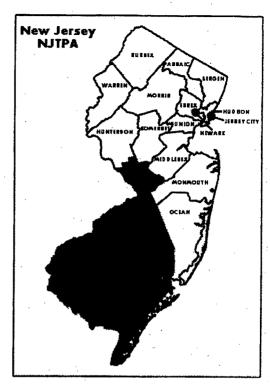
A one-man crusade against factionalized government, because it creates sprawl, has been waged by Myron Orfield, state representative for the City of Minneapolis in the Minnesota House of Representatives. Orfield believes that the best way to control sprawl is to get local governments to cooperate in developing regional strategies, land-use policies, and regulatory mechanisms. In his book Metropolitics, Orfield composed an aggressive regional strategy that links tax base sharing to affordable housing provision, farmland protection, and urban/inner-suburb redevelopment

(Orfield 1997). Orfield is a realist, however, and acknowledges that regional governments are not growing nationally but regional cooperation is. Currently, there is increased willingness to share selected municipal service delivery systems; there is virtually no interest in forming new regional governments (Petersen 1996).

At another level, there is an ongoing effort to promote planning at state and regional levels and to coordinate planning with infrastructure provision. State plans and growth management initiatives have been successfully put in place for the entire states of Colorado, Florida, Georgia, Maine, Maryland, New Jersey, Oregon, Rhode Island, and Washington, and for specific areas (e.g., the Coastal Zone, etc.) in California and North Carolina (DeGrove 1990). The guru of statewide planning, who has followed it for most of his career and has testified as an expert witness in most state house hearings, is John DeGrove of Florida Atlantic University. DeGrove is also politically astute and realizes that even the most encompassing state plan or growth management act will either be voluntary for compliance by subunits of government, or non-punitive for noncompliance by these same subunits.

No discussion of growth management would be complete without discussing the work of Douglas Porter of the Growth Management Institute and Arthur C.

Nelson of Georgia Tech. For a decade, Porter has been a focal point of the literature on growth management. Porter participated in Sam Seskin's "Transit and Urban Form" study (Parsons Brinckerhoff 1996d), Reid Ewing's Best Development Practices (Ewing 1995a), and the LUTRAQ study (Davis and Seskin 1997). From State and Regional Initiatives for Managing Development to



The New Jersey Transportation Planning Authority, Inc. (NJTPA) serves as a forum for cooperative decision-making in the 13-county, northern New Jersey regional area.

Source: New Jersey Institute of Technology and Rutgers University. TELUS: Transportation Economic and Land Use System—State-of-the-Art Information System for the 21st Century (April 1998).

Managing Growth in America's Communities (Porter 1992; Porter 1997), Porter has been involved in implementing managed growth alternatives. This includes model regulatory and programmatic techniques and pairing these specific techniques with a particular growth management issue or problem.

Nelson has similarly authored *The Regulated Landscape* (Knapp and Nelson 1992) and *Growth Management Principles and Practices* (Nelson and Duncan 1995) and has been a principal in multiple regional costs of growth studies. One of the most difficult tasks in land use

is to effect meaningful regionwide growth management. Both Porter and Nelson have been involved with many regional growth management implementation efforts.

# RESPONDING TO THE CHARGE: SUSTAINABLE DEVELOPMENT AND SMART GROWTH

As yet another response for a new direction in land use, the sustainable development and smart growth movements have emerged in the United States. The U.S. sustainable development movement is a direct outflow of the World Congress on Sustainable Development held in Rio de Janeiro in 1992. This philosophy of development reflects a desire to "develop today without compromising available resources for future generations." For the most part, overburdened U.S. communities in the South, Southwest, and West have justified growth management programs under the guise of compliance with this norm (Krizek and Power 1996).

Currently, twenty-one communities in the United States have adopted sustainable development ordinances that essentially limit growth to the degree that public facilities and services are in place to

This philosophy of development reflects a desire to "develop today without compromising available resources for future generations."

accommodate this growth. Counties and regions are preparing development policies consistent with the goals of sustainability. In Florida, the Governor's Commission for a Sustainable South Florida in December 1997 enacted an energy conservation policy for the southern portion of the state. Among energy-conserving ideas, the Commission required utility companies to derive

measures other than expansion of the user base as appropriate indices of company performance. Further, this Commission is deciding how improved transportation, education, and employment opportunities either add to or possibly detract from the goals of sustainability.

Precursors to current sustainability regulations were the 1970s growth control efforts of California and Florida cities, and the concurrency requirement of the Florida Growth Management Act of 1985. In the United States, the President's Commission on Sustainable Development. the U.S. Department of Commerce, the U.S. Economic Development Administration (EDA), and the U.S. Environmental Protection Agency (EPA) have implemented sustainable development objectives that their funded projects must observe. For the most part. the emphasis on sustainable growth ensures that capital projects respect the environment of which they are a part and do not unnecessarily spur growth in locations where existing infrastructure cannot support the growth.

Smart growth was an initiative of the American Planning Association (APA), the U.S. Department of Housing and Urban Development (HUD), and the Henry M. Jackson Foundation on the one hand, and the National Resource Defense Council (NRDC) and the Surface Transportation Policy Project (STPP) on the other. The APA/HUD initiative called for an updating of land-use controls to make them more sensitive to the ongoing problems of lack of housing diversity, traffic congestion, and environmental degradation. The initiative also called for land-use controls that emphasized compact development to conserve resources; that limited development in undeveloped areas while encouraged investment in older central cities; that promoted social equity in the face of

economic and spatial separation; and that were sensitive to the role of the private market and the need for simplicity and predictability in land use (APA 1997).

The NRDC/STPP Smart Growth effort consisted of a "Toolkit" for policymakers that attempts to promote growth that is "compact, walkable, and transit accessible" and will ultimately "compete better with sprawl in policy forums and in the marketplace." The Toolkit contains: (1) three policy reports on sprawl's environmental, economic, and social impacts; (2) research reports on sprawl-induced fiscal impacts and infrastructure requirements (including utilities and roads); and (3) a "Smart Growth Guidebook" (NRDC/STPP 1997).

Maryland adopted smart growth legislation at the state level in 1997. This legislation withholds, or at least sharply limits, any subsidies for new roads, sewers, or schools for political jurisdictions outside state-targeted smart growth areas (Maryland Office of Planning 1997). Rhode Island and Colorado have also adopted similar initiatives (ULI 1998).

The Smart Growth initiative calls for an updating of land-use controls to make them more sensitive to the ongoing problems of lack of housing diversity, traffic congestion, and environmental degradation.

Each of the above techniques has as its basis the better management of growth and more compact development for the purpose of resource conservation. In a September 1998 speech in Chattanooga, Tennessee, Vice President Al Gore recommended a "renewed federal commitment to the policies of smart growth (Gore 1998).

# A GROWING CONCERN—THE EQUITY ISSUE IN SUSTAINABLE DEVELOPMENT

One of the under-researched sides of the sustainable development movement is whether there is a dark side to the goal of not compromising the physical environment for future generations. At the regional level, this dark side might take the form of freezing the movement of minority and ethnic populations to the outer reaches of the metropolitan area by making inner cities and inner suburbs "more attractive" to all, and especially to these groups. Thus, exurban resources would be "sustained" by reduced access to these resources by those with the least economic wealth (Lake 1997). The central thesis of the equity issue is that better environments for some will mean worse environments for others. Even if there is a solution that improves conditions for some without hurting others, the benefits of better environments will still be unevenly distributed (Marcuse 1998).

New urbanists take a hit in this literature in that their new environments for the most part continue to promote new space consumption: suburban-bound, affluent housing seekers (few "new urban" environments accommodate the poor in urban areas). Resultantly, many of these new environments do little to improve the physical sustainability of urban areas.

In a four-day National Science Foundation (NSF) workshop at Rutgers University in the spring of 1998, Robert W. Lake of Rutgers and Susan O. Hanson of Clark University brought together environmental and first/third world researchers from the United States, Canada, and the United Kingdom to propose an integrated agenda for studying urban sustainability. This involved differentiating between such terms as

urban sustainability (developed areas function to minimize the consumption of resources and manage equity) and sustainable development (an increment of land is developed to minimize the consumption of resources), and determining the effect of scale (local versus global) on both definitions and issues. The results of this workshop will be used by NSF to formulate a research program on urban sustainability.

The workshop focused on four issues, and a research agenda will be prepared regarding each. These are:

- economy-environment,
- local-global,
- urbanization as process,
- and governmental and institutional intervention.

### **SUMMARY**

According to Robert G. Healy of the Nicholas School of the Environment at Duke University, the time may be right for an "alignment of the stars" on land use policy affecting sprawl. Healy points out the following signs: (1) the transit bike path and urban trail initiatives of the 1998 Transportation Equity Act for the 21st Century (TEA-21); (2) states moving to sustainable development, smart growth, or open space land acquisition initiatives; (3) citizens approving park and recreation bond issues of \$1.37 billion in 1997; and (4) private industry initiatives such as the Silicon Valley Manufacturers Group's attempts to support public transportation, affordable housing, and environmental protection to ensure that sought-after workers will continue to be attracted to the San Francisco region (Healy 1998).

Healy notes that the situation is different from federal land use initiatives of the 1970s that failed to get out of Congress because:

- There is agreement in the environment and development communities that growth is inevitable but must be carefully monitored;
- Sprawl is understood as an outcome of current conditions, and positions—both positive and negative—have been taken about it; and
- Federal, state, and local governments are moving in similar directions in land use, and their sprawl-abetting and sprawlcontrolling roles are being carefully examined.

Sprawl is a type of growth in the United States that even the most unenlightened realize needs rethinking. Yet sprawl is so endemic to the culture of the United States that it is almost impossible to change. Americans like its outcome. It provides safe and economically heterogeneous neighborhoods that are removed from the problems of the central city. In low-density, middle-class environments, life takes place with relative ease, and when residents wish to relocate, they typically leave in better financial condition—the result of almost certain housing appreciation in these locations.

The public services available to residents in sprawl locations are more than adequate—and their cost, until recently, has been relatively inexpensive. But costs are beginning to increase. Americans are looking, albeit halfheartedly, for an alternative to current development patterns. There is a general sentiment that communities and individuals specifically, and society as a whole, cannot continue to pay for the costs of sprawl. Costs have been held at a manageable level only because overall infrastructure is underprovided and developmental infrastructure is not repaired adequately or replaced.

Over time, sprawl has garnered a long list of detractors, but increasingly observers are asking that the issues be discussed fairly. Most of the early literature criticized sprawl, but much of the recent literature asks for an analysis that deliberately isolates both the costs and benefits of sprawl. This is the emphasis of Section II of this study: to break down the phenomenon of sprawl into its basic alleged impacts, both positive and negative, and to detail deliberately the strengths and weaknesses of each impact statement with specific citations from the literature. Impacts are categorized in five groupings. These are:

- public-private capital and operating costs;
- 2) transportation and travel costs;
- 3) land and natural habitat preservation;
- 4) quality of life; and
- 5) social issues.

The above categories obviously contain significant overlap. The objective is not to define mutually exclusive groups but to begin to point out and synthesize the major concerns of the literature.



# LITERATURE SYNTHESIS

The purpose of this section is to divide the literature on sprawl into major fields and subfields of impact in an effort to synthesize the most important studies in a systematic way.

This effort identifies what researchers on the subject have considered and debated; what data have been used and how the data have been analyzed; and where the gaps in the state of knowledge are.

The section is divided into two parts. The first is a synthesis of the literature as described above. The second is a summary of the literature, including: (1) topical coverage, databases, methodologies, and deficiencies; and (2) alleged negative and positive effects of sprawl. Thus, the synthesis of the literature in the first part of the section serves as a basis for statistical summaries of literature by type, database, methodology, and category of impact in the second part of the chapter. The statistical summary is one of the first of its type. Although different literature citations could signal different emphases, it is believed that these citations and resulting emphases are correct in both direction and magnitude.

### Analysis of the Literature

A search of the literature reveals that various commentators have attributed more than two dozen negative and more than one dozen positive impacts to sprawl. These impacts are set forth in Table 7. The list is not a scientific taxonomy; it does not include all the alleged effects of sprawl. Rather, in the judgment of those reviewing the literature, it includes some of sprawl's most significant impacts. Further, not all of the allegations can be substantiated; nor are they of equal importance. However, this inventory presents a comprehensive set of allegations based on the literature assembled here.

# ALLEGED NEGATIVE AND POSITIVE IMPACTS OF SPRAWL

- 1		
Substantive Concern	Alleged Negative Impacis	Allegea Fosilive Impacis
Public-Private Capital and Operating Costs	Higher infrastructure costs	Lower public operating costs
	Higher public operating costs	Less expensive private residential and nonresidential development costs
	More expensive private residential and nonresidential development costs	Fosters efficient development of "leapfrogged" areas
	More adverse public fiscal impacts	
	Higher aggregate land costs	
Transportation and Travel Costs	More vehicle miles traveled (VMT)	Shorter commuting times
	Longer travel times	Less congestion
	More automobile trips	Lower governmental costs for transportation
	Higher household transportation spending	Automobiles most efficient mode of transportation
	Less cost-efficient and effective transit	
	Higher social costs of travel	
Land/Natural Habitat Preservation	Loss of agricultural land	Enhanced personal and public open space
	Reduced farmland productivity	
	Reduced farmland viability (water constraints)	
	Loss of fragile environmental lands	
	Reduced regional open space	
Quality of Life	Aesthetically displeasing	Preference for low-density living
	Weakened sense of community	Lower crime rates
	Greater stress	Enhanced value or reduced costs of public and private
		spood
	Higher energy consumption	Fosters greater economic well-being
	More air pollution	
	Lessened historic preservation	
Social Issues	Fosters suburban exclusion	Fosters localized land use decisions
	Fosters spatial mismatch	Enhances municipal diversity and choice
	Fosters residential segregation	
	Worsens city fiscal stress	
	Worsens inner-city deterioration	

The allegations have been classified into five substantive categories:

- 1) public/private capital and operating costs:
- 2) transportation and travel costs;
- 3) land/natural habitat preservation;
- 4) quality of life; and
- 5) social issues.

Each of the alleged negative and positive impacts found in the literature search under these groupings uses a common presentation format as follows:

- 1) *Topic*. What is the specific subject matter of the alleged cost or benefit?
- 2) Allegation/Basis. Synopsis of the alleged cost or benefit and the basis or logic of the supposed effect.
- 3) Literature Synthesis. Pertinent studies on the allegation are cited, either supporting or rebutting it. The presentation of the literature synthesis is accomplished using both text and a matrix. The matrix distinguishes:
  - a) Whether or not the alleged factual condition exists under conditions of sprawl (or more generally whether development pattern affects the item in question).
  - b) Whether or not the alleged factual condition—if it exists—has been significantly linked to sprawl (i.e., to development pattern).

For example, one allegation is that "sprawl generates more vehicle miles of

travel than higher-density forms of development." The literature synthesis first notes whether there is, in fact, agreement among observers who comment on this subject. (There appears to be general agreement in this regard.)

The next observation addresses the question of whether there is agreement in the literature that the presence of greater vehicle miles of travel in low-density settlements is significantly related to sprawl. (There is, again, general agreement on the second count.) For simplification, these judgments are shown in the form of a matrix:

	+2 General Agreement	+) Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			
Is it strongly linked to sprawl?	. <b>X</b> ~		<i>)</i> -	

An "x" is placed in the matrix cell that contains the appropriate answer to the question on that line.

The above matrix is not a rigorous measuring instrument. It could have been produced in a variety of ways. Even as currently structured, there are areas of disagreement among reviewers on how to "slot" an item—i.e., whether there is "general agreement" or "some agreement" in the literature that the situation as described indeed exists. For that matter, there are also areas of disagreement on how convincing the literature is in linking identified development impacts to sprawl.

### **CHAPTER**



# Literature Synthesis

# PUBLIC/PRIVATE CAPITAL AND OPERATING COSTS

 $P_{ublic}$  capital and operating costs of sprawl refers to the construction of roads. water and sewer infrastructure, and public buildings, as well as the annual expenditures necessary to maintain them. These costs are incurred both in small enclaves in remote locations of the metropolitan areas where population is growing and in central cities from which some of the population growth is drawn. Private capital and operating costs of sprawl refers to the construction and occupancy costs of private housing and commercial and industrial space. Most of the literature discusses how metropolitan location and density/form of development cause these costs to vary.

Engineering-per capita analyses examine the costs of different types of development by applying such factors as cost per linear foot of roadway, expense per gallon of treated sewage, and police expenditures per resident or per employee.

Alternative growth analyses are broaderscale analyses that employ a series

of land use, transportation, and infrastructure models to examine the effects of two differing growth scenarios on development costs. These models begin with per capita averages but extend them to capture the effects of variables that affect costs. For instance, water consumption is related not only to population growth but also to housing type, density, and the demographics of occupation of structures; housing costs are related to population growth and influences such as density, housing type, and location of development.

Regression analyses apply multivariate statistical tools to further refine linkages between growth and public-private capital and operating costs.

A final group of studies includes a number of retrospective case studies. These view the effects of the overlay of regulations inherent in managed growth on the costs of local housing. Each of these types of research techniques is found in the literature that is discussed below.

### **Sprawl's Alleged Negative Impacts**

Higher Infrastructure Costs
Higher Public Operating Costs
More Expensive Private Residential and
Nonresidential Development Costs
More Adverse Public Fiscal Impacts
Higher Aggregate Land Costs

# **Sprawl's Alleged Positive Impacts**

Lower Public Operating Costs
Less Expensive Private Residential and
Nonresidential Development Costs
Fosters Efficient Development of
"Leapfrogged Areas"

# SPRAWL'S ALLEGED NEGATIVE IMPACTS

# **Higher Infrastructure Costs**

Allegation/Basis

Infrastructure of a wide scope—e.g., local and regional roads, water and sewer systems, and schools—is more expensive under sprawl than under compact development. This allegation alludes to infrastructure that is primarily public (i.e., state, county, or local government roads; public utility systems; and public schools) and occasionally private (i.e., privately owned utility systems and subdivision-level roads that are not dedicated to the public sector).

The effect of sprawl on the cost of infrastructure allegedly occurs for several reasons. At sprawl's lower development densities, various components of infrastructure that are linearly related (i.e., sidewalks, curbs, subdivision-level roadways, and water and sewer mains) serve a lesser increment of development than these components of infrastructure would serve at higher levels of density.

The segregation of land uses associated with sprawl further increases infrastructure costs. Segregation of land uses by residential and nonresidential types often means that parallel infrastructure systems have to be provided to individual residential and nonresidential locations. Further, sprawl's leapfrog development, which locates growth away from existing development. does not capitalize on pockets of surplus infrastructure capacity that may already be present in and around existing development. Finally, fragmented governance, a seemingly natural accompaniment to sprawl, often leads to duplicative city halls, police stations, courts, fire houses, schools, water/sewer treatment facilities, and so on.

### Literature Synthesis

As shown earlier in Table 1, The Costs of Sprawl (RERC 1974) found that capital costs per unit were higher in the "lowdiversity sprawl" and "sprawl mix" neighborhood prototypes than they were in the "planned mix" or "high-density planned mix" prototypes. The Costs of Sprawl also found that capital expenses per unit were higher in detached housing (more pronounced under sprawl) than they were in attached housing (more pronounced under compact development). The first finding of The Costs of Sprawl, although criticized, has basically stood the test of time (Altshuler 1977); the second finding proved to be the undoing of the study (Windsor 1979).

Frank (1989) reanalyzed (using current cost numbers) several studies conducted between the 1950s and the 1980s that examined relationships between land use and infrastructure costs (including *The Costs of Sprawl*). Accounting for the limitations of *The Costs of Sprawl* study, he concluded that infrastructure costs were *highest* in situations of low density

and for development located a considerable distance from centralized public services (conditions of sprawl). Infrastructure costs were lowest in situations of higher density and for development that was centrally and/or contiguously located (conditions of compact development). Duncan (1989) analyzed the infrastructure costs of multiple Florida residential and nonresidential developments with varying patterns of development. Costs were higher for those with sprawl characteristics than they were for those with compact development characteristics (see Table 8).

Infrastructure costs were highest in situations of low density and for development located a considerable distance from centralized public services.

The longest-run modeling of infrastructure costs under different development scenarios was performed by Burchell (1992-1997) in New Jersey and in other locations. The infrastructure models applied by Burchell relate development density and housing type to the demand for local/state roads and water/sewer infrastructure. The studies found that the amount of land consumed for development was directly related to lane-miles of road required for two-lane (local) and four-lane (state) roads. Thus, density of development was found to be inversely related to lane-miles of local and state roads and their attendant infrastructure costs. Housing type and, to a lesser extent, density were related to the amount of water and sewer services consumed (measured in gallons) by development. Almost all of the difference in residential water usage related to whether or not occupants of residential and nonresidential facilities watered their lawns. Lawn watering takes place primarily in single-family detached

residences and high-value research and commercial headquarters uses. The difference in water usage among various commercial and industrial uses is also related to the service or product that is generated by the facility.

Larger and more significant than water/sewer usage are differences observed in water/sewer infrastructure. particularly as related to the number of feeder hookups from the trunk line that an individual land use requires. Higher density, the clustering of land uses, and attached housing and linked nonresidential uses all contribute to a reduced number of infrastructure feeder lines and reduced costs. A model sensitive to these differences, applied in New Jersey to alternative growth scenarios differentiated by sprawl-like versus more compact development patterns, showed the former's infrastructure costs to be considerably higher. The findings were basically similar in order of magnitude across most of the other locations analyzed by Burchell (Burchell and Listokin 1995a) (see earlier Tables 3 and 4). The findings were also comparable to those arrived at by Frank (1989) and Duncan (1989) in their studies (see Table 9).



Billions of dollars are spent annually on massive road infrastructure projects.

Source: U.S. Department of Housing and Urban Development.

### **TABLE 8**

# DUNCAN (1989)—FLORIDA GROWTH PATTERN STUDY: CAPITAL FACILITY COSTS UNDER SPRAWL VERSUS COMPACT DEVELOPMENT

(per dwelling unit; 1990 dollars)

Category of Capital Costs	Average of Case Studies under Sprawl Development	Average of Case Studies under Compact Development <sup>2</sup>	Sprawl Ver Compact Deve	
			Difference	#/%
Roads	\$ 7,014	\$ 2,784	(+) \$4,230	60.3
Schools	6,079	5,625	(+) 454	7.4
Utilities	2,187	1,320	(+) 867	39.6
Other	661	672	(-) 11	1.7
TOTAL	\$15,941	\$10,401	(+) \$5,540	36.7

### Notes:

- 1. Sprawl development as defined here include the following patterns of "urban form" analyzed by the Florida study: "scattered," "linear," and "satellite." The capital cost figures shown in this table are averages of the Florida case studies characterized by the scattered, linear, and satellite patterns (i.e., Kendall Drive, Tampa Palms, University Boulevard, and Cantonment).
- 2. Compact development as defined here includes the following patterns of "urban form" analyzed by the Florida study: "contiguous" and "compact." The capital cost figures shown in this table are averages of the Florida case studies characterized by the contiguous and compact patterns (i.e., Countryside, Downtown Orlando, and Southpoint.)

### Source:

Memorandum from James Duncan and Associates to Robert W. Burchell and David Listokin, May 8, 1990; and James Duncan et al., *The Search for Efficient Urban Growth Patterns*. Report prepared for the Governor's Task Force on Urban Growth Patterns and the Florida Department of Community Affairs (Tallahassee, July 1989).

Other relevant research indicating higher infrastructure costs under conditions of sprawl includes Archer (1973) and Duensing (1977). Base data on infrastructure and its costs not related to development pattern, such as average capital outlays per single-family house or costs per linear foot of roadway, are provided by FACIR (1986), Fodor (1995), Nelson (1988), Nichols et al. (1991), and California OP&R (1982).

Carson, in a study on the costs of growth in Oregon, uses these prior studies to estimate the costs of growth in that state. Again, these costs were not related to specific development patterns (Carson 1998).

The above body of research which reflects, in part, an approach dating back to *The Costs of Sprawl*, has been criticized on several counts by Altshuler (1977) and Altshuler and Gomez-Ibanez (1993) for the following reasons:

1) The higher infrastructure costs found in instances of lower versus higher density (i.e., sprawl versus compact development) are not meaningful because the housing units and their attendant scale found under the different development alternatives (i.e., more detached housing under sprawl and more attached housing under compact development) are not comparable.

- 2) The higher infrastructure costs attributed to sprawl due to its leapfrog patterns will essentially be neutralized as areas that were initially passed over are ultimately developed. The next wave of growth will capitalize on the infrastructure in place. Thus, the higher initial costs will be recouped. "The cost of sprawl is the cost of supplying some infrastructure in advance of its eventual need and will ultimately be lower the more rapidly that infill takes place" (Altshuler and Gomez-Ibanez 1993, 72-73).
- 3) The higher infrastructure costs (under sprawl) attributed to the distance of development from central facilities does not consider potential economies of scale that could be realized in regionalized, oversized trunk lines or similarly located water/sewer treatment plants (Altshuler and Gomez-Ibanez 1993, 73). In other words, the added "costs of distance" because feeder lines are longer under sprawl are not significant if the feeder lines are attached to regionally located (and oversized) trunk lines and water/sewer plants.

Holding aside the above criticisms, at least one researcher, Richard Peiser, found the cost difference in infrastructure between sprawl and compact development patterns to be quite slight.

Peiser (1984) examined infrastructure costs for new residential development in two Texas "prototype" communities—one planned, the other unplanned. The planned and unplanned developments were located on 7,500-acre sites in Houston. The planned community was designed to accommodate a population of about 80,000 residents in 26,500 dwelling units and a workforce of 72,000 in 24 million square feet of office and industrial space. The development was largely selfcontained and near existing development in the form of a large center. The unplanned development was located in a primary growth corridor at the urban fringe, typical of Houston's sprawl pattern (100- to 500-acre subdivisions, strip malls, and shopping centers). The Houston development was designed to accommodate about the same number of residents (80,000) and workers (72,000) as the planned development. In Peiser's model, the difference in capital expenses for the planned and unplanned scenarios was about 5 percent in favor of the planned development. The finding in the Peiser study that contradicts other findings in the field was the inclusion in overall planned development infrastructure savings of higher road costs associated with planned as opposed to unplanned development (Table 10).

TABLE 9 RELATIVE INFRASTRUCTURE COSTS OF SPRAWL VERSUS COMPACT **DEVELOPMENT FROM THREE MAJOR STUDIES** 

		Spraw	elopment Costs  Development  Tom Three Majo	Costs:	1
Infrastructure Cost Category	Sprawl Development	Duncan Study (1989)	Frank Study (1989)	Burchell Studies (1992-1997)	Compact Development Costs: Synthesis from Three Major Studies (in percent, relative to sprawl)
Roads (local)	100%	40%	73%	74-88%	≈75%
Schools	100%	93%	99%	97%	≈95%
Utilities	100%	60%	66%	86-93%	≈80%

TABLE 10
Infrastructure Costs for Planned and Unplanned Development
The Peiser Model

Infrastructure Costs Component	Planned Development (for 80,000 residents) (\$ in millions)	Unplanned Development (for 80,000 residents) (\$ in millions)
Roads	\$10.0	\$8.0
Sewer	4.3	4.7
Water	9.2	11.8
Drainage	16.3	17.4
TOTAL	\$39.8	\$41.9

Source: Richard B. Peiser 1984

In sum, although there is general agreement that development density is linked to infrastructure costs, there is less agreement about the interrelationship between sprawl (as a less carefully defined development form) and infrastructure costs.

Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	O No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			×.
Is it strongly linked to sprawl?		х		

### **Higher Public Operating Costs**

## Allegation/Basis

Sprawl generates greater local/school district operating costs than higher density forms of development. This allegation relates to splintered public local and educational agencies that provide duplicative administrative and operating services.

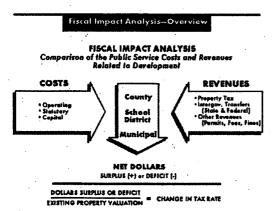
### Literature Synthesis

Operating costs are those costs that accrue on a day-to-day basis and form the annual

expenses of local government. These costs include public workers' salaries and benefits; normal expenditures for supplies, repairs, and replacement items; and debt service for capital facilities purchased or contracted for at the local government level (municipal and county). The literature is rich with descriptions of variations in local (county and municipal) costs as a function of jurisdiction size, wealth, growth rate, and density of development.

Generally speaking, per capita *local* costs are "U" shaped as a function of population size—i.e., they are expensive for jurisdictions with populations under 2,500 and over 50,000, with points of most efficiency in those locations where the population is between 10,000 and 25,000. School district per pupil costs increase with school district size. Districts with more than 3,000 pupils spend 20 to 30 percent more per pupil than districts of fewer than 1,000 pupils; districts of 1,000-3,000 pupils spend 10 percent more than districts of fewer than 1,000 pupils (Sternlieb and Burchell 1977; Burchell and Listokin 1996).

Both local (municipal and county) public service costs per capita and school district public service costs per pupil also vary directly with the wealth of the jurisdiction. The citizens of wealthier jurisdictions demand greater qualities and quantities of local and educational public services and are willing to pay for them (Burchell and Listokin 1996).



Fiscal impact analysis compares the public costs versus public revenues generated by growth.

Source: National Association of Home Builders.

Per capita local and school district costs also have been found to vary directly with density, and inversely with the growth rate of the jurisdiction. Generally speaking, the higher the density, the higher the per capita and per pupil costs; the faster the growth rate, the lower the per capita and per pupil costs (Ladd 1992). Two caveats are noteworthy, however. First, comparisons almost always are made between suburban- and urban-level densities and rarely between densities that reflect more- versus less-intense suburban development. Second, none of the analyses performed to date standardize the quality or quantity of public services delivered (Altshuler and Gomez-Ibanez 1993).

Thus, buried in the above findings is the fact that public services that are delivered in very large and dense local (municipal and county) jurisdictions are more complex and more individualized than those delivered in smaller, more sparsely populated jurisdictions. Foot patrol or two-person automobile police patrol takes

the place of one-person automobile police patrol; full-time paid fire department employees take the place of volunteers; and significant numbers of special education teachers must be hired instead of contracting out special education services. All these examples point to the service differences that complicate comparison of costs in more intensely populated versus less intensely populated jurisdictions.

Local government costs nationally average about \$700 per capita; school district costs average about \$7,000 per pupil (Census of Governments 1997). Of the former, about 60 percent goes toward salaries and benefits, 35 percent toward other expenses, and 5 percent toward capital purposes. Of the latter, 70 percent goes toward salary and benefits, 20 percent toward other expenses, and 10 percent toward capital purposes.

Compact or managed growth, the opposite of sprawl development, may encourage more regionalism in school systems and more sharing of non-police, local public resources. It also reduces the amount of local roads and water/sewer utility lines and hookups that are *constructed* and paid for by local debt service and *maintained* and paid for out of annual operating budgets.

Burchell, in his analysis of the growth alternatives in the Impact Assessment of the New Jersey State Development and Redevelopment Plan, found that combined municipal and school district operational costs could be reduced by 2 percent annually under planned (compact) growth as opposed to trend (sprawl) growth (Burchell 1992a). Although the percentage seems small, the savings occur annually; they are not a one-time windfall, and the savings could

potentially be applied nationally to local budgets that sum to \$175 billion per year, and to school district budgets that sum nationally to \$500 billion annually.

Service differences complicate the comparison of costs in more intensely populated versus less intensely populated jurisdictions.

In similar type studies in the Delaware Estuary, and in the state of Michigan, municipal costs were found to be 5-6 percent less annually under compact growth scenarios than they were under sprawl development.

Basically equivalent findings were arrived at earlier by James Duncan in Florida (Duncan 1989). Conflicting findings have been suggested, but not empirically tested, by Altshuler and Gomez-Ibanez (1993) and Gordon and Richardson (1997a). Altshuler and Gomez-Ibanez indicate that the inability to control for the quality and quantity of services under comparison renders most of these studies at best "time and location bound" by who is providing the services, the types of public services, and when they are provided. At worst, most of the studies cannot be used to draw appropriate conclusions, given their inability to differentiate between levels of service provided (Altshuler and Gomez-Ibanez 1993).

Gordon and Richardson indicate that Burchell's prospective alternative development scenarios allow no flexibility for the trend (sprawl) scenario to improve over time and no flexibility for the plan (compact growth) scenario to be worse than envisioned due to the lack of full compliance with this alternative (Gordon and Richardson 1997a). Literature Synthesis Matrix

	+2 General Agreement	+) Same Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?			х	

# More Expensive Private Residential and Nonresidential Development Costs

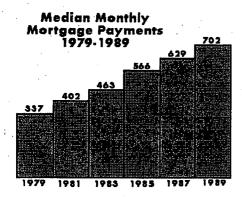
Allegation/Basis

Sprawl causes residential and nonresidential building and occupancy costs to rise due to the larger lot and structure sizes in locations where land is less expensive.

#### Literature Synthesis

Development costs include land and improvement costs, and are impacted by the scale of each. Spacious single-family dwellings on large lots are usually the most expensive types of housing; similarly, spread-out, low-rise non-residential development on large parcels of land are the most expensive type of commercial and/or industrial development. Both are low-density examples of their respective development forms.

To the degree that density increases in residential development and floor-arearatios increase in nonresidential development, holding all other structure/environmental amenities constant, residential and nonresidential development costs should decrease. Similarly, to the degree that structures are smaller, holding all other structure/environmental amenities constant, residential and nonresidential development costs will also be less.



Housing costs have been rising consistently during the past decade.

Source: U.S. Bureau of the Census.

Other factors that affect the costs of residential and nonresidential development include: 1) the amount of zoned land available for development, as determined by the local zoning ordinance; and 2) the time it takes development to engage and clear the permitting process (which is also largely determined by local land-use regulations). If land is limited or inappropriately zoned, residential and nonresidential development costs will rise. If government regulations are excessive, permitting time will increase, and the costs of development will also rise.

In the Impact Assessment of the New Jersey State Development and Redevelopment Plan, Burchell (1992a) found that if new development is contained around existing development and is also increased somewhat in terms of density and floor-area ratio, even with significant decreases in density to preserve lands at the periphery, overall residential and nonresidential development costs will be approximately 10 percent less per unit or per 1,000 square feet. Somewhat lesser savings (6-8%) emerged from studies conducted in Lexington, Kentucky (Burchell and Listokin 1994b), the Delaware Estuary (Burchell and Moskowitz 1995), and the state of Michigan (Burchell 1997a).

Other studies of residential development have produced essentially parallel findings on the effects of increased lot and structure size on housing costs. Downs (1973), Schafer (1975), Seidel (1978), and others have found that large-lot zoning and minimum building size increase the costs of new housing. This same type of analysis applied to nonresidential development—although not often looked at by researchers in the field—has produced similar findings (Burchell 1992-1997).

Some researchers have found that largelot single-family zoning and minimum building sizes are associated with sprawl development. Smaller lot sizes (zero lot line) and different types and intensities of development (single-family attached and multifamily) are associated with compact development (Avin 1993; CH2M Hill 1993). Linking the above two sets of findings, the savings noted by housing type should then extend to these two polar development forms.

Large-lot single-family zoning and minimum building sizes are associated with sprawl development.

One cannot assume, however, that housing preference changes will accompany development pattern shifts. In other words, if compact development is opted for, and denser forms of housing comprise this type of development, it cannot be assumed that market preferences will correspondingly shift and families previously occupying less dense types of housing under sprawl will opt for the more intense development forms under compact development. Further, if there is a crossover between housing types, one must carry the occupancy profile of the former to the new type of housing unit. Otherwise, false conclusions could be drawn with

regard to development cost savings associated with the often smaller and less intensely occupied housing of compact development, and with the annual fiscal impact savings resulting from this development form. A critical error was discovered by Windsor in his review of The Costs of Sprawl (Windsor 1979). According to Windsor, The Costs of Sprawl study failed to account for the fact that the characteristics of new townhouse occupants who switched from detached single-family occupancy (if they could be assumed to do so) would be closer to the characteristics of occupants of the units that they had left than to the characteristics of the occupants of units similar to their new housing. This lack of realization led to the erroneous conclusion that compact development (containing a larger percentage of townhouses) was less expensive to service than sprawl development (containing a larger percentage of single-family homes), when the same households that occupied the former would likely be the ones moving to the latter.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?			Х -	

#### **More Adverse Public Fiscal Impacts**

#### Allegation/Basis

Sprawl generates more adverse fiscal impacts than compact development because public operating costs are significantly higher and residential uses and attendant revenues do not compensate for these costs. Further, fragmented governments compete for land uses

according to these land uses' fiscal superiority. Most "good" (from a local fiscal impact perspective) economic uses have been withdrawn from central cities and transplanted to suburban jurisdictions. Since there are not enough "good" land uses to go around, only the wealthiest jurisdictions truly benefit fiscally from these land uses.

#### Literature Synthesis

In analyzing the impacts of land uses, the notion that some types of land uses are better fiscally than others has become widely accepted. Nonresidential land uses. for the most part, have been shown to be more profitable than residential uses, and most standard forms of residential land uses less profitable (see Table 11). Further, within the nonresidential and residential sectors, varying degrees of advantage and disadvantage exist. Some land uses produce more revenues than costs; if service levels are maintained at the same level after development, taxes could be decreased. The reverse is also true. In some cases, costs exceed revenues and, all things being equal, taxes might have to be increased (Burchell and Listokin 1994a).

Position on the fiscal impact hierarchy depends on the type of unit (the size or intensity of use) within both residential and nonresidential classifications. Fiscal position also depends on the service district in which impact is being viewed. Often, for instance, a small condominium or age-restricted housing unit may be break-even or have a slightly positive or negative impact on the municipal service jurisdiction, yet both may be very positive fiscal ratables in the school district. On the other hand, larger townhouses may be just below break-even in the school district yet significantly negative in the municipal jurisdiction.

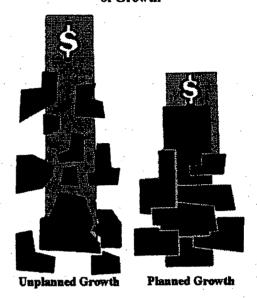
Fiscal impacts and observed differences under sprawl versus compact growth are dependent upon two different influences from development patterns. The first is the ability of the development pattern to influence type of development. To the degree that dwelling type can be changed by compact development in sub-state settings, the demographics and, consequently, the public service costs of development will change. The second is the ability of the development pattern to influence the intensity of development and geographic spread of new neighborhoods. If compact development can provide tighter development patterns, infrastructure provision will be less. So too will the annual debt service on capital costs for roads, water/sewer lines, and so on, as well as the annual costs of maintenance associated with these new facilities. The location where development takes place is also an important factor. If located near existing development, excess service capacity may be drawn upon. If development is skipped over, public service infrastructure will almost always have to be provided at costs greater than if existing facilities were extended.

If development is located near existing development, excess service capacity may be drawn upon.

Burchell's Impact Assessment of the New Jersey State Development and Redevelopment Plan (Burchell 1992a) employed a fiscal model to view the effects of trend versus planned development. The Rutgers fiscal impact model estimated the number of people, employees, and students that were generated under each of the development scenarios and projected their future costs and revenues to host public service jurisdictions. Although at the regional and state levels population and employment

projections did not vary between alternatives, at the municipal level the

### The Fiscal Impacts of Growth



Unplanned growth is believed to result in greater costs to municipalities.

Source: Michigan Department of Natural Resources.

differences were significant. In the compact development case, urban communities with slack service capacity received more growth than rural areas with lesser amounts of public service infrastructure. The reduced infrastructure provision and potentially reduced annual maintenance on this infrastructure led to diminished fiscal impacts for this alternative.

Burchell's study in New Jersey found that by containing population and jobs in already developed areas and by creating or expanding centers in newly developing areas, the State Plan offers an annual \$112 million [or 2 percent] fiscal advantage to municipalities. This advantage reflects the ability under plan to draw on usable excess operating capacity in already developed areas as well as efficiencies of service delivery. For instance, fewer lanemiles of local roads

TABLE 11
THE HIERARCHY OF LAND USES AND FISCAL IMPACTS

•	RESEARCH OFFICE PARKS	
	OFFICE PARKS	
	INDUSTRIAL DEVELOPMENT	
	High-Rise/Garden Apartments (Studio/1 Bedroom)	
	AGE-RESTRICTED HOUSING	
(+)	GARDEN CONDOMINIUMS (1-2 BEDROOMS)	
MUNICIPAL BREAK-EVEN	OPEN SPACE	
	RETAIL FACILITIES	
	Townhouses (2-3 Bedrooms)	
	Expensive SINGLE-FAMILY HOMES (3-4 BEDROOMS)	
	•	(+)
		SCHOOL DISTRICT BREAK-EVEN
	Townhouses (3-4 Bedrooms)	(-)
	INEXPENSIVE SINGLE-FAMILY HOMES (3-4 BEDROOMS)	
	GARDEN APARTMENTS (3+ BEDROOMS)	
	MOBILE HOMES (UNRESTRICTED AS TO OCCUPANCY LOCALLY)	

Note: The above list contains too many disclaimers to include here. Suffice it to say that specific fiscal impacts of a land use must always be viewed in the context of other land uses' impacts and within the fiscal parameters of the jurisdiction in which the land use is being developed.

Source: Burchell, Robert W., "Fiscal Impact Analysis: State of the Art and State of the Practice."

will have to be built under plan, thus saving municipal public works maintenance and debt service costs.

Public school districts will realize a \$286 million [or 2 percent] annual financial advantage under the State Plan, again a reflection of drawing on usable excess public school operating capacity and other service and fiscal efficiencies realized due to the redirection of population under the plan alternative. Thus, municipal and school district providers of public services could be ahead fiscally by close to \$400 million annually under plan compared to trend, while meeting similar population demands for public services.

Under trend, the state's school districts will have to provide 288,000 net pupil spaces to the year 2010 (365,000 gross need less 77,000 usable excess spaces); for plan, the net need is lower at 278,000 pupil spaces based on excess space available in central cities. Overall, if new space had to be built to accommodate net new students, costs of new school facilities would be approximately \$5.3 billion under trend and \$5.1 billion under plan. Thus, \$200 million (or approximately 3 percent) is potentially saved due to more excess capacity in closer-in areas being drawn upon by plan as opposed to lesser amounts of excess capacity available to trend in suburban and rural areas (Burchell 1992a).

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
is it strongly linked to sprawl?		x		

#### **Higher Aggregate Land Costs**

#### Allegation/Basis

Total land costs of urban settlements are higher under sprawl. This occurs even though the average price of land per acre may be lower, because a given total population occupies more suburban land than under higher density urban forms of growth.

#### Literature Synthesis

Most of the modeling efforts to date that involve prospective development futures have found that alternatives to "status quo" development patterns (i.e., sprawl), consume less overall land than the sprawl development pattern does. In New Jersey, Lexington (Kentucky), the Delaware Estuary, and Michigan, alternatives to sprawl consumed 20-40 percent less overall land (Burchell 1992-1997). In the San Francisco Bay area, alternatives to sprawl consumed 10-25 percent less overall land than did sprawl (Landis 1995). Thus, land consumed under sprawl has almost always been shown to be more than land consumed under compact growth patterns.

Further, in the Burchell (1992-1997) studies, because densities were increased to design levels under compact growth, housing costs decreased as a result of the reduction in land costs associated with this alternative. In other words, in situations where there were no growth restrictions, housing costs were higher

Land consumed under sprawl has almost always been shown to be more than land consumed under compact growth patterns.

under sprawl because land costs were higher. In the above four Burchell study locations, for example, housing costs under sprawl development were more due to the land component of these costs. This was true because under compact development, the majority of development taking place closer-in was subject to density increases of 10 to 30 percent. Total land costs of urban settlements have been found to be generally higher under the sprawl alternative.

(See also Land/Natural Habitat Preservation—Negative Impacts).

#### Literature Synthesis Matrix

·	+2 General Agreement	+1 Same Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		·
is it strongly linked to sprawl?		×		

### SPRAWL'S ALLEGED POSITIVE IMPACTS

#### **Lower Public Operating Costs**

Allegation/Basis

Local and school district operating costs are lower under sprawl development because service demands and the costs of meeting these demands increase with higher densities (compact development).

#### Literature Synthesis

Gordon and Richardson express this argument, citing the research of Ladd:

Ladd (1992) argued that except within a range of very low densities, per capita public service costs for traffic management, waste collection and disposal, and crime control, increase with higher densities. (Gordon and Richardson 1997a, 99)

Again, this is the type of research that has not standardized for the quality and quantity of public services delivered in jurisdictions of varying densities.

Nonetheless, the above research indicates that without taking into account what services are delivered or who delivers them in a service district—operating costs, whatever they are comprised of, appear to be less in jurisdictions of low density than in jurisdictions of high density.

Operating costs appear to be less in jurisdictions of low density than in jurisdictions of high density.

However, comparisons of operating costs are usually made between locations of rural-suburban (1 to 3 units per acre) density and those of urban density (16 to 30 or more units per acre). These studies may well be measuring the differences in range and complexity of public services delivered in densely populated urban areas versus rural-suburban areas, where the public services delivered are very limited and much simpler.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?			х	

# Less Expensive Private Residential and Nonresidential Development Costs

Allegation/Basis

Sprawl has lower housing costs because it does not limit the amount of development. Many managed approaches to growth seek also to control growth. Various forms of growth control limit housing production and drive up the costs of housing.

#### Literature Synthesis

Does the overlay of regulations inherent in managed growth drive up the cost of housing? A number of studies reveal that in the immediate area where growth restrictions exist, housing prices increase (Fischel 1990). Schwartz, Hansen, and Green (1981) followed the effects over time of the Petaluma (California) Plan which severely limited building permits, favoring dwellings with costly design features and developer-provided amenities and services to the community. Using a statistical (i.e., hedonic) pricing technique. the authors compared the price of a standard bundle of housing characteristics to the corresponding price in nearby Santa Rosa, which had not adopted growth controls during the period. The authors found that after several years. Petaluma's housing prices had risen 8 percent above those of Santa Rosa.

Schwartz, Zorn, and Hansen (1989) did a similar study of the growth controls in Davis, California, comparing house prices in Davis to those in a sample of other Sacramento suburbs. They found that growth controls caused house prices in Davis to be nine percent higher in 1980 than they would have been without them.

In Petaluma (Schwartz, Hansen, and Green 1981) and in Davis (Schwartz, Zorn, and Hansen 1989), the effects on the housing stock affordable to low- and moderate-income households relative to control areas were also monitored. In Petaluma, the authors found that the percentage of the housing stock that was affordable to low- and moderate-income households dropped significantly below that of a control group (Fischel 1990).

In Davis, on the other hand, growth controls required those who received building permits to construct some units earmarked for low-income occupants. Thus, the limited growth that did occur in Davis contained both low-income and high-income housing. According to Fischel (1990), however, an unanticipated offset to this apparent success occurred: the existing housing in Davis increased not only in price but in quality. Fischel's interpretation of this outcome was that older housing was filtering up rather than down.

Katz and Rosen (1987) analyzed 1,600 sales transactions of single-family houses during 1979 in 64 communities in the San Francisco Bay Area. Of these transactions, 179 involved houses located in communities where a building permit moratorium or binding rationing system had been recently, or was currently, in effect. According to Fischel (1990), this study is particularly valuable since, unlike the other California studies, it did not focus on just a single community. The authors found that the price of houses sold in the growth-controlled communities was higher than the price of houses sold in other communities. Where growth is controlled as opposed to managed, housing costs are higher.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?		x		

#### Fosters Efficient Development of "Leapfrogged" Areas

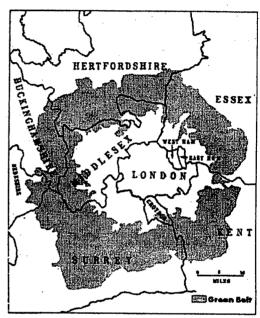
#### Allegation/Basis

Sprawl fosters efficient infill development. Sprawl permits appropriate, relatively high-density development of still vacant close-in sites late in the development period of a metropolitan area, without having either to demolish existing improvements on those sites at great cost, or to expend public funds buying such sites in advance and reserving them for later development. The "leapfrogging" aspect of sprawl leaves sizable tracts of land vacant and undeveloped. Parcels remain vacant long after the wave of current growth has passed them by. These parcels can be developed later as "infill" sites at relatively high densities, which are more appropriate to their more central locations. This process of deferred development is more efficient than first developing all peripheral land at low densities, and then tearing down the existing structures when the development market, reflecting the preferences of structure occupants, shifts to higher densities.

#### Literature Synthesis

This allegation is considered by Peiser (1984) and is also discussed by Altshuler and Gomez-Ibanez (1993). But it is often a highly neglected component of the analysis of infrastructure costs related to sprawl. Just as there are those who call for full costing methods to expand and

account for the costs of sprawl to the private sector and to society as a whole, there are also those who believe that the secondary benefits of sprawl (i.e., its lagged infill economies) must be adequately tabulated in any accounting scheme related to development alternatives.



Greenbelts provide open space for recreational uses and for future infill development.

Source: Cartographic Laboratory of the University of Wisconsin.

In an accounting system, the land areas that are skipped over and initially not used become relatively inexpensive to access and service secondarily. Further, the potential for using these skipped-over lands as inner-ring open space also becomes apparent. Only Altshuler and Gomez-Ibanez (1993) have begun to address these issues.

#### Literature Synthesis Matrix

	+2 General Agreement	+† Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?			Х	
Is it strongly linked to sprawl?			X	

#### **CHAPTER**



### Literature Synthesis

# TRANSPORTATION AND TRAVEL COSTS

Transportation is a discipline unto itself with a vast number of monographs, journals, and other publications devoted to it. The body of literature considered here includes key transportation studies relevant to the current investigation of the costs and benefits of sprawl. Many of these studies are not about sprawl per se but contain information on changes in travel over time, which are then associated with coterminous development (e.g., decentralized suburbanization) or characteristics linked to coterminous development (e.g., low density and segregation of land uses), which in turn are related to travel criteria. Costs of travel are considered as well.

The changes in travel studies report on such characteristics as the number of total trips, the number of trips by type (e.g., work versus nonwork), and commutation distances and time.

In addition to the study and deciphering of gross travel statistics, the transportation literature looks at characteristics that both define development type and affect travel behavior. Here again, the characteristic most studied is density, particularly how density affects trip length, mode choice, and other transportation decisions.

To a much lesser extent, land-use characteristics other than density are examined with respect to their travel influences. Some studies consider the effect of leapfrog development on commuting times; other studies view the effect of integration of land uses on walking for internal trips and enhanced transit use for external trips.

A final component of the transportation literature establishes baseline figures on the costs of travel. Numerous site-specific investigations concentrate on user, governmental, and societal costs of travel and how they vary by travel mode (e.g., auto, transit, walking); type of trip (e.g., work versus shopping); time (off-peak versus at-peak hours); the physical environment (higher- versus lower-density); and other factors (e.g., single-occupancy vehicle [SOV] versus high-occupancy vehicle [HOV] trips).

### Sprawl's Alleged Negative Impacts

More Vehicle Miles Traveled (VMT)
Longer Travel Times
More Automobile Trips
Higher Household Transportation
Spending
Less Cost-Efficient and Effective Transit
Higher Social Costs of Travel

#### **Sprawl's Alleged Positive Impacts**

Shorter Commuting Times
Less Congestion
Lower Governmental Costs for
Transportation
Automobiles Most Efficient Mode of
Transportation

### SPRAWL'S ALLEGED NEGATIVE IMPACTS

### More Vehicle Miles Traveled (VMT)

Allegation/Basis

Sprawl generates more total miles of vehicle travel than more compact forms of development. Sprawl generates more travel because the places where people live, work, shop, and play are spread over a larger total area. Vehicle miles of travel also increase because sprawl developments are designed so that virtually the only way to make most trips is by automobile.

#### Literature Synthesis

There is no question that vehicle miles of travel are increasing. Vincent et al. (1994) found that on an annual basis, person miles of travel increased by 19 percent between 1983 and 1990, and vehicle miles of travel (VMT) increased at the even faster rate of 37 percent. Ray et al. (1994)

found that the number and length of vehicle trips were increasing at an accelerating rate between 1977 and 1990.

Sprawl, which creates the longer travel distances and increases dependence on the automobile, is a major source of increased vehicle use.

The question is what proportion of the growth in VMT is due to sprawl versus other factors, such as a higher rate of women participating in the workforce, the baby boom generation being at the peak driving years, or rising incomes that allow every licensed driver in a household to own a car. Three factors have contributed about equally to the growth in VMTchanging demographics, growing dependence on the automobile, and longer travel distances (Dunphy et al. 1997). Thus, sprawl, which creates the longer travel distances and increases dependence on the automobile, is a major source of increased vehicle use.

Numerous studies have linked lower vehicle miles of travel with more compact mixed-use developments. In a 1990 analysis of the San Francisco Bay area and a 1994 study of 28 California communities, Holtzclaw found that residents of the denser neighborhoods drove fewer miles per year. In a second study, where Holtzclaw (1994) controlled for the levels of transit service and vehicle ownership, a doubling of residential densities was associated with 16 percent fewer vehicle miles of travel. Other research by Harvey (1990), 1000 Friends of Oregon (1996), and the Urban Land Institute (Dunphy et al. 1997) confirm that as densities increase, per capita vehicle miles of travel decline.

The interspersing of residents, employment, shopping, and other

functions can also reduce VMT, by allowing shorter trips and the use of non-vehicle modes. An empirical analysis by Frank and Pivo (1994) in the Puget Sound region and a simulation of the Trenton region undertaken in central New Jersey by the Middlesex, Somerset, Mercer Regional Council (1990) show that greater land-use mixes (with a higher jobshousing balance) decrease trip distances and automobile mode shares.

	ediamontalis	
	1983 1990 1995	183 95 % Change
Average Work Trip Length (Miles)	<b>6.5</b> 10.6 14.6	36:5
Average Work:7/avel Time (Minutes	18.2 19.7 20.7	213.Z
Average Work Trip		20
Speed (MPH)		

The daily commute length increased 36.5 percent from 1983 to 1995; the trend is continuing.

Source: Federal Highway Administration.

The segregation of uses and a leapfrog development pattern were both linked to increased travel in a recent Cervero (Cervero and Wu 1996) study of dispersed subcenters in the San Francisco Bay area. Between 1980 and 1990, the workers at these subcenters experienced a 23 percent increase in average commuting VMT. Cervero attributes 80 percent of the increase to longer distances between home and work.

Simulations of alternate growth patterns have also shown that sprawl development produces more VMT than more compact development. A simulation by Metro (1994) of growth in the Portland, Oregon metropolitan area compared a "Growing Out" scenario with new development continuing at current types and densities with a "Growing Up" scenario that kept all growth within the existing urban growth boundary by reducing lot sizes

and introducing more multifamily housing. Average daily VMT was estimated to be 15 percent higher in the "Growing Out" scenario than in "Growing Up."

Gordon and Richardson (1997a), however, do not agree that VMT would be reduced by more compact development. They contend that market forces embodied in sprawl may ultimately result in less VMT as households and businesses locate near one another. They further argue, based on Crane's (1996) theoretical analysis of travel on the grid street networks of neo-traditional development, that this neo-traditional, or compact, type of development may produce more VMT due to the ease of automobile travel. But Ewing (1997) points out that the demand for activities is relatively inelastic and residents of more compact, neo-traditional developments are unlikely to drive more simply because of better street design. A preponderance of evidence contradicts Gordon and Richardson's claim that sprawl is not a factor contributing to increased VMT.

Market forces embodied in sprawl may ultimately result in less VMT as households and businesses locate near one another.

Literature Synthesis Matrix

J	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	X			
Is it strongly linked to sprawl?	х			

#### **Longer Travel Times**

Allegation/Basis

Sprawl requires that more time be spent traveling than do more compact forms of development. The greater dispersion of activities in sprawl makes it necessary to spend more time traveling between activities than in more compact, mixeduse areas where trips are shorter and can serve multiple purposes. Workers in mixed-use settings can eat lunch or run errands at noon without using significant amounts of time for travel. Residents of compact neighborhoods can meet many of their needs at community shopping centers.

#### Literature Synthesis

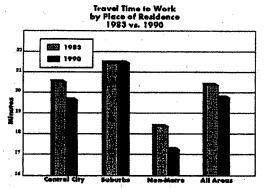
The evidence is mixed on the effects of sprawl on total travel times. Ewing (1995c) has shown that total travel time varies with regional accessibility. His Florida study found that residents of areas with high levels of access to a mix of uses including jobs, schools, shopping, and other services spent up to 40 minutes less per day in vehicular travel than residents. in less accessible neighborhoods. Time was saved by linking trips into tours and by making shorter trips. Dunphy et al. (1997), on the other hand, also report that according to surveys, people are willing to accept longer travel times to work and shopping in order to have the quality of housing they desire. Thus, the segregation of land uses and less expensive land at the periphery—two characteristics of sprawl—can increase travel times, whereas mixed-use developments, wherever they are located, appear to decrease travel times.

Others contend that travel times do not increase with sprawl because more trips are made by the automobile, the fastest mode of travel, and people and activities adjust over time to keep travel times relatively constant (Gordon and Richardson 1997a). A study by the European Conference of Ministers of Transport (1994) found that people in four cities with very different urban structures (Wismar, West Germany; Delft, The Netherlands; Zurich, Switzerland; and Perth, Australia) made about the same number of trips and spent about the same amount of time traveling even though modal shares differed significantly. The average time spent traveling ranged only from 62 to 69 minutes.

Purvis (1994) reported that travel time budgets remained fairly constant in the San Francisco Bay Area between 1960 and 1990. In the latest survey, the number of trips per person declined, but travel times remained constant because of the longer duration of trips. Purvis says the results are comparable to those in other metropolitan areas and consistent with the travel time budget studies of the 1970s and 1980s.

Residents of areas with high levels of access to a mix of uses including jobs, schools, shopping, and other services spent 40 minutes less per day in vehicular travel than residents of the least accessible neighborhoods.

Overall, the evidence is not clear about the relationship between sprawl and households' total travel times. On the one hand, some metropolitan-wide data suggest that people have fairly constant travel time budgets. On the other hand, a finer level of analysis indicates that the outward expansion of urban areas and the segregation of uses has boosted the amount of time some households spend traveling to their daily activities.



Suburban residents spend more time commuting to work than central city residents.

Source: Federal Highway Administration.

(See also Positive Impacts—Shorter Commuting Times, for a discussion of the mixed evidence on work trip duration under sprawl.)

#### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?			x	
Is it strongly linked to sprawl?			. <b>x</b>	

#### **More Automobile Trips**

#### Allegation/Basis

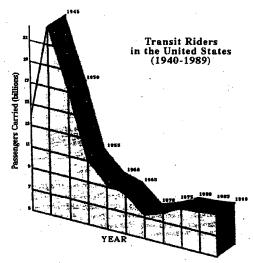
A greater share of trips are made by car and a lesser share by transit, walking, and bicycling in sprawled development than in more compact development. This assertion is almost true by definition since one of the defining characteristics of sprawl is that motor vehicles are the dominant mode of transportation. Sprawl, with its low densities and spatial segregation of uses, requires that virtually all trips be made by automobile, whereas residents of areas with higher densities and a greater mix of uses have the option of riding transit, biking, or walking.

#### Literature Synthesis

An extensive literature shows that when development is more compact and land uses are mixed, transit and walking mode shares rise and vehicle mode shares decline. Research for TCRP H-1 (Parsons Brinckerhoff 1996c) shows that residents of denser, more mixed-use neighborhoods were more likely to go by transit or to walk for all types of trips. Another part of this project showed that higher residential densities in rail corridors and higher employment densities in the CBDs increase rail use (Parsons Brinckerhoff 1996b).

Empirical research by Cervero (1986, 1989), Cervero and Gorham (1995), Dunphy and Fisher (1994), Frank and Pivo (1994), Handy (1992, 1995), Kenworthy and Newman (1993), and Kitamura et al. (1994) confirm that higher density, more pedestrian-friendly neighborhoods and employment centers support travel by non-automotive modes. Kenworthy and Newman compared the rates of growth in central, inner, and outer neighborhoods in the United States (where those with higher incomes move to the edge) and Australia (where those with lower incomes move to the edge) and found that automobile travel was growing rapidly in the outer areas of cities in both counties. Their conclusion:

It is clear that the level of automobile use is not simply a matter of how wealthy people are, but is also heavily dependent on the structure of the city and whether transport options are available other than the automobile. Thus as cities become more dispersed and lower in density towards the edges, the level of compulsory automobile use rises markedly, regardless of income level. (Kenworthy and Newman 1993, 12)



Transit ridership fell dramatically after World War II. The automobile accounts for the decline.

Source: American Public Transit Association,

Transit Fact Book 1990.

Even Gordon and Richardson (1997a, 99) agree that "...the spreading out of cities reduces markets for conventional public transit (especially fixed rail, which is spatially inflexible and usually oriented to downtown)..."

Residents of denser, mixed-use neighborhoods were more likely to use transit or to walk for all types of trips.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	No Clear	-2 Substantial Disagreement
Does this condition notably exist?	х			
Is it strongly linked to sprawl?	x			

## Higher Household Transportation Spending

#### Allegation/Basis

Households living in sprawl developments must spend higher fractions of their incomes for transportation. Households under sprawl spend more for transportation than those in higher density forms of development because the residents of sprawl areas travel greater distances and make more of their trips in automobiles.

#### Literature Synthesis

That household spending on transportation is higher under sprawl would appear to be a logical consequence of the greater miles of travel and more travel by the automobile. However, only a few studies directly address the issue of household costs for transportation under different development scenarios.

Holtzclaw (1994) concludes that residents of denser, more transit-friendly neighborhoods are able to spend a smaller share of their budgets on travel due to greater use of transit and walking. The impact is especially great if households can reduce their automobile ownership levels because of the viability of other modes of travel. However, it is unclear whether the lower transportation costs are a direct or indirect result of sprawl, due to the types of people who choose to live in the denser, more transit-friendly neighborhoods.

Residents of denser, more transitfriendly neighborhoods are able to spend a smaller share of their budgets on travel due to greater use of transit and walking.

The current literature suggests that sprawl has higher transportation costs, but more studies are needed to substantiate this conclusion.

#### Literature Synthesis Matrix

	+2 General Agreement	+} Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?			x	
Is it strongly linked to sprawl?			X .	

### Less Cost-Efficient and Effective Transit

Allegation/Basis

Sprawl reduces the cost-efficiency and effectiveness of transit service compared to more compact development. Transit service is not as efficient or effective in sprawl development because of the dispersion of origins and destinations. The higher ridership generated by denser developments improves the cost-efficiency (cost per vehicle mile) and effectiveness (passenger-miles per linemile) of transit.

#### Literature Synthesis

Research for TCRP H-1 has shown that the use of light rail and commuter rail increases when more people live in the rail corridor and work in the central business district. Because density boosts ridership, the cost per vehicle mile declines and the passenger-miles per linemile of transit increase. For example, consider a ten-mile light rail line serving a corridor with a medium residential density gradient and 100,000 employees in the CBD. If the residential density gradient were to increase by 1 to 4 persons per acre throughout the length of the line, the cost per vehicle mile would decline by about 5 percent and the effectiveness would increase by about 26 percent. Adding 50,000 jobs to the CBD and increasing employment densities would lower costs per vehicle mile by about 9 percent and

increase effectiveness by 44 percent (Parsons Brinckerhoff 1996b, 1996d).

Transit service is not as efficient or effective in sprawl development because of the dispersion of origins and destinations.

As the section in this report on More Automobile Trips also shows, higher densities support higher bus use. Pushkarev and Zupan (1977) and a number of other authors have identified thresholds at which transit use substantially increases. Frank and Pivo (1994), using data from the Puget Sound region, identify thresholds of 50 to 70 employees and 9 to 13 persons per gross acre for work trips and 75 employees and 18 persons per gross acre for shopping trips. Due to the increase in ridership at these densities, the cost-efficiency and effectiveness of transit service increases.



Most suburbs do not have the densities necessary to make effective use of mass transit. *Source:* Courtesy CUPR Press.

Of course, development patterns are not the only factor affecting the efficiency and effectiveness of transit. The level of transit use is also related to the quality of the transit service and the ease of access (i.e., walking environment, park-and-ride facilities). Costs are also related to wages and other aspects of transit operations.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			
Is it strongly linked to sprawl?		х		

#### **Higher Social Costs of Travel**

#### Allegation/Basis

Travel in sprawl development generates higher social costs than in more compact development. Social costs include air and water pollution, waste, barrier effects, noise, and the costs of parking and accidents that are not paid by the transportation user. Because more travel is by automobile in sprawled development, these cost rise.

#### Literature Synthesis

Various studies of the full costs of travel have found that social costs are highest per passenger mile for single-occupant vehicles, the dominant mode of travel under sprawl conditions. Studies using similar methods and location-specific data for Boulder, Colorado; Boston, Massachusetts; and Portland, Maine report that 16 to 17 percent of the costs per passenger mile for single-occupant vehicles (SOV) are social costs, whereas only 1 to 7 percent of the total costs for transit use and a negligible share of the costs for walking and bicycling are social costs (Apogee Research 1994; Parsons Brinckerhoff 1996a). Todd Litman's (1995) study estimating the national costs of travel reports that social costs represent a higher share of total costs due to different assumptions. He finds that 43 percent of the cost per passenger mile by SOV is a societal cost compared to 6 percent of the cost per passenger mile by transit.

Previous studies examined the social costs of travel from both a trip and a national perspective. The issue of whether the total costs of travel vary with the type of development, however, has not been studied systematically.

Various studies of the full cost of travel have found that social costs are highest per passenger mile for the single-occupant vehicle, the dominant mode of travel under sprawl conditions.

#### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?		х		

### SPRAWL'S ALLEGED POSITIVE IMPACTS

#### **Shorter Commuting Times**

#### Allegation/Basis

Commuting times are reduced in sprawl development, compared to those in more dense settings. The suburban-to-suburban commute, which characterizes sprawl, is shorter in time, if not in distance, than commuter trips between suburbs and central cities, due to higher speeds of travel. In addition, more trips are made by automobile, especially the single-occupant vehicle, the fastest and most direct mode of travel.

#### Literature Synthesis

Gordon and Richardson (1997a) argue that businesses follow people to the suburbs, thereby making trips to work shorter as measured in time, not in distance. The correction is not instantaneous, but over time, businesses move to suburban locations near workers, creating a new equilibrium with shorter work times. Although some people have longer trips, especially during the adjustment period, on average, commuting times have not increased due to sprawl.

Pisarski (1992a) found that average work trip times in the U.S. increased by only 40 seconds in the 1980s. Gordon, Richardson, and Jun (1991) and Levinson and Kumar (1994) found that work travel times remained stable over time in the core counties of the 20 largest metropolitan areas and in the Washington, D.C., metropolitan area, respectively. Dueker et al. (1983), Zimmer (1985), Gordon, Kumar, and Richardson (1989), and Dubin (1991) all found that the suburbanization of jobs has shortened commuting times, although not necessarily distances.

The suburbanization of jobs has shortened commuting times, although not necessarily distances.

But, there is contrary evidence. Vincent et al. (1994) analyzed the National Personal Transportation Survey Data for 1990 and found that commute times for residents of urbanized areas outside of central cities were longer than those for central city residents. The average peak period commute length for suburbanites was 21.6 minutes, compared to 18.9 minutes for central city residents. Likewise, the average length of off-peak commutes for suburbanites was 19.7 minutes compared to 17.2 minutes for central city residents. Pisarski (1992a) further reports that suburbanites had much greater increases in commute times between 1980 and 1990 than central city residents. The average travel time for suburban residents who commuted either to suburban or central

city locations increased by 14 percent over the period, while the average commute time for a central city resident increased by only 5 to 7 percent.

The extreme outward extension of urban areas may have also increased travel times. Davis (1993) found that the average commute of exurbanites in the Portland metropolitan area was seven minutes longer than that of suburbanites, holding constant occupations, household structure, and other factors affecting commuting times.

Commute times for residents of urbanized areas outside of central cities were longer than those of central city residents.

Thus, researchers have drawn substantially different conclusions, sometimes utilizing the same data sets. Most of their studies addressed issues other than the effects of sprawl versus compact development on commuting time, however, leaving the results unclear.

#### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?			X	
Is it strongly linked to sprawl?			X	

#### **Less Congestion**

#### Allegation/Basis

Sprawl reduces congestion by spreading trips out over more routes. Sprawl has improved travel by spreading out origins and destinations and utilizing the capacity of suburban roads and highways. The shift to suburban destinations has relieved traffic on the routes to the city center.

#### Literature Synthesis

Gordon and Richardson (1994c) claim that suburbanization has reduced congestion, citing the lack of growth in travel times. Specifically, they say:

[S]uburbanization has been the dominant and successful mechanism for reducing congestion. It has shifted road and highway demand to less congested routes and away from core areas. All of the available recent data from national surveys on self-reported trip lengths and/or durations corroborate this view. (Gordon and Richardson 1994c, 1)

They argue that, over time, people and firms make adjustments in their locations to keep travel times from growing. The spreading out of urban areas has kept congestion from overwhelming urban areas, as some have predicted.

Cervero (1986, 1989), however, found that congestion has followed jobs to the suburbs. Since jobs have moved to areas where there is little, if any, transit service, people have no choice but to drive to these jobs. This increase in traffic has used up all the available highway capacity near suburban activity centers, creating congestion in these areas. An index developed by the Texas Transportation Institute indicates that congestion (defined as the ratio of freeway and arterial VMT to capacity) worsened in 47 out of 50 major U.S. cities between 1982 and 1991. Two of the cities where congestion decreased, Houston and Phoenix, made sizable investments in highway capacity during the time period. This research points to a factor other than development pattern which contributes to congestion, namely, investment in transportation. In most areas, highway capacity additions have not kept pace with the growth in traffic, due to lack of funds, opposition to

road building, environmental regulations, and other factors (Dunphy et al. 1997).



Suburban office parks usually front wider, less congested roadways than their central city counterparts.

Source: Courtesy CUPR Press.

# Congestion worsened in 47 out of 50 major cities between 1982 and 1991.

Simulations also show that in addition to the pattern of development, roadway networks and capacity, congestion levels depend upon opportunities to use alternative transportation modes. The LUTRAQ analysis of alternate development patterns for a suburban county in the Portland, Oregon metropolitan area, for example, forecast the least congestion for a pattern of sprawled development with substantial investments in additional highway capacity and transportation demand reduction measures, such as pricing. Compact transit-oriented development focused on an expanded transit system, using the same transportation demand measures, had the second lowest levels of congestion. Building highways in sprawl development without controlling travel demand had higher levels of congestion than either of these two alternatives (1000 Friends of Oregon 1996).

Because researchers disagree about how to measure congestion, they also disagree about whether congestion is getting better or worse. Regardless, both sides agree that suburbanization is one of the major factors affecting congestion levels.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	O No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?			x	
ts it strongly linked to sprawl?	x	,		

## Lower Governmental Costs for Transportation

Allegation/Basis

Much of the cost of building and operating highways and streets, the dominant mode of travel under sprawl, is paid for by users, through gas taxes and licensing fees. In contrast, transit users pay a lower share of the costs of building and operating transit systems, especially rail systems. Thus sprawl, with its emphasis on highway investment, requires less subsidization of transportation systems even when governmental costs, such as highway patrols and publicly provided parking, are considered.

#### Literature Synthesis

Considerable disagreement exists about whether transit or automobile governmental subsidies are higher, as evidenced by the debate between Gordon and Richardson (1997a) and Ewing (1997). Although government subsidies are a visible part of transit budgets, there is much dissension about what constitutes a subsidy for highways. As Deluchi notes:

There is a good deal of argument about whether motor vehicle users "pay" fully for government-provided infrastructure and services (i.e., Lee 1994: Green 1995). This

disagreement, of course, results from different opinions about what should count as a public-sector cost of motor vehicle use, and what should count as a payment by motor vehicle users for motor vehicle use. (Deluchi 1996, 43)

There is a good deal of argument about whether motor vehicle users "pay" fully for government-provided infrastructure and services.

Most federal and state funding of highways derives from the gas taxes and registration fees that are dedicated to highways. However, as Hanson (1992) Litman (1995), and Dunphy (1997) point out, local governments finance a considerable share of road costs with property and sales taxes.

None of the costs of travel studies have analyzed whether governmental costs vary depending upon the type of development.

#### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?			x	
Is it strongly linked to sprawl?			х	

## **Automobiles Most Efficient Mode of Transportation**

Allegation/Basis

Automobiles are the most efficient mode of transportation in sprawl. The low-density, dispersed patterns of sprawl development were designed for automobile access and make the automobile the most efficient means of travel for many trips.

#### Literature Synthesis

An analysis of the total cost of travel for ten diverse, prototypical trips in Boulder, Colorado showed that the automobile is clearly the *least* costly means of travel for trips between dispersed, low-density destinations even when estimates of user, governmental, and social costs are totaled. Although the cost per passenger mile of the single-occupant automobile is higher than the cost of any other mode during peak times, automobiles are more efficient for many off-peak trips because they can take direct routes, are faster, and allow drivers to avoid waiting times. Getting to destinations that require bus transfers, taking trips that link many destinations, or taking trips involving more than one person are often most efficiently done in the automobile.



Only the automobile can offer the convenience of door-to-door transportation.

Source: Thomas Johnston, AIA. Courtesy American Planning Association.

#### Literature Synthesis Matrix

t.	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		x ·		
is it strongly linked to sprawl?	x			



### Literature Synthesis

# LAND/NATURAL HABITAT PRESERVATION

This subset of the literature includes, as a starting point, investigations about overall land consumption trends and the threats to such fragile lands as wetlands and prime agricultural acreage. Numerous studies deal specifically with how different development patterns affect land and natural habitat preservation.

Following this overview, the chapter examines the evidence on reduced farmland productivity and viability resulting from proximate suburban development. Do invading suburban land uses threaten cropland harvests, and does this phenomenon reduce the value of land for farming?

Finally, do skipped-over lands destroy the possibility of garnering meaningful regional open space, or does this pattern leave for future development land interstices that can be used for small-scale, community, or personal open space at a later period?

Because there is a view that Americans are wasteful in their use of land for development and that land savings are an "obvious" outcome of some forms of managed growth, there is less empirical

research that focuses on the topic of preservation and sprawl.

## Sprawl's Alleged Negative Impacts

Loss of Agricultural Land Reduced Farmland Productivity Reduced Farmland Viability Loss of Fragile Environmental Lands Reduced Regional Open Space

#### **Sprawl's Alleged Positive Impacts**

Enhanced Personal and Public Open Space

### SPRAWL'S ALLEGED NEGATIVE IMPACTS

#### Loss of Agricultural Land

Allegation/Basis

Sprawl removes more prime agricultural land from farming use than other more compact forms of development. Three reasons are usually cited. First, the low-density uses inherent in sprawl's

residential development patterns require more space for the direct placement of dwelling units than the higher-density uses under compact development. Second, the scatteration of dwelling units across the landscape far from the edges of built-up settlements renders the agricultural use of much of the land adjacent to the scattered dwellings inefficient and under intense development pressures. Third, the prospect of obtaining high prices for land motivates farmers and land speculators to assemble large parcels of farmland because these lands are contiguous and can be bought in bulk.

#### Literature Synthesis

Multiple studies have documented the significant loss of agricultural lands to the current development process. These studies range from national reviews of the loss of farmlands and farms over time, such as the National Agricultural Lands study (1981) and the American Farmland



Farms near metropolitan areas are increasingly facing intense development pressures.

Source: Peter Dunning. Courtesy American Farmland Trust.

Trust's Farming on the Edge (1994), to regional/state investigations of a similar type (i.e., Nelson [1992b] in Oregon and Adelaja et al. [1989] in New Jersey). There is substantial disagreement, however, about whether this loss of agricultural land has created significant social costs. To some observers, it appears that there is no shortage of prime

agricultural land in the United States, since the nation has often produced crop surpluses (Gordon and Richardson 1997a), and 2,000 of the 3,000 counties in the United States can still be counted as rural and undeveloped (Burchell and Shad 1997). Yet, demands for food are rising sharply as living standards increase in once-poor locations throughout the world. Prices of major agricultural crops have increased substantially in just the last few years. Hence, the argument is made that in the long run, the world will need all the food production capacity it can muster (Ewing 1997).

On the domestic front, there are widespread policy initiatives that seek to preserve farmland as much with the goal of maintaining a diverse economy as any other reason. Many states (e.g., Maryland, New Jersey, and Vermont) and other levels of government (e.g., Lancaster County, Pennsylvania) have adopted programs in recent years, ranging from the purchase of development rights to the enactment of "right to farm" laws, in order to foster land, particularly farmland, preservation (Nelson 1992b).

Numerous growth management plans attempting to reverse sprawl-include farmland preservation as an objective (Maine 1988; Vermont 1988; New Jersey 1991). They address preservation as a goal of planned development, not merely an attempt to curtail sprawl. The limited empirical investigations of sprawl's impact on "consuming" farmland—and in opposition, the impact of alternatives to sprawl on farmland—that have been done were performed by Burchell (1992-1997) in New Jersey, Lexington (Kentucky), the Delaware Estuary, Michigan, and South Carolina, and by Landis (1995) in the San Francisco Bay area. These analyses employed land consumption

models at the minor civil subdivision level to view differences between trend development or "business as usual" scenarios and more environmentally conscious land development approaches. The business-as-usual scenarios embodied sprawl-like characteristics; the latter, more compact, planned development characteristics. These models allowed future projections of households and jobs to be converted to the demand for residential and nonresidential structures, and ultimately to demand for residential and nonresidential land, with allowances for spillover to adjacent municipalities and to unincorporated areas.

In both the Burchell and Landis studies, historical rates of farmland takings were applied to land consumed under existing development patterns, and the goal of farmland retention was applied under the alternative development patterns. (A similar procedure was used for environmental land consumption comparisons.) In the Burchell studies, agricultural lands included such categories as cropland that is harvested, lands in permanent pasture, and woodlands that could be used for agricultural purposes. Fragile environmental lands encompassed floodplains and wetlands, acreage with steep slopes or with critical habitat designation, aquifer recharge areas, critical sensitive watersheds, and stream buffers (Burchell 1992-1997).

Numerous growth management plans include farmland preservation as an objective.

The models, employing different densities, development locations, and occasionally different housing types under the alternatives for future growth, calculated the total agricultural (and fragile environmental lands) that would be consumed. Burchell's results showed savings in the consumption of agricultural

acreage of roughly 20 percent in South Carolina, Michigan, and Lexington under plan versus trend development; savings of about 30 percent in the Delaware Estuary; and savings of 40 percent in New Jersey (Burchell 1992-1997). (See Tables 3 and 4 for details.) Landis's results in the San Francisco Bay Area were even more pronounced. His "scenario C" (compact growth) saved nearly 50% of farmland acreage and steep-sloped areas, and close to 100% of wetland areas (Landis 1995, 449).

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			
Is it strongly linked to sprawl?	х			

#### **Reduced Farmland Productivity**

Allegation/Basis

The productivity of land being farmed near scattered sprawl settlements is reduced by the difficulty of conducting efficient farming operations near residential subdivisions. Subdividing land into small lots for residential purposes inhibits farmers' ability to operate on large contiguous land parcels and thereby reduces the efficiency of mechanized agricultural operations. Furthermore, under sprawl development, subdivisions and farms may be interspersed, and residents often object to the odors, noise, truck traffic, and other local conditions associated with active agricultural uses. When this contiguous development occurs, local governments sometimes opt to impose restrictions on farming. These conditions bring about an "impermanence syndrome" that is antithetical to sustained farmland productivity.

#### Literature Synthesis

There is an extensive literature on constraints to farming in urbanizing locations (Lisansky 1986; Lopez et al. 1988; Nelson 1992b). In rural areas that can be readily developed, high land values often shift farmers' "objective function" from agricultural operations to capital gains from real estate sales. Real estate sales, in turn, reduce the average farm size, thus limiting the realization of economies of scale—a characteristic of U.S. agriculture. A variety of other restraints on farmland productivity have also been imposed, ranging from restrictive regulations to recurring vandalism. All of these factors generate an "impermanence syndrome"—a



Increasing numbers of farms have been sold and converted into sprawl development.

Source: Peter Dunning. Courtesy American Farmland Trust.

reluctance by the farmer to invest in new technology and farm infrastructure. Land remains idle, awaiting conversion to other uses. Studies involving sprawl development allege that this impermanence syndrome is deleterious to farmland productivity (AFT 1997).

The direct relationship of sprawl development patterns to farmland consumption was examined by Burchell (1992a) in the state of New Jersey. In addition to projecting the total farmland that would be lost under sprawl versus planned development, the New Jersey analysis identified the quality of farmland that would likely be consumed—"prime," "marginal," or "poor." The New Jersey

No analysis to date has examined how development pattern (i.e., sprawl versus compact) would affect the productivity of farmland that remains in agricultural use.

analysis showed that not only would continued sprawl development draw down more farmland, but since better quality farmland is the most amenable for development (in that it is flatter, drains better, and so on), the loss of farmland to sprawl would be concentrated in the "prime" and "marginal" categories. Farmland consumption under planned development would be less overall and wholly contained in the subprime or "poor" farmland category.

The Burchell (1992a) New Jersey study thus considered the association of farmland quality and development patterns—but only from a farmland consumption perspective. No analysis to date has examined how development pattern (i.e., sprawl versus compact) would affect the productivity of farmland that remains in agricultural use.

Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		X.		
Is it strongly linked to sprawl?			X	

## Reduced Farmland Viability (Water Constraints)

Allegation/Basis

Growth through sprawl causes great expansion in the demand for water for urban uses, and thereby reduces the amount of water available for agriculture. The reduction in available water is especially significant in the southwestern regions where sustained shortages of water exist. However, agriculture currently uses much more water than urban settlements in many states where farming depends upon irrigation, such as Arizona, California, Colorado, Oklahoma, and Texas. As urban settlements expand in these areas, more water will have to be diverted from agriculture to supply the basic human needs of the resident population. This diversion will restrict the operation of farming in such areas. Furthermore, single-family property owners and corporate commercial facilities often use vast amounts of water for lawn sprinkling, an excessive use of this natural resource that is needed for food production.

#### Literature Synthesis

Multiple studies have examined how development in more arid locations, especially in the West and Southwest United States, is drawing down the water supply, potentially in conflict with the irrigation needs of agriculture. The literature has not examined the specific association of sprawl and farmland viability with respect to water supply. This would involve a multi-linked analysis of:

- 1) how development affects water demand;
- whether development's consumption of water would differ under sprawl versus other forms of development in these areas; and

3) the relationship of steps (1) and (2) to the amount of water supply for agricultural and residential settlements in given locations, compared to the total supply available there.

Although a fully linked analysis such as the one described above has not been undertaken, some research has been undertaken on water demand relevant to steps (1) and (2). For instance, the Army Corps of Engineers incorporates in its water demand forecasting model, among other factors, the magnitude of lawn sprinkling, which is likely to be higher under sprawl versus compact development (Consultants 1980). The Hittman water demand model includes housing density as one factor—a variable clearly different under sprawl versus more compact development. In a similar vein, the multivariable IWR-Main water forecasting model (Baumann and Dziegielewski 1990) incorporates in its multiple coefficients development density and the number of housing units by type (detached versus attached)—variables that differ under sprawl versus compact development.



Development, both residential and nonresidential, demands more water than its agricultural predecessors and neighbors. *Source:* Courtesy CUPR Press.

The Burchell (1992a, 1992b) analysis of trend versus plan development in New Jersey considered how water demand influenced water consumption under

these two scenarios and incorporated some of the variables (i.e., housing type) noted above. Burchell found only small differences in water demand by development scenario; from 1990 to 2010, the increase in statewide water demand was projected to be 60.1 million gallons per day (MGPD) for trend, versus 58.0 MGPD for plan. This analysis did not, however, relate the 2-MGPD variation finding to the demands on water supply for residential development versus agricultural uses in New Jersey. Water supply is not a development-constraining issue in New Jersey—as it is in more arid regions of the United States.

#### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?			х	
is it strongly linked to sprawl?			х	

#### Loss of Fragile Environmental Lands

#### Allegation/Basis

More frail lands are destroyed by sprawl than by more compact settlement patterns. Because sprawl spreads urban development over a much larger area than more compact settlement patterns, it inherently consumes more land. Because land development under sprawl is not centrally planned or supervised, there is a greater probability that fragile environmental lands will be converted to residential and other uses. Local governments are likely to misjudge the consequences of environmental degradation because they are not concerned with the overall balance between environmentally sensitive lands and developing land uses in the region as a whole.

#### Literature Synthesis

Several studies document losses of, and threats to, fragile lands. Dahl (1990) estimates that since colonial times the United States (48 lower states) has lost about 110 million acres of wetlands—about 55 percent of the starting wetlands inventory. The Michigan Society of Planning Officials (MSPO) estimates that 20 percent of Michigan's forested, wetland, and steeply sloped areas was lost to development between 1970 and 1990 (MSPO 1995).

Numerous growth management plans attempting to reverse sprawl—have evaluated how managed versus traditional development patterns would affect fragile lands. These plans include the Orlando, Florida, Urban Area Growth Management Program (Orlando, FL 1981), the Evaluation of City of San Diego Growth Management Program (1978), and the Report of the Year 2020 Panel of Experts (Chesapeake Bay Executive Council 1988). The Orlando study examined how managed growth versus a "continuation of past trends" would affect the preservation of wetlands and flood plains. It projected a saving under managed growth of almost 20 percent in the inventory of these fragile environmental lands (i.e., 20 percent less acreage lost).

The Michigan Society of Planning Officials (MSPO) estimates that 20 percent of Michigan's forested, wetland, and steeply sloped areas were lost to development between 1970 and 1990.

Analyses of sprawl's impact on fragile lands have been conducted by Burchell (1992-1997) in New Jersey, Lexington (Kentucky), Delaware Estuary, and Michigan. Similar studies were also done by Landis in the San Francisco Bay area. Burchell found that plan (compact) versus

trend (sprawl-like) development would reduce consumption of fragile environmental lands by almost one-fifth.



Homes are being built on unsuitable and unsafe, but available and less-expensive lands.

Source: U.S. Department of Agriculture, Soil

Conservation Service.

The range of the saving was from 12 to 27 percent, depending on the starting level and location (see Tables 3 and 4). Landis found even larger land savings under his compact growth scenario. His findings were calculated separately for steep slopes and wetland areas (Landis 1995).

Literature Synthesis Matrix

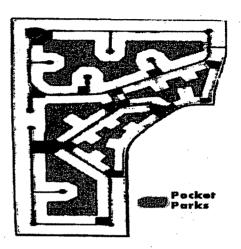
	+2 General Agreement	+1 Same Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	×			
Is it strongly linked to sprawl?	x			

#### Reduced Regional Open Space

#### Allegation/Basis

The setting aside of open space for public use by residents of an entire region may be "underfinanced" in sprawl-dominated areas, compared to those with more regionally oriented governance structures. Municipal governments, motivated by

fiscal pressures to provide benefits only for their own residents, may be unwilling to devote resources to creating facilities for use by persons throughout a region.



Many neighborhoods incorporate pocket parks, accessible only to their residents, instead of relying on regional open space.

Source: Florida Department of Community Affairs

#### Literature Synthesis

There is scant literature dealing with this issue explicitly; it is difficult to determine whether a substantial consensus exists. The only literature that does exist finds that very large-scale developments and conservation developments, both generally "nonsprawl" in nature, frequently have significant set-asides for contiguous open space. Most of the local ordinances of the 1970s and the new countywide community general development plans of the 1980s called for mandatory provisions of continuous open space as an alternative to traditional subdivision development (Burchell, Listokin, and Dolphin 1994).

Very large-scale developments and conservation developments, both often of a nonsprawl nature, frequently have significant setasides for contiguous open space.

Arendt (1994a) points to a movement away from golf course communities to open space communities that give the private and public sectors a greater chance to share in the land resources. The Sterling Forest Corporation, potential developers of a 17,500-acre site in Tuxedo, New York, pledged 75% of the land would remain as some form of private/public open space (Sterling Forest Corporation 1995). Much of the site was later bought by federal and state governments.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	x			
Is it strongly linked to sprawl?	х			

### SPRAWL'S ALLEGED POSITIVE IMPACTS

### **Enhanced Personal and Public Open Space**

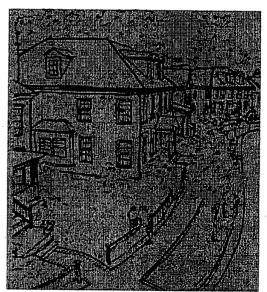
Allegation/Basis

- (a) Sprawl provides more open space directly accessible to individual households in the form of larger private yards attached to their dwellings than is possible via more compact forms of settlement. The average lot size in sprawl settlement patterns is much larger than in more compact forms of settlement, and a higher fraction of dwellings have individual yards. Therefore, more households have direct access to their own private open space, and the space is larger, on average, than the equivalent in more compact settlements.
- (b) Sprawl's leapfrog development provides both larger amounts of, and more accessible, open space without

significant public expenditures, by leaving large unsettled sites "inboard" of the farthestout urban subdivisions. This provides aesthetic and recreational benefits to the public without requiring use of taxpayers' funds.

#### Literature Synthesis

Personal open space continues to be high on the list of the desires of most Americans (Fannie Mae 1995). In surveys conducted by the Federal National Mortgage Agency, prospective home buyers want not only yards, but yards on all sides. In the mid-1990s, according to the most current surveys of buying preference, single-family detached housing was more popular than it was a decade ago. Much of the appeal is related to occupants' dislike of the instability or fee structure of condominium associations. But at least some of the appeal is related to the desire for more, rather than less, personal open space (Fannie Mae 1994).



Large yards on all sides of the house appeal to suburban home buyers.

Source: Copyright 1997. The Georgia Conservancy.
All rights reserved.

Although a potential for innercity/suburban open space appears to be the result of skipped-over lands, rarely does this happen in either developed or redeveloping neighborhoods.

A very limited literature indicates that the skipped-over development patterns of sprawl create parcels of land that can be used for inner-suburban or urban open space as this becomes a local priority. Except in the wealthiest and most resilient of inner suburbs, open space is almost never a choice or option of local government. Most governments in these localities are pressed for fiscal resources and dispose of these land parcels to the highest bidder. Thus, the opposite to what is popularly assumed to be a trend often takes place. Through the local variance process, the lands frequently are

given a higher intensity residential or nonresidential use designation. The abutting properties, rather than receiving permanently improved open space, are subject to more intensive and occasionally disruptive land uses, which can pay more in taxes than either existing neighboring uses or the previously undeveloped vacant land. Thus, although a potential for inner-city/suburban open space appears to be the result of skipped-over lands, rarely does new open space materialize in either developed or redeveloping neighborhoods (Downs 1994).

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		·
is it strongly linked to sprawl?			X,	

#### **CHAPTER**



### Literature Synthesis

### **QUALITY OF LIFE**

This subset of the literature, like the preceding subject areas, consists first of general investigations on the concept of "Quality of Life" (QOL) and how it can be measured, as well as specific studies that attribute both positive and negative QOL attributes to sprawl and its alternatives. As one would expect, there is no consensus on what QOL entails, so the review of the literature begins with numerous studies that grapple with defining the concept and monitoring its attributes.

While the vast majority of the literature on QOL deals generally with the overriding issue of what QOL is, a smaller number of studies focus specifically on the QOL—sprawl nexus. Some current studies add as a QOL critique that contemporary, singleuse residential subdivisions, accessible primarily by the automobile, have lost their sense of "place." Others indicate that traveling through the congestion and aesthetics of sprawl is stressful.

Yet another group of studies points to the fact that sprawl development consumes unnatural amounts of energy, contributes to regional air pollution, and lessens the regional and national resources that might be devoted to historic preservation, cultural infrastructure provision, and the like.

The chapter concludes with a discussion of the premise that low-density living is preferred by most of the population: Outer-metropolitan locations separate them from the problems of the poor, reduce the costs of housing and public services, and are the locus of the greatest appreciation of housing values.

## Sprawl's Alleged Negative Impacts

Aesthetically Displeasing Weakened Sense of Community Greater Stress Higher Energy Consumption More Air Pollution Lessened Historic Preservation

#### **Sprawl's Alleged Positive Impacts**

Preference for Low-Density Living
Lower Crime Rates
Enhanced Value or Reduced Costs of
Public and Private Goods
Fosters Greater Economic Well-Being

#### SPRAWL'S ALLEGED NEGATIVE IMPACTS

#### **Aesthetically Displeasing**

Allegation/Basis

Low-density patterns are less pleasing aesthetically and provide fewer cultural opportunities than high-density patterns. An important element of the quality of life of any community is the aesthetic and cultural satisfaction of its residents in daily life. If the environment they normally encounter is dominated by the homogeneous architecture of subdivisions and strip malls, the absence of quality civic spaces and landmark buildings, and a lack of pedestrian-scale amenities, the aesthetic satisfaction people derive from their surroundings is reduced. Moreover, sprawl does not easily lend itself to the formation of communities that have a feeling of cohesiveness and can organize to support the arts or other cultural institutions.

#### Literature Synthesis

The aesthetically less-pleasing aspects of sprawl, such as visual uniformity, are often cited as a cost of this form of development (Nelessen 1994). Critics of sprawl often decry its ugliness. For example, Shore (1995) maintains that "spread city" is inherently ugly because the settlement pattern has no clear form; retail businesses located along highways must use "raucous" signs to attract passing motorists; and a significant portion of the land is given over to the automobile. Diamond and Noonan (1996) find a growing portion of suburbanites faced with "real burdens on the texture, continuity, and depth of social life, as well as on the diversity, beauty, and health of the surrounding landscape."



Strip commercial development along heavily traveled routes is both unappealing and unsafe.

Source: George Hull and W. C. King. The Chattanooga Times, Chattanooga, TN.

Low-density developments, however, are not necessarily less-pleasing aesthetically than more compact forms of development. The aesthetics vary from development to development. Some lowdensity residential developments, particularly high-income ones, have much more open space and elaborate landscape designs than high-density residential areas. In fact, defenders of sprawl often contend that the individually owned, discrete open spaces of sprawl make it more attractive than compact forms of development.

Sprawl does not easily lend itself to the formation of communities that have a feeling of cohesiveness and can organize to support the arts or other cultural institutions.

The literature reflects these two conflicting opinions. There is little evidence within the literature, however, to suggest that Americans find sprawl less attractive than more compact forms of development or that low-density living provides them with fewer cultural opportunities. Visual preference surveys have been used to gauge the reaction of Americans to sprawl, although such studies are often criticized for failing to make a distinction between sprawl and factors not typically associated with that form of development (e.g., architectural design). Moreover, survey research does

not consistently indicate that Americans overwhelmingly find sprawl to be aesthetically less pleasing than compact forms of development. When shown images of both sprawl and traditional communities, some surveys have revealed that individuals favor the latter by a wide margin (Neuman 1991). But some aspects of sprawl appear to appeal to Americans. Individuals were found to favor homogeneous neighborhoods over mixed neighborhoods by a margin of two to one (Bookout 1992). Survey research in Florida has suggested that individuals there have a strong preference for lowdensity or exurban living (Audirac and Zifou 1989).

There is little evidence within the literature, however, to suggest that Americans find sprawl less attractive than more compact forms of development.

On the subject of cultural activities, Shore (1995) contends that sprawl does not allow for the formation of communities that easily organize to support activities such as the arts. As a result, low-density residential communities may have fewer and lower-quality cultural activities than urban areas. Shore argues that a movement away from "spread city" and toward the restoration of downtown areas would result in more cultural activities and other services that are typically supported by large communities.

In general, few argue with the belief that an attractive and aesthetically pleasing community increases the overall quality of life. Within the economics and migration literature, it has been well documented that a community viewed as having a high quality of life will attract and retain individuals. Studies of migration patterns find that a community's scenery, natural environment, and outdoor recreational opportunities are important factors in

attracting and retaining individuals. A survey study of migrants to and residents of 15 wilderness counties found that scenery and environmental quality were more important factors in attracting settlers than employment opportunities or cost of living (von Reichert and Rudzitis 1992). Two of the most important conditions that "lone eagles" (individuals who are able to live anywhere and telecommute to work) cited as influences on their decision to move to the state of Washington were the quality of the natural environment and the outdoor recreational opportunities found there (Salant et al. 1996). Cushing (1987) demonstrated that proximity to mountains and coastlines influenced population migration because of these natural resources' aesthetic qualities and the recreational opportunities that they provided. Empirical results indicated that interstate migrants were attracted to hilly terrain and major coastlines.

As noted, however, there is only some agreement about whether low-density developments are aesthetically lesspleasing than more compact development patterns. In particular, the literature fails to indicate a significant causal relationship between sprawl and aesthetically lesspleasing low-density development; there are numerous examples of unattractive higher-density inner suburbs in the Northeast and Midwest. What the literature does indicate, however, is that the aesthetics of low-density areas vary from place to place, and that the preferences of individuals vary from person to person.

#### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х	·	
is it strongly linked to sprawl?			х	

#### **Weakened Sense of Community**

Allegation/Basis

Low-density development weakens households' connections to both their immediate neighbors and to the larger metropolitan community, and encourages unsociable values. Sprawl weakens the linkages of residents—both among nearby neighbors, and among all other residents of their metropolitan area. Linkages with neighbors are reduced because low residential density, the heavy orientation toward car travel rather than foot travel. and the lack of neighborhood retail outlets and other meeting places diminish interpersonal contacts. Linkages with other residents throughout the metropolitan area are also diminished by the fragmentation of governance and fiscal resources that prevent commonality of purpose, and by the extreme diffusion of households and jobs throughout an area. The resultant loss of sense of community makes it difficult to generate support for region-wide attacks on social and other problems that cannot be solved by purely local policies and actions. Finally, because sprawl in its most pejorative manifestations is believed by most to be wasteful, unaesthetic, and antisocial, it does not nurture the important social values of ecology, sustainability, and community.

#### Literature Synthesis

Critics of sprawl often claim that a loss of "sense of community" is one of its greatest social costs (Ewing 1997). Defenders of low-density settlements, however, deny that residents experience any less "sense of community" than residents in big cities or more compact settlements (Gordon and Richardson 1997a). In fact, the evidence from as far back as 1954 (Herbert Gans as cited in Jacobs 1961) indicates that some dense

areas lack community while some suburban areas have it. Much of the controversy arises because "sense of community" is difficult to define and even more difficult to measure.

In his review of the literature on "sense of community," Cochrun (1994) finds that the term has been used to describe a number of disparate elements, but the most comprehensive definition was developed by McMillan and Chavis (1986). McMillan and Chavis identified four factors that contribute to a sense of community:

- 1) membership;
- 2) influence:
- integration and fulfillment of needs;
   and
- 4) shared emotional connection.

"Sense of community" is difficult to define and even more difficult to measure.

Cochrun offers a definition of "sense of community" that incorporates the four factors identified by McMillan and Chavis:

People who have a strong sense of community feel like they belong in their neighborhoods, they believe they exert some control over what happens in their neighborhoods while also feeling influenced by what happens in them, and they believe that their needs can be met through the collective capabilities of their neighborhoods. (Cochrun 1994, 93)

In Edge City: Life on the New Frontier, Garreau (1991) searches for a definition of community, particularly within edge cities, and reaches the conclusion that community and neighborhood no longer mean the same thing. Instead, Garreau maintains that "mobility" and "voluntary" are two important terms that help to define community—individuals want to

be able to both join and leave communities at their choosing. Moreover, Garreau contends that a community should be a "social grouping" that is readily available to individuals and does not interfere with individual freedoms.

In partial contradiction, Lemann (1989), in an article examining changes in suburban Illinois, found that community-building efforts in Naperville, a fast-growing suburb of Chicago, were hindered by the high rate of turnover of its residents.



Curved streets and mixed uses help to create a sense of community.

Source: Courtesy American Planning Association.

Critics of sprawl argue that residents in mixed-use neighborhoods have more sense of community and social interaction than do residents living in low-density developments because they are more likely to walk from place to place and, consequently, they are more likely to have contact and interaction with others. Residents in low-density areas, on the other hand, rely more on their cars for shopping and recreation trips and, hence, are less likely to develop contacts and friendships with neighbors (Nasar and Julian 1995). Drawing on the work of Glynn (1981), Nasar and Julian assessed the psychological sense of community across different neighborhoods and housing conditions in northwestern Columbus, Ohio. They found that residents of mixed-use areas had

significantly more sense of community than residents of single-use neighborhoods.

Opponents of sprawl also maintain that low-density development weakens a "sense of community" by segregating residents (Duany and Plater-Zyberk 1995; Kelbaugh 1993). According to Kelbaugh. suburban insularity breeds "ignorance, misunderstanding, and ultimately builds tension" among residents. Kelbaugh prefers high-density, mixed socioeconomic, racial, and ethnic neighborhoods because they allow individuals to "rub shoulders" with fellow residents on a daily basis and work out differences. Similarly, Duany and Plater-Zyberk contend that suburban housing fosters a breakdown of the larger community because it segregates residents by income into enclaves.

Kunstler (1996a) attacks suburban sprawl and the zoning laws that have created it. The allegation that low-density residential living lowers "sense of community" may be inferred from his remark that "The model of human habitat dictated by zoning is a formless, soulless, centerless, demoralizing mess. ... It corrupts and deadens our spirit." Like Duany and Plater-Zyberk (1995), Kunstler argues for development patterns that are mixed-use and provide housing for people with different incomes.

Sprawl may weaken not only neighborhood connections but also connections between family members who occupy the same residence. Some contend, for example, that sprawl reduces the amount of time parents spend with their children because more households must have two people working outside the home in order to pay for the multiple automobiles required by daily life. This need to

Some have argued that even if only one person working outside the home could support a one-car

support the household's transportation facilities may, in fact, even reduce the quality of child care provided by parents. Some contend that mothers working outside the home provide lower quality child care than those who stay at home. The subject is fraught with controversy (Joseph 1992). Meanwhile, Kelbaugh (1993) examines another potential noneconomic social cost associated with sprawl—the tensions that result from parents spending long hours commuting instead of with their children or each other.

Sprawl may weaken not only households' connections to neighbors and the larger community, but it may also weaken connections between family members who occupy the same residence.

The literature does not readily provide support for the opposite allegation—i.e., that low-density development strengthens households' connections to both their neighbors and larger community. Ewing suggests, however, that low-density development does not provide residents with any less "sense of community" than higher-density development. After reviewing extensive literature on sprawl, he concludes that there is not enough evidence to determine whether a lack of an identifiable community is associated with sprawl (Ewing 1994).

One further issue related to a lack of "sense of community" is the emergence of a "throw-away" mentality or, more elegantly, the lack of value for ecology and sustainable lifestyles. Some argue that sprawl encourages a "throw-away" mentality among households.

family, most residents of sprawl settlements need two cars for conducting daily family life. The lowdensity pattern of both housing and jobs makes use of public transit impractical for commuting and daily errandrunning. Sprawl development may be seen as a continuation of the "prairie psychology" of early American settlers who believed they could change their current situation by leaving existing homes and problems behind and moving west onto vacant land.

In a sense, sprawl development may be seen as a continuation of the "prairie psychology" of early American settlers who believed they could change their situation by leaving existing homes and problems behind and moving west onto vacant land (Delafons 1962). More recently, millions of American households have moved out of central cities and older inner-ring suburbs for the same reason to escape the problems of those areas. They have left the problems behind for others to solve. Few, if any, studies of sprawl have dealt with this issue, and none have proposed any way to measure the "throw-away" mind-set.

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?		х		

### **Greater Stress**

Allegation/Basis

Because people spend more time driving, they have less free time and more stress. This allegation has two components: first, that sprawl increases the time people spend in cars relative to higher-density forms of development and, second, that increased travel time leads to stress and other impacts. It has also been alleged that commuting through the aesthetically unattractive environments of commercial

strip development that are typical of sprawl produces more psychological stress on commuters than would commuting through environments dominated by trees and open space.

### Literature Synthesis

Here, as with many of the topics evaluated in this report, there is substantial overlap with other topics and their alleged effects. In this case, the overlap is with transportation effects, which include allegations about traffic congestion and travel times.

Much of the debate about commute time has been based on data that compare travel times for residents of suburbs and central cities. There is little data on travel times associated with density of development. Ewing (1997), in his analysis of household travel patterns in a sprawling Florida county, purports to show that households living in the most accessible areas spend about 40 minutes less per day traveling by vehicle than do households living in the least accessible locations (Ewing 1995c; Ewing et al. 1994). Ewing states that this savings in travel time is due almost entirely to shorter auto trips, and that the significant land-use variable affecting travel times is regional accessibility, not local density (Ewing 1997).

There is also evidence that greater commuting time increases the stress of commuters. Novaco et al. (1990) found that increased travel impedance, as measured by commuting distance and time, is associated with increased measures of stress. Travel impedance was also found to have statistically significant effects on job satisfaction, work absences due to illness, and overall incidence of colds or flu. Subjective or perceived conditions of travel impedance were found to have statistically significant

effects on mood at home in the evening and chest pain. Consequently, the study found that job change, in its sample, was primarily related to commuting satisfaction. The study validated results from the author's previous work, which had found that impedance characteristics of commuting raise stress levels, as measured by effects on blood pressure. tolerance for frustration, negative mood, and overall life satisfaction. This earlier work also found that the desire to change residence because of transportation conditions was related strongly to high impedance (Novaco et al. 1979; Stokols and Novaco 1981; Stokols et al. 1978). The physical stress effects of impedance have also been corroborated by a study of the effects of average commuting speed on blood pressure and frustration levels (Schaeffer et al. 1988).

Increased travel impedance, as measured by commuting distance and time, is associated with increased measures of stress.

Koslowsky and Krausz (1994) directly addressed the links among commuting time, stress, and workers' attitudes toward their jobs, in a statistical analysis of survey responses from more than 600 nurses. The researchers found that commuting is a possible source of recurrent stress, which can lead to undesirable organizational consequences. This study also found that the correlation between commuting time and stress was stronger for those who drove to work than for those who used public transit. But the authors do not rigorously explore the reasons for this difference. Koslowsky and Krausz do cite prior literature that found a relationship between the commuting experience and such organizational outcomes as absenteeism (Taylor and Pocock 1972), lateness (Gaffuri and Costa 1986), and turnover (Seyfarth and Bost 1986).

Although the link between commuting and stress is well established, the literature on the stress effects of commuting does not rigorously address the link between commuting stress and the density of development or urban form. Novaco et al. (1990) begin to address this link with their finding that stress effects are strongly associated with freeway travel and with road exchanges; they also assert that freeway travel in southern California has become increasingly congested because roadway capacity has not kept pace with continued growth.

Literature on the stress effects of commuting does not rigorously address the link between commuting stress and the density of development.

Although it has been alleged, as noted earlier, that commuting through the aesthetically unattractive commercial strip development typical of sprawl produces more psychological stress on commuters than does commuting through environments dominated by trees and open space, very little literature pertaining to this allegation exists. One study, however, claims to have tested commuters psychologically and arrived at a finding that supports this claim (Ulrich et al. 1991).

Other sections of this report comment in more detail on the evidence regarding sprawl and travel time. No conclusion is made here. The professional literature suggests, however, that commuting can be shown statistically to contribute to stress—a happy coincidence of science and common sense.

### Literature Synthesis Matrix

	42 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
is it strongly linked to sprawl?		х		

### **Higher Energy Consumption**

### Allegation/Basis

Under sprawl, society consumes more scarce energy, especially imported oil. Sprawl requires more travel overall and more of this travel is by energy-inefficient automobiles instead of more efficient modes of transit.

### Literature Synthesis

Ewing (1997) and many other researchers contend that the evidence consistently demonstrates that automobile use, and hence energy use, is higher with sprawl. Yet, Gordon and Richardson (1997a) are not convinced that the link between vehicle miles of travel, energy use, and density is firmly established.



Americans are among the heaviest consumers of energy in the world. Although oil is primarily imported, the government subsidizes and reduces the cost of gasoline.

Source: Anton Nelessen, Rutgers University, Urban Design Studio.

Coloring this argument are the differing perspectives on energy availability.

Gordon and Richardson (1997a) speak of an energy glut and an OPEC cartel that has lost its clout, while Ewing (1997) cautions that energy sources are not unlimited, and reliance on foreign energy supplies is a continuing concern for United States foreign policy.

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
is it strongly linked to sprawl?		х	,	

### **More Air Pollution**

### Allegation/Basis

Sprawl worsens the overall air pollution in a metropolitan area. Sprawl is alleged to generate more vehicle miles of travel than other forms of development and to produce more total vehicle emissions as a result. Under many local climatic conditions, this can generate a greater total amount of air pollution, even though it may result in less intense local pollution than would occur in some very highdensity portions of more compact regions.

Sprawl can generate a greater total amount of air pollution, even though it may result in less intense local pollution.

### Literature Synthesis

Most, but far from all, observers agree that low-density settlements generate more total automotive travel than more compact settlements, other things being equal (see prior discussion). Therefore, low-density settlements are presumed to generate more auto-oriented emissions per

100,000 residents. However, the intensity of air pollution in each metropolitan area is affected by many factors, including the locations of major urban centers, prevailing winds, mountain barriers, temperature inversions, and general climate. Hence, there is substantive disagreement whether sprawl is a key factor in determining the degree of air pollution in each metropolitan area.

There is substantive disagreement whether sprawl is a key factor in determining the degree of air pollution in each metropolitan area.

Burchell, in the Impact Assessment of the New Jersey State Development and Redevelopment Plan, found that air pollution would be very similarly reduced in the future under either sprawl or compact development scenarios (Burchell 1992a). Most of the reduction would be due to more stringent emission controls that would affect the entire motor vehicle fleet of New Jersey, as opposed to the region where this fleet would be replaced. In other words, development pattern, at least in this instance, did not significantly influence air pollution levels. (The New Jersey Impact Assessment also considered effects on water pollution under trend [sprawl] and plan [compact] conditions. Plan conditions were found to generate about one-third less water pollution than trend, although heavy metals in urban stormwater runoff were increased under the plan development scenario.)

### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?				x

### **Lessened Historic Preservation**

Allegation/Basis

Sprawl makes it difficult to preserve historically significant older structures. Sprawl encourages businesses and households to leave older cities and innerring suburbs by permitting them to move to the exurban areas without paying the full marginal costs of their doing so. Through publicly financed roads, water and sewer line extensions, and special tax benefits, taxpayers are often forced to subsidize sprawl-type development. Simultaneously, regulatory and policy barriers make it more difficult for developers to rehabilitate and revitalize existing communities. Therefore, the economic base supporting older structures of historical significance located in innercity neighborhoods is weakened. Neighborhood conditions in the vicinity of such structures also worsen because of the increased concentration of poverty; historic structures located there are eventually consumed by these forces.

Sprawl encourages businesses and households to leave older cities and inner-ring suburbs by permitting them to move to the exurban areas.

### Literature Synthesis

This allegation has been put forward mainly by the National Trust for Historic Preservation in its various publications attacking sprawl.

The following argument (Beaumont 1996a) summarizes the reasoning behind the professed association between sprawl and preservation. Beaumont is one of the few observers of sprawl who has commented on whether or not this association is valid.



As residents and businesses leave the urban areas, older buildings are often abandoned and begin to decay.

Source: Courtesy CUPR Press and HUD Photo Library.

According to Beaumont, sprawl affects historic preservation in five major ways:

- 1) Sprawl adversely affects older downtown areas and neighborhoods, where historic buildings are concentrated. When the economic vitality of a historic area suffers, the buildings in it often become underused or empty. Over time, many of them are "demolished by neglect" or torn down to make way for surface parking lots.
- 2) Sprawl destroys community character and the countryside. Cohesive main streets, old stone fences, historic trees, country roads—these and other features of the American landscape are rapidly being destroyed by sprawl development and the vast expanses of asphalt required to accommodate it.
- 3) Sprawl reduces opportunities for face-to-face interaction among people, thereby making it more difficult to create, or retain, a sense of community. By scattering the elements of a community across the landscape in a haphazard way, sprawl provides no town centers and reduces the sense of ownership—and therefore also the commitment—that people have toward their community.

- 4) Sprawl forecloses alternatives to the automobile as a means of transport, thereby adding to pressures to create or widen roads that often result in the demolition of historic resources or the degradation of their settings.
- 5) Sprawl leaves older cities and towns with excessively high concentrations of poor people with social problems, making these places a very difficult environment in which to revitalize communities. (Beaumont 1996a, 264)

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?			X	

## SPRAWL'S ALLEGED POSITIVE IMPACTS

### Preference for Low-Density Living

### Allegation/Basis

Many households prefer low-density residential living. Many consumer preference surveys reveal that a key part of the "American dream" is ownership of a detached, single-family home with attached private open space in the form of a backyard. More important than the stated preference, however, is the revealed preference: for the last 50 years, suburban development has been the primary form of metropolitan residential growth, and single-family housing units have been the dominant residential form. Consumers clearly choose low-density suburban living given existing alternatives and prices. Most housing developers consistently build low-density subdivisions because they are easier to market than higher-density developments.

In order to make this low-density single-family, detached housing affordable to most people, it is generally built at the urban fringe where land prices are lower (Downs 1994).

### Literature Synthesis

The suburbanization of population and jobs in the United States has been well documented. In 1950, almost 70 percent of the population of 168 metropolitan areas lived in central cities; by 1990 over 60 percent of the population of 320 metropolitan areas lived in the suburbs. and a majority of jobs in metropolitan areas were in the suburbs as well (Rusk 1993). The process of suburbanization has lowered average population densities in urban areas. Between 1950 and 1990, the number of residents in urbanized areas. with populations over one million in 1990, increased 92 percent, while average population density decreased 44 percent (Wendell Cox Consultancy 1996). The fact that so many Americans choose to live in low-density areas has been cited as strong evidence that Americans prefer that lifestyle.

The fact that so many Americans choose to live in low-density areas has been cited as strong evidence that Americans prefer that lifestyle.

People appear to be willing to pay for different land use and community forms. The most recent annual survey by Fannie Mae (1996) shows that homeownership is a top priority for 69 percent of Americans, and 73 percent desire a single-family detached house with a yard on all sides.

Another study that generated quality-oflife rankings for the fifty U.S. states over the period 1981-1990 found that sparsely populated, mountainous Western states such as Montana and Wyoming had a higher quality-of-life ranking than the more densely populated states in the East and Midwest (Gabriel et al. 1996). Urban congestion has been cited by "lone eagles" (individuals who are able to live anywhere and telecommute to work) as a factor influencing their decision to move (Salant et al. 1996).

A 1997 issue of the Journal of the American Planning Association (Winter 1997) has two articles dealing with sprawl that summarize many of these arguments. Gordon and Richardson (1997a) revisit several issues relevant to the compact cities discussion, including residential density preferences. They maintain that consumers, given the choice between lowdensity suburban living and high-density urban living, overwhelmingly choose the former: "But that suburbanization itself should be an object of attack is amazing, given the expressed preferences of the majority of Americans for suburban lifestyles and the supposed sanctity of consumer sovereignty." Drawing on the literature, they attempt to dispel the belief that the choice of low-density residential living is a constrained choice, strongly influenced by government policies that promote suburbanization, including subsidized automobile use and zoning laws that restrict high-density development. Gordon and Richardson argue that more subsidies per user are given to public transit than to auto travel; hence, government policies do not necessarily promote low-density living over highdensity living. In response to the argument that developers are prevented by zoning and land-use regulations from building at higher densities, Gordon and Richardson maintain that developers just offer what the market demands: "The risks of building an unacceptable product are very high, and builders are well aware of the strong consumer preference for the single-family detached home."



The single-family detached home, with garage, in the suburbs is the preferred housing type in America.

Source: Florida DCA.

Though Ewing (1997) agrees with Gordon and Richardson (1997a) that the recent choice of U.S. households has been for low-density suburban living over highdensity urban living, he contends that given a larger set of single family residential environments, consumers do not necessarily favor the former: "There is strong consumer preference for new single-family detached housing—a housing type concentrated in the suburbs. But most people could do without the rest of the suburban package" (Ewing 1997). Ewing maintains that compact development is capable of holding its own in the marketplace and cites evidence from the literature on consumer preferences. According to Ewing, the literature reveals several interesting facts:

- 1) The suburbs often rank below small towns, villages, and rural settings as a desirable place to live.
- Home buyers, given a choice, are evenly divided on whether they prefer low- or medium-density residential settings.
- Home buyers in high-priced housing markets often prefer small-lot houses.
- 4) The public, given a choice, is almost evenly divided on whether it prefers mixed- or single-use areas.

In his earlier study, "Characteristics, Causes, and Effects of Sprawl: A Literature Review," Ewing (1994) offered additional evidence to bolster his contention that consumer preference surveys do not clearly support low-density living over more compact forms of settlement. Surveys where people are shown images of both sprawl and traditional communities reveal that, for the most part, the latter are favored by wide margins (Neuman 1991). Some surveys, however, have found that people favor homogeneous neighborhoods over mixed-use neighborhoods by a margin of about two to one (Bookout 1992), and that people prefer low-density suburban or exurban living (Audirac and Zifou 1989).

Recent choice of U.S. households has been for low-density suburban living over high-density urban living.

Other surveys of consumer preferences have also shown mixed results. A September 1995 survey of people who shopped and ultimately bought units in planned communities indicated that 57 percent of the respondents agreed with the statement "I'm tired of living in the sterile uniformity of most suburbs." Yet, more than three-fourths of the respondents believed in the American dream of a big yard and a house set back from the street (Bradford 1996).

There may be something approaching universal agreement that U.S. residential patterns in metropolitan areas have become increasingly suburbanized (i.e., have lower density or sprawl). There is probably close to general agreement that many, if not a majority, of U.S. households prefer single-family detached housing given current options and prices—albeit observers raise the issue whether households would move in

significant numbers if other options were available.

Fifty-seven percent of the respondents agreed with the statement "I'm tired of living in the sterile uniformity of most suburbs." Yet, more than three-fourths of the respondents believed in the American dream of a big yard and a house set back from the street.

The question about whether sprawl is strongly linked to these residential choices is a matter of interpretation. At one extreme, the choice of low-density housing is, in essence, the definition of sprawl, so the question of whether it is caused by sprawl is a circular one. Another interpretation is that the mere existence of the pattern (sprawl) and its accompanying low-density housing influences people's preferences, like the advertising of any product.

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	O No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			
is it strongly linked to sprawl?		х		·

### **Lower Crime Rates**

### Allegation/Basis

Low-density development patterns have lower crime rates. Households move out of central cities to escape the high rates of crime encountered there. Relatively high crime rates are statistically associated with very low-income areas, especially within large cities. Such areas also often have much higher population densities than the neighborhoods typical of sprawl development.

### Literature Synthesis

Statistics appear to indicate that urban residents experience higher rates of crime than their suburban or rural counterparts. In 1994, the estimated rate (per 1.000) persons aged 12 and older) of personal victimization, which includes robbery, assault, rape, and personal theft, was highest for inhabitants of urban areas (67.6). Suburban areas experienced a rate of personal victimization of 51.8; rural areas had a rate of 39.8 (Pastore and Maguire 1996). Crime statistics released by the Federal Bureau of Investigation (FBI) for 1995 indicate that the Crime Index (comprised of selected violent and property offenses) was higher in Metropolitan Statistical Areas (MSAs) (5,761 per 100,000 inhabitants) than cities outside MSAs (5,315 per 100,000). Rural counties had the lowest index number— 2,083 per 100,000 inhabitants (Federal Bureau of Investigation 1996).

Research does not strongly indicate that the higher-density living commonly found in urban areas is associated with higher crime rates.

Other research, however, does not strongly indicate that the higher-density living commonly found in urban areas is associated with higher crime rates. Using 1974 census data, Newman and Kenworthy (1989a) correlate density with crime statistics for 26 major U.S. cities. Simple linear correlations suggest that there is no significant relationship between crime and density. Similarly, correlational studies within the environmental psychology literature find no consistent relationship between population density and social pathologies (Sherrod and Cohen 1979).

Several studies indicate that communities with high quality-of-life rankings exhibit low crime rates (Roback 1982, 1988). The amount of crime in a community may also affect migration patterns for both workers and firms. Salant et al. (1996) and von Reichert and Rudzitis (1992) found that the amount of crime was a factor that influenced individuals' decisions to migrate to a community that they perceived would provide a better quality of life.

Results from the Salant et al. study also indicated that individuals were attracted to locations that provided a safe place to live. A study using data from the 1983 Annual Housing Survey, however, found that few individuals moved to a particular neighborhood for greater safety (Spain 1988). The main reasons for moving that survey respondents reported were to find a less expensive place to live and to reduce their commuting times.

A study by Gottlieb (1995) concludes that firms in the high-tech sector are less willing to locate in areas characterized by high levels of violent crime.



Inner-city, high-density areas are believed by some to foster crime and decay. Source: Courtesy CUPR Press and HUD Photo

Other studies have found that perceptions of personal safety differ between residents of high-density urban areas and lowdensity suburban areas. A 1995 nationwide telephone survey of more than 1,400 adults attempted to discern how

safe individuals felt in their communities. When asked, "In the past year do you feel safer, not as safe, or about the same on the streets in your neighborhood?" 14 percent of suburban residents, compared to 22 percent of urban residents, felt less safe. On the other hand, 12 percent of urban residents, compared to 9 percent of suburban residents, felt their safety had increased over the past year (Pastore and Maguire 1996). Through interviews, Hummon (1990) determined that rural residents view danger as both an integral part of city life and an indicator of social problems. Urban residents, however, consider crime and danger to be more a factor of socioeconomic conditions and location than an integral part of city life. Using surveys of low-income, single mothers, Cook (1988) found that urban women were two times more likely than suburban women to indicate they felt unsafe in their apartments and neighborhoods.

A low crime rate is one of the top 10 quality-of-life characteristics desired by Money magazine subscribers,

Researchers within the criminal justice field conclude that perceptions of crime and security vary with site characteristics and socioeconomic conditions; thus, fear of crime does not always accurately reflect actual crime rates. Instead, fear of crime is often derived from incomplete knowledge of crime rates, observable evidence of disorder, and prejudices arising from neighborhood change (Skogan 1986). Other studies conclude that the direct effects of the physical environment on crime rates range from small to moderate (Taylor and Gottfredson 1986).

Within the popular literature, there appears to be agreement that crime reduces a community's overall quality of

life. Studies from popular literature commonly use crime as one measure of a community's desirability. Quality-of-life rankings of cities in the *Places Rated Almanac* (Savageau and Boyer 1993), *Money* magazine's "Best Places to Live in America" (Fried et al. 1996), and *Fortune* magazine's "Best Cities: Where the Living is Easy" (Precourt and Faircloth 1996), all include some measure of crime as a component of a community's overall quality of life. In particular, Fried et al. found that a low crime rate is one of the top 10 quality-of-life characteristics desired by *Money* magazine subscribers.

In short, selected crime statistics obtained from the Federal Bureau of Investigation indicate that lower-density developments. such as suburban and rural areas, have lower crime rates than high-density urban areas. Empirical studies that have examined the relationship between crime and density, however, have found mixed results—increased density does not necessarily result in higher crime rates. The mixed results may be a factor of how individual studies define and measure crime and crime rates. There appears to be agreement that suburban residents perceive themselves to be safer than their urban counterparts.

Although the literature appears to demonstrate, at best, correlation between density and crime, it does not demonstrate causality between sprawl and low crime rates. Studies have found that the effect of physical environment on crime rates ranges from minimal to moderate and that crime is more a factor of socioeconomic conditions than density. An argument might be made that sprawl reduces crime rates in a roundabout way—sprawl is correlated with higher incomes which, in turn, are often correlated with greater spending on home protection and public safety. This

argument, however, does not demonstrate that sprawl causes lower crime rates.

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?			х	

# Enhanced Value or Reduced Costs of Public and Private Goods

### Allegation/Basis

Many households find the cost of public services and some private services in suburban locations a better value. For the public sector, suburban locations often provide better services (especially schools) for an equivalent or lower tax burden. For private-sector goods and services, particularly retail sales, the lower land values in suburban areas allow land-intensive development formats, which include expansive ("big box") floor space and parking. These development formats, in turn, attract high-volume, low-cost retailers.

### Literature Synthesis

The alleged benefit for *public* services substantially overlaps the alleged benefits reviewed under the heading Social Issues in this literature review. Two of the alleged benefits discussed there are germane here:

1) The ability of jurisdictions to define a relatively homogeneous population with relatively similar service needs (which also provides opportunities for both economies of scale and concentration), and the ability to drop services not needed by the homogeneous population (i.e., social

- services for low-income households).
- 2) The ability to have different tax levels and service qualities.

There is an ongoing professional debate about the institutional structures by which public services are most efficiently and fairly provided, and a large body of literature on the subject. Not surprisingly, the poles of the debate are occupied by those who believe in the efficiency of markets and those who believe markets operate imperfectly without government intervention. In the 1950s, Tiebout (1956) laid out the basic arguments for market choice (which, when applied to government, is sometimes referred to as "public choice"). He argued in favor of multiple small governments that allow households to "vote with their feet," choosing to live where the combination of public services, quality, and cost best meet their preferences.

Multiple small governments allow households to "vote with their feet," choosing to live where the combination of public services, quality, and cost best meets their preferences.

In contrast are those who argue (see, for example, Foster [1996]) that typical market failures in the provision of public goods require larger units of government so that external costs can be internalized, increasing the odds that sufficient public goods will be provided. Arguments are made for the improvement of both efficiency and equity.

Because this topic is considered elsewhere in this report, it is merely alluded to here. There is certainly no agreement on this subject. Nor is any likely, since to come to a conclusion would require, among other things, agreement on two issues on which people's opinions derive as much from underlying philosophies as from the results of social science: 1) the proper scope of government intervention, and 2) the trade-offs between efficiency and equity.

For private goods, there is ample anecdotal evidence that big box retailers make their money by high volumes on low margins, which for consumers means low cost. The growth of these retailers (e.g., Wal-Mart, Home Depot, Costco) is evidence of demand and suggests that they are giving consumers more of what they want (Linneman 1995). Additional anecdotal evidence suggests that many people who would oppose such retailers in their neighborhoods are some of the same ones who drive, often substantial distances, to shop at these stores in other parts of a region.

The next question, however, is: To what extent are low-density development patterns essential for these cost savings? Recent work done to help evaluate the impacts of managed growth plans for metropolitan Portland, Oregon (ECONorthwest 1996) sheds some light on this issue. After quantifying vacant land supply, researchers conducted focus groups and work sessions with retail developers and brokers. Their opinion was that to satisfy today's consumers most retail development had to accommodate the automobile, and as a result, vacant, low-priced land in sizable parcels was critical to retail development, especially big box retail. High density areas are likely to have higher land values, less vacant land, smaller parcels, and more existing residents to oppose the new retail development.

A few central cities have seen new discount retailing. In most cases, however, the development has occurred on underutilized industrial parcels whose zoning either defines the retail uses as compatible or makes variances easy to receive. In these cases, low-value land is still the primary factor allowing the development to proceed.

Market failures in the provision of public goods require larger units of government so that external costs can be internalized.

There is reasonable evidence to conclude that people want goods at lower prices in lower-density parts of metropolitan areas. As with other effects, whether sprawl causes this effect is a matter of interpretation. On one hand, sprawl is the effect; the low-density retail pattern is what enables retailers to reduce prices. On the other hand, a pattern of sprawl may be causal if it implies more retail of the same type is desirable and allowable, and if it creates a pattern that allows more low-cost land to be developed more easily. Sprawl probably does both.

### Literature Synthesis Matrix

•	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
is it strongly linked to sprawit			х	

### Fosters Greater Economic Well-Being

Allegation/Basis

As an outcome of a free market, sprawl benefits from the market decisions made by individual households and firms to maximize their welfare (as measured by utility or profit). By restricting these individual choices, efforts to limit sprawl will reduce the overall standard of living.

A central tenet of free-market economics is that individual households and firms act in ways to maximize their welfare, and the result of these individual decisions is to maximize welfare for society as a whole. In this context, sprawl is considered to maximize welfare for society because it represents the outcome of individual choices by households and firms about where to locate and how to build homes and businesses.

Critics of free-market economics point out that decisions are based solely on the costs and benefits faced by the individual household or firm, and so do not consider the costs or benefits to others that may result from their decision (the costs and benefits to others are referred to as externalities). Critics of sprawl point out the negative externalities—traffic congestion, increased public infrastructure costs, and accelerated development of farmland and open space, for example and argue that these externalities reduce social welfare. Critics of sprawl often suggest policies to address the negative externalities of sprawl. It is the debate over these policies that the alleged impact on economic wellbeing is most often discussed.

There is also extensive debate about the level of negative externalities; whether these externalities are caused by sprawl, and the effectiveness of policies to address these externalities. This debate occasionally touches on whether the policies will affect the costs and benefits faced by individual households and firms.

A primary concern is whether policies to limit sprawl will increase the cost of housing—this impact is addressed elsewhere in this literature review. An argument that is also occasionally raised is whether policies to limit sprawl will in turn limit job growth in an area, thereby

reducing income for area residents and limiting economic development opportunities. These are the impacts that are focused upon in this section.

### Literature Synthesis

In the New Jersey impact assessment, Burchell (1992a) found that New Jersey could accommodate similar magnitudes of population and employment growth under both trend and plan development patterns. Distributional patterns would differ, however. Plan development would direct more jobs to urban and rural centers and fewer to suburban areas than trend.

Sheppard (1988) relates sprawl to the economic well-being of residents. Sheppard found that an increase in space available to a particular class of residents results in lower rents at all locations, increased "suburbanization" for all classes, and increased utility for all classes. Sheppard cautions the reader, however, that the results consider neither externalities nor the public good associated with the exercise of development controls.

Most authors argue simply that sprawl must maximize societal welfare because it results from free-market decisions (Gordon and Richardson 1997a). This obviously ignores the public contributions of both highway and arterial capacity. The benefits of sprawl that affect economic well-being are most often addressed in arguments against policies to limit sprawl. These arguments are based on the considerable literature that shows that increased density increases the cost of land. It is argued that an increase in density will reduce job growth and economic development opportunity by increasing the cost or limiting the number of sites available for commercial development, and by increasing the cost

of housing, which in turn will limit the supply of labor (ECONorthwest 1994).

# Growth controls raise housing prices in communities where they are established.

There is considerable evidence that measures to control growth cause the price of land to increase. Shilling et al. (1991) found that state land-use controls both restrict the supply and increase the demand for residential land, driving up its price. Brueckner (1990) cites a large empirical literature documenting the effects of growth controls on housing and land markets. His evidence points to the fact that growth controls raise housing prices in communities where they are established (Dowall and Landis 1982; Katz and Rosen 1987; Schwartz et al. 1981, 1989).

Most of the literature that addresses the impact of growth controls on land prices focuses on the residential land market. There appear to be very few articles that address the impact of sprawl, or measures to control sprawl, on commercial land markets, the level of employment growth, or wage income. While there are logical reasons to suspect that uninhibited growth fosters more employment and wage growth than limited growth, the literature does not document this at all.

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х	٠.	
Is it strongly linked to sprawl?		х		

### **CHAPTER**



### Literature Synthesis

## **SOCIAL ISSUES**

There are many social issues related to sprawl. Assembled for this review is literature focusing on how sprawl affects the places and the people that are not part of this phenomenon. This includes, as a starting point, studies on the "condition" or "health" of cities, especially relative to proximate suburban communities.

Examined next is a group of studies considering the historical development of suburbs with the recurring leitmotif of separation of, and exclusion from, the older urban center. Also considered are numerous recent studies that link the welfare of cities to the economic and social health of the overall metropolitan area and propose, in turn, that urban revitalization is futile without a closer integration of cities and their suburbs.

Conditions of cities and the interconnections between cities and suburbs are viewed in depth in this literature. Cities are considered not only as being important in their own right for retaining higher-order central place functions but are linked to suburbs as a necessary stabilizer of the overall metropolitan economy. In much of this literature, sprawl, which encourages

outward movement of population and functions from cities, is cast as a detriment both to cities and ultimately to suburbs as well.

But there is an alternative view. Cities are viewed in this literature as relics that have lost much of their purpose as population and employment have suburbanized. Yet, for the urban poor and minorities, there was hope in the form of zones of emergence (Sternlieb and Beaton 1972). These were the better areas of cities and inner-ring suburbs which, as their more mobile populations left for the more vigorous outer-ring suburbs, offered themselves as places for the disenfranchised to emerge.

This view is analogous to the concept of filtering in housing. Filtering provides housing to the poor in the form of modest units that are vacated over time as former occupants seek housing with more amenities. Similarly, more affordable inner-ring suburbs filter down to become, over time, the suburban zone of emergence for urbanites and minorities. In this view, an unrestrained ability to move to the suburban outer ring—one of the characteristics of sprawl—is essential

to allow inner-ring neighborhoods and communities to filter down, much as the ability to consume better housing is the linchpin on which housing filtering rests.

# Sprawl's Alleged Negative Impacts

Fosters Suburban Exclusion
Fosters Spatial Mismatch
Foster Residential Segregation
Worsens City Fiscal Stress
Worsens Inner-City Deterioration

### **Sprawl's Alleged Positive Impacts**

Fosters Localized Land Use Decisions Enhanced Municipal Diversity and Choice

# SPRAWL'S ALLEGED NEGATIVE EFFECTS

### **Fosters Suburban Exclusion**

Allegation/Basis

Suburban exclusionary zoning increases the concentration of low-income households in certain neighborhoods. Most low- and moderate-income households cannot afford to live in suburbs where exclusionary zoning raises housing costs; thus, such households become disproportionately concentrated within central cities and older inner-ring suburbs. Housing in many parts of these communities is generally older, smaller, more functionally obsolete, less wellmaintained, and much less costly to occupy than housing in newer suburbs. Moreover, subsidized housing units especially those in public housing projects—are heavily concentrated within older neighborhoods in central cities and inner-ring suburbs, because residents of other areas-including most suburbsrefuse to permit them within their

boundaries. This further concentrates very low-income households both within central cities and older suburbs, and within particular inner-city neighborhoods. The concentration of high proportions of very poor residents within older, deteriorated neighborhoods fosters conditions that are adverse to the welfare of residents. These include high rates of crime, drug abuse, delinquency, births out of wedlock, welfare dependency. unemployment, alcoholism, and mental illness. In addition, the quality of education received in public schools in these areas, or where children from such areas dominate, is very low.

### Literature Synthesis

There is some disagreement about the degree to which suburban exclusionary zoning is responsible for poverty concentrations in core-area neighborhoods. Some observers believe other factors are as important in producing such neighborhoods (Downs 1994). These other factors include negative behavior patterns among the residents that make them unwelcome elsewhere; the concentration of deteriorated, very lowcost housing in such neighborhoods which attracts people who cannot afford better accommodations; the concentration of public housing units in such neighborhoods; the lack of public transportation in suburban areas that makes it difficult for poor persons without cars to live there; and the desire of poor households to live together in neighborhoods where public services aiding the poor are more easily accessible.

In contradiction, recent findings in New Jersey from the New Jersey Council on Affordable Housing (COAH) and similar findings from the Gautreaux (Chicago) and Special Mobility Program (SMP) (Cincinnati) studies indicate that those who occupy affordable housing in more suburban locations take on the employment characteristics, ambition levels, and success rates of the population of those jurisdictions (Davis 1993; Fischer 1991; Wish and Eisdorfer 1996). In New Jersey, close to 15,000 affordable housing units have been built and occupied as a result of legislation emanating from the series of Mt. Laurel cases challenging exclusionary zoning practices in that state. Occupants of these housing units are employed, doing well at local schools, and integrated without incident in neighborhoods they would not have had access to without the court decisions.

The Gautreaux and Special Mobility Program studies show that residents moving from the central city to the suburbs using housing vouchers have higher rates of employment and higher salaries, and their children have better school attendance and higher grades, than families who choose not to move. While the confounding issue of self-selection is clearly present here—i.e., the successful and ambitious families are the ones that opted to participate in the moves—a growing body of literature indicates that "place" matters. There is a "rub-off" effect of place wherein success patterns can be communicated by residents to newcomers who specifically wish to improve their current economic and social positions (Poisman and Botein 1993).

### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?				х

### **Fosters Spatial Mismatch**

### Allegation/Basis

The resulting "spatial mismatch" between where most new jobs are being created (far-out suburbs) and where many lowskilled workers must live (inner-city neighborhoods) aggravates high rates of unemployment in inner-city neighborhoods. The unlimited extension of urbanized uses on the periphery of the metropolitan areas permits many employers to move to locations that are very far from inner-city neighborhoods. Consequently, unemployed workers living in those neighborhoods can neither readily learn about job opportunities in far-out locations nor afford to commute to such jobs even if they learn about and qualify for them. This mismatch aggravates both high rates of unemployment in inner-city neighborhoods and suburban shortages of unskilled labor.

### Literature Synthesis

Kain (1992) was one of the first to examine whether a mismatch exists between the increase in lower-skilled and otherwise attainable jobs in the suburbs and the high levels of unemployment of residents in central cities who should be able to access these jobs.

Spatial mismatch has also been examined by sociologists Kasarda (1990) and Wilson (1987) and by economists Ihlanfeldt and Sjoquist (1990). Although the original literature related the mismatch to black workers of all ages, later studies focused on the spatial mismatch as it affected young black workers. Race as the causative agent is the main focus of inquiry throughout most of the studies mentioned above. In other studies by Harrison (1974) and Kasarda (1990), causes of the mismatch (which according

to them may not be spatial) are extended to the inadequate skills and education of young black workers, and limited transportation or access to transportation. Findings on spatial mismatch, although not always consistent in unearthing a spatial component (see Harrison [1974], Ellwood [1986], and Leonard [1987]), are persistent in their specification of a mismatch of some type (Pugh 1998).



Poor inner-city residents often cannot reach jobs located in the suburbs.

Source: Bob Deammrich Photography.

The reality of this mismatch is a population desiring to be employed in one location and available jobs going unfilled in another. Often, the unfilled jobs are lower-order jobs that are not worth accessing by public transit if the prospective worker must also pay for child day care services to retain the job.

Other jobs similarly located in the suburbs may require skills that applicants, even after training, cannot meet. Or they may be jobs that casual workers available during the summer or during college breaks can easily meet without training.

The confluence of elements that create spatial mismatch is so complex that sprawl versus more compact development patterns probably play only a minor role. Spatial mismatch will grow to be a major issue with significant consequences as workfare replaces welfare. Moreover, the relationship between sprawl and central

city unemployment rates, the bottom-line issue of the above discussion, is even more complex than relationships between sprawl and spatial mismatch.

The confluence of elements that creates spatial mismatch is so complex that sprawl versus more compact development patterns probably play only a minor role.

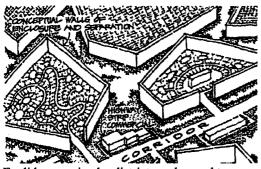
### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			
Is it strongly linked to sprawl?		x	,	

### **Fosters Residential Segregation**

### Allegation/Basis

Residential segregation by race and income is greater under sprawl than where less fragmented governance over land uses exists. While socially segregated neighborhoods certainly exist in cities. exclusionary zoning by many outlying suburban communities inhibits the construction of relatively low-cost housing for low- and moderate-income households, most of whom are minorities. This occurs because residents of each community control land-use decisions therein. They usually take into account only their own interests in making such decisions—not the interests of the region as a whole or of citizens in other parts of it (Freilich and Peshoff, 1997). They have compelling economic motives for trying to minimize the number of low-cost housing units within their own communities. These include maintaining housing prices as high as possible and excluding households



Euclidean zoning by district can be used to foster homogenous neighborhoods with residents of similar incomes, profiles, and backgrounds.

Source: Illustration by Roger Lewis in Growth

Management Handbook published by MSM

Regional Council.

whose need for public services—especially schools—will cost the community more than the taxes these households will contribute to the community (Fischel 1985). Because Blacks and Hispanics tend to have much lower incomes, on average, than other major groups in American society, such income segregation is also an effective means of achieving ethnic segregation in many areas.

### Literature Synthesis

There is only partial agreement about this allegation. Such a small number of metropolitan areas without fragmented governance over land uses exist in the United States that statistical testing of conditions in them versus conditions elsewhere probably are not valid.

Yet coming at this issue from another direction, those states and regions that have made overt efforts to provide affordable housing in locations where it has not before existed are achieving integration in those locations. In New Jersey, where a municipality must provide its fair share of affordable housing or lose its right to zone, racial and ethnic integration is taking place in what were once predominantly white outer-ring neighborhoods. New Jersey's affordable

housing program requires that those who fill municipal quotas come from outside the municipality's boundaries but inside its commuting region. There are strict advertising and queuing requirements that ensure that minority households in central cities have an equal chance to occupy affordable housing in the suburbs. With these kinds of mandates, integration of neighborhoods moves quickly and directly (Wish and Eisdorfer 1996).

Those states and regions that have made overt efforts to provide affordable housing in locations where it has not before existed are achieving integration in those locations.

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		!
is it strongly linked to sprawl?			х	

### **Worsens City Fiscal Stress**

### Allegation/Basis

Under sprawl, central city governments become fiscally strapped or "squeezed," because they must provide costly services to large numbers of very poor households, while the properties owned, occupied, or patronized by such households produce relatively low per capita tax revenues. Low-income neighborhoods in particular have higher costs of crime and fire prevention, street cleaning, and public health and welfare services than middle- and upper-income neighborhoods. Yet the former produce lower property and sales tax revenues per capita than the latter. This situation forces city governments serving such communities to either raise taxes above

those in surrounding communities or to provide lower quality and quantities of key public services to their residents, or both.

### Literature Synthesis

Only limited agreement exists on the extent to which sprawl is regarded as a major cause of fiscal stress. The concentration of very poor households within inner-city neighborhoods is surely not caused solely by suburban sprawl; many other causal factors largely unrelated to the specific form of growth within a metropolitan area also contribute to this result. Unfortunately, it is probably impossible to decide scientifically how to allocate "responsibility" for this outcome among these causal factors—a fact which presents an obstacle to "proving" that sprawl contributes significantly to this outcome.



As stores and offices move out, central cities must shift fiscal burdens onto those remaining. usually in the form of higher property taxes. Source: Teri Leigh.

The ability of households and employment to shift locations in a metropolitan area is virtually unrestrained. To the degree that households and employers seek safer and more aesthetically pleasing locations, even when these are found distant from the core, the households and employers will move there. If taxes are lower or tax incentives to relocate are offered, core-toperipheral relocation will also take place.

If high-income residential and nonresidential properties are either "footloose" locationally or are being bid out of central locations to more distant locations, only those households and employers who are not footloose or are not bid out will remain. These are often the poorer households and businesses, which demand higher services and provide less revenues. The end result is a strain on public service districts in the form of higher service costs and reduced revenue receipts. When this happens, property taxes rise—sparking another wave of residential and nonresidential exodus (Sternlieb and Burchell 1977).

Most of the central city fiscal deterioration forces described above, although largely independent of development patterns, certainly need the defining characteristics of sprawl to operate. Fragmented governments in competition with each other for the "better" land uses create fiscal stress for those governments that cannot compete (Downs 1994).

Most of the central city fiscal deterioration forces described above. while largely independent of development patterns, certainly need the defining characteristics of sprawl to operate.

(See also Public/Private Capital and Operating Costs—Negative Impacts— More Adverse Public Fiscal Impacts.)

Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		
Is it strongly linked to sprawl?		х		

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### **Worsens Inner-City Deterioration**

### Allegation/Basis

A self-aggravating downward spiral of negative conditions and the consequent withdrawal of viable resources occurs in inner-city neighborhoods, making them continually worse off. The presence of areas with deteriorating conditions in central cities tends to motivate many economically viable families and business firms to move elsewhere. The same conditions also discourage viable households and firms from moving into those cities in general, and into highpoverty neighborhoods in particular. As a result, the economic and social viability of the households and firms left residing in such communities deteriorates.

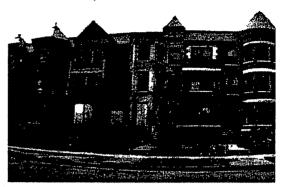
### Literature Synthesis

There is only some agreement on the extent to which sprawl is a major cause of this downward spiral. The concentration of very poor households within inner-city neighborhoods is obviously caused by other factors largely unrelated to the specific form of growth within a metropolitan area.

A study of residential abandonment in cities nationally (Sternlieb and Burchell 1977) investigated numerous causal relationships including:

- 1) other abandoned structures on the block
- 2) race of tenant and owner
- 3) commercial use of part of the property
- racial and economic characteristics of neighborhood and city.

The study found that the most significant causal relationship to central city abandonment was the amount of housing built outside the central city yet inside the city's metropolitan area (Sternlieb and Burchell 1977).



Row houses in Washington, D.C., lie decaying and empty as residents moved into surrounding suburbs.

Source: Ellis Herwig/Stock, Boston.

To the degree that significant amounts of housing are built farther out in the metropolitan area and the occupancy costs of this housing are comparable to, or cheaper than, existing housing, this new housing will be sought in preference to closer-in housing (Schafer 1975).

The most significant causal relationship to central city abandonment was the amount of housing built outside the central city.

Unfortunately, however, as with fiscal stress, it is probably impossible to decide scientifically how to allocate "responsibility" for this outcome among multiple causal factors.

(See also Quality of Life—Positive Impacts—Reduced Costs of Public and Private Goods).

### Literature Synthesis Matrix

	+2 General Agreement	+1 Some Agreement	0 No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?		х		,
Is it strongly linked to sprawl?		х		

# SPRAWL'S ALLEGED POSITIVE IMPACTS

# Fosters Localized Land Use Decisions

Allegation/Basis

Sprawl keeps government decisions about land use at the local level, where individual citizens have much more chance of influencing the results than they do where regional decision making predominates. Because sprawl involves fragmentation of government powers among many relatively small localities, it keeps land-use decision making closer to the people most directly affected by it. This satisfies the strong American desire for local sovereignty. Like-minded citizens can pass zoning and other regulations that exclude types of development from their communities they do not like. This in turn allows them to prevent "socially undesirable" influences in their neighborhoods and schools. Such negative influences include potentially dangerous households with characteristics markedly different from their own, as well as region-serving land uses with negative local spillovers, like airports or incinerators.

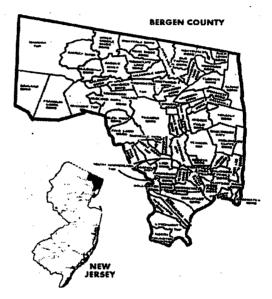
### Literature Synthesis

The literature dealing with the merit of local government praises its democratic responsiveness, as is illustrated in the following quotations:

Others came to suburbs for better schools. This has been due, at least in part, to the responsiveness of these schools to parental expectations, rooted in turn in the smaller size of many suburban school districts. Indeed, in an age primarily given over to state centralization, the suburbs have encouraged a countervailing

decentralization governance, forcing a healthy kind of competitiveness onto local governments. (Carlson 1996)

The trend in many places has been for cities to incorporate their surrounding suburbs, creating mega-jurisdictions without local identity and administrative nimbleness. This is a bad idea. Instead, cities ought to be breaking themselves into smaller political units that enjoy a degree of social consensus where governing can be done flexibly and with less impersonality. (Kotkin 1996)



The State of New Jersey alone has more than 500 independent municipal governments.

Source: New Jersey (State of), Statement of Financial Condition of Counties and Municipalities.

Obviously, the literature is divided on this point. One statistic beyond refute is that there is little growth in regional governments on a national basis, and although municipalities or counties may be willing to join together to distribute one or another carefully selected public services, they appear unwilling to join together for common governance. Further, on a national basis, the number of regional school districts currently desiring to split apart is greater than the

110

number of school districts currently desiring to join together (Petersen 1996).

### Literature Synthesis Matrix

	+2 General Agreement	+ Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			
Is it strongly linked to sprawl?		х		

# **Enhanced Municipal Diversity and Choice**

### Allegation/Basis

Sprawl provides citizens with a great variety of localities with differing tax levels, public service qualities, and housing costs, thereby increasing the range of choice available. The many individual localities in a metropolitan area function like suppliers of "bundles" of tax levels, public services, and local amenities in a market. Competition among them provides households with many more choices of living environments than would exist if all key fiscal and land-use decisions were made centrally and applied similarly throughout the metropolitan area. This process, first conceptualized by Tiebout, (1956) is widely praised by economists for bringing many of the virtues of a free market to the public sector, thereby benefiting potential residents of suburban communities.

### Literature Synthesis

There is reasonable agreement that housing costs, public services (primarily education), tax levels, and housing stock aesthetics of a community form the bundle of goods that is bid for in community selection. Within a metropolitan area, citizens have significant choices of communities, and

within a fragmented metropolitan area, they have even more choices.

Sprawl's contribution to diversity in choice is the mussive amount of reasonable alternatives (not best or worst) that it offers the locational consumer.

Those who "shop" for communities take all of the elements listed above into account before making a locational decision. Sprawl's contribution to diversity in choice is the massive amount of reasonable alternatives (not best or worst) that it offers the locational consumer. Some minor argument is found from those who contend that sprawl creates many similar communities, thus stifling diversity.

Fragmented governments, primarily supporting residential housing, offer infinite variations of the bundles of housing, public services, and tax structure described above. Most of the variations found at the periphery of metropolitan areas are superior in housing value, school systems, property tax levels, and housing amenities to locations found closer in. As such, these are the locations most often sought; the closer-in communities are the locations most often left behind. The most significant variables appear to be housing cost and housing appreciation, which in combination appear to be maximized in locations more distant from, as opposed to closer to, the urban core (Downs 1994).

### Literature Synthesis Matrix

	+2 General Agreement	Some Agreement	No Clear Outcome	-2 Substantial Disagreement
Does this condition notably exist?	х			
Is it strongly linked to sprawl?		х		

### **CHAPTER**



### Literature Synthesis

## OVERALL SUMMARY OF THE LITERATURE

This chapter is divided into two parts. The first part aggregates the information presented in chapters 3, 4, 5, 6, and 7. It attempts to detail how much of the sprawl literature is represented by a topic such as public and private capital and operating costs versus other topics like transportation and travel costs, land/natural habitat preservation, quality of life, social issues, and so on. The first portion of the chapter further details the share of the sprawl literature that employs a certain methodology or type of empirical analysis as well as how much of the literature relies on particular databases. Finally, it discusses inherent weaknesses in the sprawl literature.

The second part of the chapter links, in summary fashion, sprawl's defining characteristics to its potential impacts. This is done to determine which of sprawl's characteristics are most associated with positive and negative impacts. The upshot of this analysis is that the three most defining characteristics of sprawl—leapfrog development, lowdensity, and unlimited outward extension—are associated with both sprawl's negative and positive impacts.

### TOPICAL COVERAGE, DATABASES, METHODOLOGIES, DEFICIENCIES

### **Necessary Disclaimers**

One logical starting point for summarizing the literature and analysis of this chapter is to review the distribution of the studies by topic and determine where there is more or less topical coverage. This can be done quantitatively, that is, by examining bibliographies on the topic—such as the one assembled here (see References), or by Ewing (1997), Gordon and Richardson (1997a), or the Growth Management and Research Clearinghouse (1993).

An overview of the literature could also be made by tabulating the numerical distribution of studies by subject type. This procedure raises its own issues, however, such as bias in the respective bibliographies (i.e., those emphasizing studies critical versus supportive of sprawl) and differences that reflect the varying professional orientations of the bibliography compilers (i.e., traffic engineer or historic preservationist).

In doing a quantitative census of the literature and topical coverage of sprawl, there is also a question of how to count multiple studies by the same author of a similar type. Should the Altshuler criticism of The Costs of Sprawl methodology, originally enunciated in 1977 and then essentially repeated in a jointly authored monograph by Altshuler and Gomez-Ibanez (1993), count as one or two entries in this census? Should Downs's prolific publications involving the issue of suburban exclusion of minorities which in some cases cover similar materials be individually counted (Downs 1970, 1973, 1981, 1985, and 1994)? The same problem of counting arises with the parallel series of publications by Gordon and Richardson (1989a, 1994a, 1996, 1997a, 1997b), Ewing (1994, 1995a, 1997), and Burchell (1992a, 1992b, 1994, 1995, 1996, 1997a, 1997b).

Another issue in undertaking a numerical tally of the literature is whether all entries should be weighted similarly. Do *The Costs of Sprawl* (RERC 1974) and the New Jersey *Impact Assessment* (Burchell 1992a, 1992b)—both influential analyses of hundreds of pages each—"weigh" the same as briefer and less substantive discussions?

Over and above these questions, an attempt to quantify the topical coverage of the literature on sprawl is frustrated by such fundamental issues as what is meant by sprawl and what counts as literature on this subject. Often sprawl is not defined in the literature, and its full elemental characteristics are not universally agreed upon. Should the literature that is to be tabulated consist only of materials on sprawl per se (i.e., examinations of sprawl's effects on infrastructure costs), or should it include broader topics relevant to a discussion of sprawl? The quality of life (QOL) subset in this report is

illustrative; there is very little literature directly dealing with QOL and sprawl. But there are many more studies on QOL that show impacts on quality of life by forces analogous to sprawl.

Even though there are persistent problems, some general census of the approximately 500 citations in the references is required. Since more than a year has been spent assembling, categorizing, and analyzing the literature, clearly some statements can and should be made concerning its topical concentration and, as well, methods and databases relied upon.

In the following analysis, except for related materials such as dictionaries and encyclopedias; economics, land use, housing, and zoning texts; and so on, all of the remaining 475 citations are included and counted equally. Citations are made part of the analysis whether or not they repeat information of another study or deal directly or indirectly with sprawl.

### Topical Coverage— Sprawl Literature

Given equal weighting, the following approximate distribution of the sprawl literature appears as follows:

	Impact Category	Percent of the Literature
l.	Public and Private Capital and Operating Costs	≈ 20%
II.	Transportation and Travel Costs	≈ <b>25</b> %
131.	Land/Natural Habitat Preservation	≈ 10%
IV.	Quality of Life	≈ 20%
V.	Social Issues	≈ 25%

Without providing a detailed statistical count but clearly paralleling concentrations found in the references, the literature is almost evenly distributed between the "harder," more quantifiable categories: transportation/travel and public and private capital and operating costs; and the "softer," less quantifiable impact categories: quality of life and social issues. These two combined categories represent about 90 percent of the literature. Comprising the remaining 10 percent of literature is material dealing with either the loss of land or natural habitats related to sprawl, or growth management as an alternative to sprawl.

Clearly, then, both social and quality-oflife considerations are significantly part of the sprawl literature and are represented far more than these categories are usually given credit for.

### Methodologies— Sprawl Literature

There are differences in the analytic quality of the literature, as is indicated in the table at the bottom of this page.

In terms of analytic methods employed, transportation and travel costs have the most quantitative analyses (columns 2 and 3), followed by public and private capital and operating costs. In reverse fashion, land/natural habitat preservation and quality of life have the least quantitative and the most descriptive analyses (column 1).

The more rigorous quantitative simulations are found in *public and* private capital and operating cost studies, whereas transportation and travel costs studies rely most on the U.S. Census, the Nationwide Personal Transportation Survey and other empirical data. The social issues studies also rely heavily on national census-type empirical data.

Beyond this gross categorization, little can be said except that studies in the "harder" impact categories appear to address sprawl directly and by that term, whereas studies in the "softer" impact categories typically address sprawl indirectly as a form of low-density exurban or fringe-suburban development.

# Examples of Data Employed by Impact Category

The five impact literature categories into which this report is divided apply both common and subject-distinctive data sources. Across all categories, socioeconomic information from the decennial census (population and housing), the triennial *American Housing Survey* (AHS), and similarly broad databases are frequently tapped. Both published (e.g., printed census reports) and computerized (e.g., *Public Use Microdata Sample* of the decennial census) sources are accessed. Land-use information of

Impac	ct Category		Levels of Analy	sis
		(1)	(2)	(3)
		Descriptive: Little or No Analysis	Empirical: Census or Case Study	Simulation: Econometric or Modeling
l .	and Private Cap- Operating Costs	≈ 15%	≈ 50%	≈ 35%
II. Transpo Travel (	ortation and Costs	≈ 10%	≈ 80%	≈ 10%
III. Land/N Preserv	latural Habitat ation	≈ <b>4</b> 5%	≈ 35%	≈ 20%
IV. Quality	of Life	≈ <b>4</b> 0%	≈ 50%	≈ 10%
V. Social I	ssues	≈ 30%	≈ 60%	≈ 10%

various types is also employed across all literature categories. These include both descriptors of a gross or aggregate nature, such as population density derived from the *County and City Data Book*, and finergrained land-use information, such as the neighborhood mix of land uses and urban design features that are found as part of local records (e.g., zoning maps) and individualized study surveys.

Across categories, socioeconomic information from the decennial census (population and housing), the triennial American Housing Survey (AHS), and similar bases are frequently tapped.

Supplementing this common socioeconomic and land-use information are data specific to the five literature categories. For the public-private capital and operating costs category, an array of engineering-infrastructure as well as financial information is utilized. Examples include the Institute of Transportation Engineers' Recommended Guidelines for Subdivision Streets (1984); DeChiara and Koppelman's Manual of Housing Planning and Design Criteria (1975); the Urban Land Institute, National Association of Home Builders, and American Society of Civil Engineers' Residential Streets (1976); the quinquennial Census of Governments (1992); and individual operating budgets from municipalities, counties, and school districts.

The other literature categories draw, in parallel, on sources pertaining to their respective disciplines and interests. Examples include the Nationwide Personal Transportation Survey for transportation and travel costs; the Census of Agriculture for land/natural habitat preservation; such guides as the Places Rated Almanac (Savageau and Boyer 1993) for quality of life; and the

County and City Data Book and specific city distress measures from Bradbury et al. (1982) and Rusk (1993) for social issues that pertain to cities.

This overview cannot convey the variety and richness of the data sources that are tapped by the subsets of the literature. To provide some example of the depth and complexity of the data, the information accessed by just one of the categoriestransportation and travel costs—is described in detail here. This body of literature draws upon databases relating to travel as well as information on household and land-use characteristics. Travel sources typically relied on include, as noted, the Nationwide Personal Transportation Survey (Pisarski 1992a; Richardson and Gordon 1989, as examples); travel and commuting information from the decennial census and American Housing Survey (Gordon and Richardson 1993; Parsons Brinckerhoff 1996b); and a variety of other sources such as Highway Statistics (Dunphy and Fisher 1994), travel diaries kept by households being surveyed (Kitamura et al. 1994), and automobile odometer readings from California smog inspections (Holtzclaw 1994).

Household information such as that related to age, income, and occupation of residents is derived from the decennial census and the *American Housing Survey* (Gordon and Richardson 1989a; Parsons Brinckerhoff and ECONorthwest 1996; Pisarski 1992b). Household surveys may supplement/update the national and regional databases.

Land-use information comes from local planning and zoning records as well as from other sources. Gordon and Richardson (1989b), for instance, measured density from the U.S. Geological Survey LANDSAT files. The costs of travel studies incorporate a broad array of data sources on topics ranging from accident-related medical expenses, to armed forces spending (e.g., providing security for overseas petroleum sources), to global warming.

One final note: Much of the data in the sprawl literature is of a secondary nature—that is, collected by one party and reanalyzed or cited by another. *The Costs of Sprawl* neighborhood prototype data originally assembled by RERC in the early- to mid-1970s (see Table 1), for example, is still being relied upon some two decades later by commentators on the subject of sprawl (Altshuler and Gomez-Ibanez 1993; Ewing 1997; Gordon and Richardson 1997a).

# **Examples of Methods Employed by Impact Category**

Multiple choices are available to the analyst when considering specific methods. As mentioned previously, one choice is empirical—that is, one that observes something tangible; another method is a simulation, wherein events are modeled rather than observed. Both types are found in the literature on sprawl, with the incidence varying by subject. In the public and private capital and operating costs literature, because development's effect on infrastructure is projected into the future, many studies are simulations. Among these simulation studies are The Costs of Sprawl (RERC 1974); Downing's (1977) capital extension supplement to RERC's original work; Peiser's (1984) analysis of infrastructure costs in a hypothetical large subdivision; and Burchell's (1992-1997) and Landis's (1995) analyses in New Jersey, the Delaware Estuary, Kentucky, and Michigan (Burchell) and California (Landis). Operating costs, including operating expenses per capita, are also simulated in these types of studies

(although not necessarily linked to development pattern); other financial parameters, such as tax rates and levels of intergovernmental revenues, receive similar treatment. Ladd's (1991) regression analyses relating density to per capita government operational spending, and the DuPage County (1991) regression of observed nonresidential development to observed tax rates, are good examples.

As noted earlier, because travel information is routinely studied and counted, much of the literature on transportation and travel costs is empirical. Examples include Pushkarev and Zupan's study (1977) linking density and transit use in 100 urbanized areas; Cervero's (1989) study examining density and modal choice in 57 "suburban employment centers"; and Parsons and ECONorthwest's (1996) study examining the effects of density, urban design, and mixed use on the demand for transit in various locations, ranging from 11 metropolitan areas to individual cities (Chicago and San Francisco). At the same time, the transportation and travel costs literature, reflecting the underlying discipline of transportation engineering with its modeling prowess, also incorporates some large-scale simulations, such as the 50-year simulation by Metro (1994), and Downs's (1992) Stuck in Traffic modeling.

The remaining literature categories (Land/Natural Habitat Preservation, Quality of Life, and Social Issues), though they apply some simulations, such as The Costs of Sprawl modeling of land consumption in alternative neighborhood prototypes, are largely a combination of empirical and descriptive analyses. The Green Index of locations (Hall and Kerr 1991) incorporates more than 250 quality-of-life indicators related to environmental quality (e.g., air and water pollution, and community and

workplace health statistics). The literature on urban decline focuses mainly on such observed characteristics as unemployment, housing loss, and tax base decline (Bradbury, Downs, and Small 1982).

Some of the empirical work tends to be microanalysis. The case study and per capita engineering studies are commonly used to describe what occurred at one or more locations. Examples of this format include Duncan's (1989) analysis of infrastructure costs in a number of Florida developments; Ewing's (1995b) analysis of household travel patterns in a Florida county; and Ewing, Haliyur and Page (1994) and Cambridge Systematics (1994) examinations of travel in Palm Beach County, Florida, and Los Angeles, California, respectively. Not coincidentally, most of the case analyses and per capita engineering studies are focused on locations experiencing rapid growth-often Sunbelt locations. In fact. so many of the investigations of travel profile as it relates to urban design have taken place in California, especially around San Francisco and Los Angeles, that questions about the replicability of the results observed to the rest of the country are beginning to be raised by the research community.

Descriptive analyses are found in significant numbers in the impact categories of land/natural habitat preservation, quality of life, and social issues. These analyses include Arendt's various (1994a, 1996, 1997) guides to developing with open space; Kunstler's (1993) description of urban and suburban neighborhoods; and Moe and Wilkie's (1997) prescription for improved metropolitan areas.

Various quantitative skills are incorporated in the literature. The per capita infrastructure studies, for instance,

are essentially arithmetic compilations: but higher-order applications are also found, especially within the transportation and travel costs analyses. These studies apply such statistical tests as analysis of variance—e.g., comparing travel behavior in auto-oriented versus transit-oriented neighborhoods (Handy 1995) and multivariate regression—e.g., using regression to show that much of the variation in transit use can be explained by density (Pushkarev and Zupan 1977). Even the most "statistical" of studies, however, are still cross-sectional. In the travel literature, for example, they show the correlation between current urban form (i.e., low to high densities, and segregated or mixed uses) and current travel behavior (i.e., mode choice or VMT). But they do not show how changes in urban form have influenced changes in travel choices. This is one of numerous deficiencies in the literature noted below.

### Limitations of the Literature on Sprawl

- 1. Almost no analyses of sprawl adequately define it. Surprisingly, the landmark study, The Costs of Sprawl (RERC 1974), did not define sprawl explicitly, and the omission of a definition has continued throughout the literature. Where sprawl is defined, or at least characterized, reference is often made to a limited number of traits such as low-density or leapfrog scattered development (Ewing 1997). Many studies, however, omit several other defining traits that cause many of the alleged negative impacts of sprawl, such as dependence on the automobile and fragmentation of governmental landuse authority. These are admittedly difficult to quantify.
- 2. Most analyses of sprawl focus too narrowly on only a few of its key

aspects. An adequate definition of sprawl must include the causal elements that underlie sprawl's many alleged negative impacts in order for subsequent analysis to respond to those impacts effectively. Therefore, a key part of this literature search is to specifically relate the negative and positive impacts of sprawl to their defining characteristics.

# Almost no analyses of sprawl adequately define it.

3. Other definitional cum measurement questions remain. Take, for instance, "density." Several studies focus on the density of a region and relate certain characteristics, such as travel behavior or infrastructure costs, to the region's density. However, densities vary widely within regions and the real question is: How does the density of the specific places where people live and work affect, say, their travel choices? The densities of these places may be substantially different from region-wide averages. For instance, Gordon and Richardson (1989b) use SMSAs as the unit of measurement in their analysis of densities and commuting times in 82 SMSAs. But is this meaningful, given that no SMSA has uniform density throughout? And at the SMSA level, perhaps density is a proxy for age of development, city size, or some other factor that affects travel behavior (i.e., transit use), as opposed to the variable density per se.

In parallel are problems with the definition and measurement of "segregation of uses." What is the definition of "uses"? At which geographical scale is separation or integration measured? Cervero (1996) found that the job-housing (JH) balance at the city level was not

significantly associated with the variation in external (to the community) commuting. Does this mean that land-use integration as reflected in the JH ratio does not affect travel behavior? Or does it mean that land-use integration really does affect travel behavior—but that the measure of land-use integration is lost when the JH is scaled at the community-wide, as opposed to a neighborhood, level?

Quality-of-life measures also pose a definitional conundrum, as do other seemingly easier-to-ascertain effects. Take, for instance, land consumption. Although it is a tautology that development consumes land, does a single-family home built on a 50-acre farm "consume" all of those 50 acres? If it consumes only a fraction, on what basis is that fraction apportioned?

- 4. Most critics of sprawl do not recognize that it provides substantial benefits to many households; hence. they do not take account of those benefits in their analyses. Several critics of sprawl, such as Kunstler (1993), engage in rhetorical exaggeration to emphasize their negative views of sprawl. They present only one side of the issue instead of a balanced descriptions. This polemical rhetoric cannot be classified as a scientific-or accurate—observation about the reality of American suburbs. Significant exaggeration is also employed by some defenders of sprawl, such as Gordon and Richardson (1997a).
- 5. Only a limited number of comprehensive empirical analyses have been undertaken. There is much discussion on sprawl but far fewer

- "facts" in the form of empirical, quantitative studies. The paucity of data is illustrated by the frequency of studies using "secondhand" or onceremoved information. A good example, as noted earlier, is the reanalysis of The Costs of Sprawl (RERC 1974) neighborhood and community prototypes some 20 to 30 vears after the fact by Altshuler and Gomez-Ibanez (1993). Frank's 1989 review and reorganization of prior studies conducted over three decades in his Costs of Alternative Development is yet another example. It is not that reanalysis or categorization per se is unimportanton the contrary, it can be quite valuable. Rather, these studies point to the dearth of new empirical research on sprawl. In a parallel vein is the tendency of the empirical research to be of a case study nature. Case studies provide valuable insight, but they are place-specific. The ability to generalize from them is quite limited.
- 6. Even when a quantitative analysis is attempted, the topical coverage is uneven, with much more attention paid to the "physical side" of infrastructure-transportation and land—and less attention paid to the service and social sides. The reason is simple; far more complete and reliable data are available for physical costs (e.g., development-generated costs for roads, water systems, and sewer systems) than for service costs. An engineering manual, for instance, can provide guidance to the cost per linear mile of road, but there is scant literature on how road mileage affects police patrolling costs. And there is an even larger gap in our knowledge of social costs. Discussions of sprawl's effects on quality of life are often superficial if not polemical; large gaps

- abound concerning sprawl's effects on cities. What is the true social cost of higher unemployment rates in innercity areas? What is the cost of the exclusion of low-income households from outlying suburbs—assuming such unemployment or exclusion is sprawl-related? Measuring these costs is extremely difficult. Nevertheless, some attempt must be made in order to include such costs in an overall analysis of sprawl.
- 7. Most discussions of sprawl focus almost entirely on new growth areas. This focus may result from the fact that sprawl itself occurs almost entirely in new-growth areas around the metropolitan periphery. True, recent discussions of sprawl, such as those described earlier by Downs (1994) and Rusk (1993), have begun to recognize that draining valuable resources away from close-in areas has serious negative impacts upon these areas and, therefore, upon society generally. No quantitative analyses of sprawl, however, have attempted to estimate the size of these social costs; most analyses simply ignore them conceptually.

Most discussions of sprawl focus almost entirely on new growth areas.

8. The extant literature also has a limited scope in its time frame of analysis—looking only at effects over a few years rather than a longer span. The concatenation of limited geographic scale (i.e., focusing only on newly developing areas) and limited time span may very well lead to an overestimation by the literature of the costs of leapfrog development, as noted below:

- Estimates probably overstate the added costs of leapfrog development in communities that expect continued growth and eventual infill development on the vacant land. Compared with the planned communities, the sprawl communities contain substantially more vacant land that is improved or semi-improved by some road and utility access. Developing improved vacant land in the future presumably would cost less than developing unimproved land. If infill development is expected, then a portion of the added costs of leapfrogging eventually will be recouped—the costs of sprawl would be the costs of supplying some infrastructure in advance of its eventual need and would be lower the more rapidly infill was expected. (Altshuler and Gomez-Ibanez 1993, 72)
- 9. Most commentators do not recognize that two types of fragmented governance—those over land uses and over fiscal resources—are fundamental causes of many of the most widely attacked results of sprawl. The main reason for this failing is that the analyses are not comprehensive enough. They focus on a few of the most obvious elements of sprawl and their consequences, rather than look at the entire relevant spectrum of elements and consequences. In addition, many observers hesitate to recommend changes in such fundamental American precepts as local control over land uses and separation of communities' fiscal resources. Several recent opponents of sprawl have recognized these connections quite explicitly, however, including Downs (1994), Richmond (1995), and Rusk (1993).

- 10. Most opponents of sprawl fail to describe feasible alternative forms of metropolitan settlement to remedy sprawl's alleged negative conditions. Like most social critics, they concentrate on describing what they dislike, not how to remove those faults in a realistic manner. Furthermore, the aspects of society they want to change are inextricably bound up with other fundamental elements—such as a lack of regional governments. The changes they call for might have many more widespread repercussions than their analyses recognize. Indeed, every critic's call to radically change social condition "X" implies the following conditions:
  - a) X is socially undesirable because it imposes unacceptable costs on some people.
  - b) Therefore, society should greatly alter or eliminate X in the future.
  - c) X resulted from forces that could have been channeled differently; it was not an inevitable outcome of irreversible or uncontrollable forces.
  - d) We know what those changeable forces are, and how to handle them differently to avoid X in the future.
  - e) It is politically feasible to adopt other methods of handling those forces.
  - f) We know what the disadvantages of using those other methods are, and how large the costs are, even if the disadvantages and costs are wholly unrelated to X.
  - g) The future benefits of eliminating, or substantially altering, X are significantly larger than the costs and disadvantages of using those other methods.

All critics of sprawl postulate conditions (a) and (b), but many stop there. Some proceed through conditions (c) and (d) as part of their prescriptions for change. But few deal with condition (e), and almost none address conditions (f) and (g)—which require the ability to measure both the costs and benefits of X and its elimination. Yet, realistic social analysis requires meeting all observable conditions.

Even the most detailed quantitative analyses of sprawl's costs tend to define only one alternative to it, and compare the costs of future development under just those two scenarios. That limitation is present. for example, in the series of analyses directed by Robert W. Burchell (1992-1997). Sprawl is a complex phenomenon containing multiple future development scenarios, not just two. Therefore, an adequate analysis of sprawl's costs compared to the costs of alternative forms of settlement must allow for more than two alternatives. Conversely, no analysis can be useful if it presents dozens or hundreds of alternatives as equally plausible. The best approach is to define three or more (but less than ten) major alternative settlement patterns and to conduct multiple sensitivity analyses concerning key elements in each of those patterns—a very comprehensive and expensive process.

11. The modeling of the analysis is often overly simplistic. The per capita engineering studies, for instance, relate capital/operating costs linearly to lane-miles of roads and related factors. But they have been criticized (rightly) for not incorporating any information on how costs can increase as thresholds of density increase, due

to congestion, public safety needs, and the like. Incorporating this dimension would increase the cost of compactness (Altshuler and Gomez-Ibanez 1993).

Comparisons of sprawl and its alternatives are also criticized for not sufficiently addressing the qualitative differences in housing amenity. Most analyses oversimplify the differences, alleging that the amenities are uniformly superior for the detached units that characterize sprawl (Gordon and Richardson 1997a; Windsor 1979).

### The modeling of the analysis is often overly simplistic.

The limited depth of many analyses also renders the associations that are drawn open to question. Inadequately specified models or controls are part of the problem. For instance, Newman and Kenworthy (1989a) applied only a single variable—urban density—to explain automobile use, whereas other factors are clearly involved. These two authors, in analyzing per capita automobile dependence, used gasoline consumption per capita as a proxy for automobile dependence. That equivalence is questionable, given the fact that many other factors, such as gas prices and fuel efficiency characteristics, affect per capita gasoline consumption. Holtzclaw (1990) related density to VMT without controlling for income levels or other household characteristics that influence VMT. Cervero's (1989) analysis of 57 suburban employment centers did not control for the centers' transit availability or the quality of the pedestrian environment. Similarly, the Cambridge Systematics (1994) study of suburban work sites did not

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control for these sites' level of transit service.

The difficulty in extrapolating the factors that influence these dynamics, and the difficulty in incorporating controls, are illustrated by the scholarly analyses of the effect of urban design. Many researchers are interested in whether neo-traditional design features (combined with a greater mix of uses) will result in travel behavior different from the pattern observed in typical suburban development. There has been too little experience with these new types of suburban development to answer the question. Therefore, studies look at older neighborhoods that have a more pedestrian-friendly environment and a finer-grain mix of uses. But it is not clear whether behavior of longstanding residents of older neighborhoods accurately predicts the behavior of residents of new neighborhoods, who in all likelihood are more accustomed to using cars.

Furthermore, the matched pairing of existing neighborhoods into "transit versus auto-oriented" or "traditional versus suburban" to test the effects of alternate design patterns on travel runs headlong into the practical difficulty of coming up with these pairings. Neighborhoods often don't slot neatly into those two polar categories. Even if this demarcation can be realized, variables other than overall design can affect the travel behavior equatione.g., resident income, occupation, and age. Matched pairing is a difficult exercise to accomplish, since design preferences and household profiles often interrelate.

The cross-sectional nature of many studies compound all these problems.

Infrastructure costs rise as development is effected in a sprawl pattern; thus, sprawl gets tagged with the heightened capital expenses. Clearly, however, many other factors. from rising income levels to changing amenity levels, are also at work (Altshuler and Gomez-Ibanez 1993). Gordon, Richardson, and Jun (1991) link decreasing commuting times to the suburban deconcentration of job and residences that has occurred at the same time. But does the former cause the latter, or is it merely coterminous? Similarly, Richardson and Gordon (1989) hypothesize that increases in nonwork trips are due to suburban decentralization. Again, this hypothesis could be true, or it could be unrelated to the spatial pattern and instead fostered by such influences as rising incomes, greater participation of women in the work force, and societal changes in leisure activities. In short, there is much peril attached to drawing conclusions from crosssectional research—precisely the kind of research that characterizes many sprawl studies.

The obverse of these deficiencies must be employed to guide future research. As detailed elsewhere, sprawl and its alternatives must be explicitly and formally defined. This effort can build from the literature. As noted in Section II. some of the more recent studies on sprawl have differentiated it from other types of development. In New Visions for Metropolitan America (1994), Anthony Downs defined sprawl as characterized by low-density, primarily single-family, development, with widespread reliance on filtering to provide low-income housing. Henry Richmond's Regionalism: Chicago as An American Region (1995), brought forth eight components of sprawl (listed

earlier). To Richmond's sound base, this literature review adds two more—(1) the commercial strip development described by Richard Moe (1995), and (2) a dependence on the filtering process to provide housing for low-income households as indicated by Downs (1994). Altogether, then, sprawl must be viewed as a form of urban development that contains most of the following ten elements:

- 1. Low residential density
- 2. Unlimited outward extension of new development
- 3. Spatial segregation of different types of land uses through zoning regulations
- 4. Leapfrog development
- 5. No centralized ownership of land or planning of development
- All transportation dominated by privately owned motor vehicles
- 7. Fragmentation of governance authority over land uses between many local governments
- 8. Great variances in the fiscal capacity of local governments because the revenue-raising capabilities of each are strongly tied to the property values and economic activities occurring within their own borders
- Widespread commercial strip development along major roadways
- Major reliance upon the filtering or "trickle-down" process to provide housing for low-income households.

The above definition both builds from the literature on sprawl and stands in marked contrast to the studies that either do not define sprawl or else characterize it too simply and/or pejoratively—e.g., as a "lack of continuity in expansion" (Clawson 1962); a "low-density ribbon or

leapfrog development" (Harvey and Clark 1965); or an "awkward spreading out of a community" (Abrams 1971).

This literature review underscores the need for a comprehensive look at the effects of sprawl. To this end, a full menu of benefits as well as costs of the different development scenarios must be considered. These benefits and costs must span the range of physical as well as social consequences. Furthermore, the benefits and costs analysis must be territorially complete—encompassing urban, suburban, and exurban locations as well as developing and developed areas. The span of analysis must also be long enough to encompass the dynamic of shifts over time, to show what happens. for example, to areas initially leapfrogged under sprawl that are subsequently "filled in" by development. The analysis of costs and benefits must further incorporate the complexity of influences e.g., the varying threshold influences of density on capitaloperating costs, and the recognition that varying density thresholds, as well as other factors, affect travel. Moreover, caution must be exercised so as to not ascribe causality when the underlying evidence is merely cross-sectional.

This literature review underscores the need for a comprehensive look at the effects of sprawl.

# ALLEGED NEGATIVE AND POSITIVE EFFECTS

# **Linking Sprawl's Defining Traits to Its Alleged Impacts**

With a detailed analysis of both the definition of sprawl (Section I) and its impacts (Section II), it now becomes possible to link the two. Tables 12 and 13

evaluate the linkages between sprawl's ten defining traits and its alleged 27 negative and 14 positive impacts. In each matrix, sprawl's defining traits are set forth from left to right as vertical columns. The impacts are set forth from top to bottom as horizontal rows, grouped into the five impact categories defined earlier.

Each cell in the matrix indicates a "score" that represents literature-influenced judgments concerning the degree of linkage of the defined trait (at the top of the column) to the specified impact (at the left of the row). The "scores" are reflected by the following symbols:

- + 2 Indicates that the trait has a major linkage to the alleged impact.
- + 1 Indicates that the trait has a moderate or minor linkage to the alleged impact.
- Indicates that the trait has no linkage to the alleged impact.
- Indicates that the trait has a negative linkage to the alleged impact; that is, the trait tends to reduce the incidence of the impact.

# The Importance of Sprawl's Defining Traits

Determining, in a rough manner, the relative linkage of a trait to its impacts can be achieved by examining the total scores of the trait in the matrix. For example, the column labeled "leapfrog development" in the negative impact matrix (see Table 12) contains sixteen "major linkage ratings," five "moderate or minor linkage ratings," and six "no linkage ratings." These sum to a total of 37 for this trait and rank it the most significant of all sprawl's traits. Similar observations, summations, and rankings have been carried out for the

other nine defining traits. Based on these calculations, three of sprawl's defining traits appear especially linked to negative impacts. These are leapfrog development, low density, and unlimited outward extension, each of which score in the thirties in terms of linkages. Two other traits—the spatial segregation of land uses and variance in local fiscal capacity—both scoring 10, seem to exhibit relatively weak linkages. Among the remaining traits, widespread commercial strip development, highly fragmented land use governance, and no central ownership or planning (scoring in the low twenties or high teens), seem somewhat more strongly linked than transport dominance by motor vehicles or reliance on filtering for low-income housing (both scoring 15).

### Negative Impacts of Sprawl

Some individual sprawl traits, more so than others, negatively affect the five potential impact areas (public and private capital and operating costs, transportation and travel costs, land/natural habitat preservation, quality of life, and social issues). For instance, leapfrog development, low density, and unlimited outward extension negatively affect public and private capital and operating costs (because residential development and nonresidential development are distant from the core and from each other, and thus are difficult to service).

Following the above, transportation and travel costs are negatively impacted by the same three traits plus transport dominance by motor vehicles, and widespread strip development (again, because development is distant, spread out, and expensive to access).

# LINKAGES BETWEEN CHARACTERISTICS OF SPRAWL AND ITS NEGATIVE EFFECTS

				DEEIN	DEEINING CHABACTEBISTICS	TEDIETICE	OF CODAMA			
					מואס בוושעא	TOANISHOT	OF SPRAWL			
NEGATIVE IMPACTS (27)	LOW	UNLIMITED OUTWARD EXTENSION	LAND USES SPATIALLY SEGREGATED	LEAPFROG DEVELOPMENT	NO CENTRAL OWNERSHIP OR PLANNING	DOMINANCE BY MOTOR VEHICLES	FRAGMENTED LAND-USE GOVERNANCE	GREAT VARIANCE IN LOCAL FISCAL CAPACITY	WIDESPREAD COMMERCIAL STRIP DEVELOPMENT	RELIANCE ON FILTERING FOR LOW-INCOME HOUSING
PUBLIC-PRIVATE CAPITAL AND										
							A STATE OF			
nigner mirasurcture costs	2	2	-	2	-	0	1	0	0	0
Higher public operating costs	2	2	-	2		0	1	0	0	0
More expensive private residential and nonresidential development costs	2	-	0	2	<del>-</del>	c	,	-		
More adverse public fiscal Impacts	2	-		2	. -	,	,		-   c	
Higher aggregate land costs	2	-	0	2	-	0	-	0		0
***TRANSPORTATION AND TRAVEL COSTS									5	
More vehicle miles traveled (VMT)	2	-	2	2	-	2	0	0	2	-
Longer travel times	7	2	1	2	0	?	0	0	0	-
More automobile trips	2	-	-	2	-	2	-	0	2	-
Higher household transportation spending	2	2	1	2	0	2	0	0	2	1
Less cost-efficient and effective transit	2	2	-	2	0	2	-	0	0	0
Higher social costs of travel	2	2	-	2	-	2	-	0	0	0
**************************************								7 7	\$ 0.00 PM	
Loss of agricultural land	1	2	0	2	ı	0	0	0	-	0
Reduced farmland productivity	-	2	0	2	0	0	0	0	0	0
Reduced farmland viability	0	0	0	1	0	0	0	o	o	0
Loss of fragile environmental lands	2	2	0	2	1	0	0	0	-	0
Reduced regional open space	-	0	0	0	ı	0	-	0	0	0
OUALITYOFLIFE										
Aesthetically displeasing	0	0	0	0	0	0	0	0	2	0
Weakened sense of community	-	-	. 0	2	0	1	1	1	1	-
Greater stress	0	0	0	0	0	0	0	0	2	0
Higher energy consumption	2	2	0	2	0		0	0	-	-
More air pollution	1	0	0	1	. 0	2	0	0	-	0
Lessened historic preservation	0	1	0	0	0	0	0	0	-	-
SOCIALISSIES										
Fosters suburban exclusion		-	0	0	2	1	2	2	0	2
Fosters spatial mismatch		-	0	1	1	1	1	0	-	-
Fosters residential segregation	0	-	0	1	1	1	2		0	2
Worsens city fiscal stress	0	0	0	0	- 1	0	1	2	2	2
Worsens inner-city deterioration	0	-	0	1	1	0	-	2	-	-
LINKAGES OF PETER TO SEE THE SE										
STATE OF THE STATE	8	2	0			510			21.	
TO SECTION OF THE SEC			100		9 1	7		91	. 4	8

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TABLE 13

LINKAGES BETWEEN CHARACTERISTICS OF SPRAWL AND ITS POSITIVE EFFECTS

Wild Captain		CHO CHO	DEFINING CHARACTERISTICS OF SPRAWL	DEFIN	DEFINING CHARACTERISTICS OF SPRAWL	TERISTICS (	OF SPRAWL	ALECTS		
POSITIVE IMPACTS (14)	LOW	UNLIMITED OUTWARD EXTENSION	LAND USES SPATIALLY SEGREGATED	LEAPFROG DEVELOPMENT	NO CENTRAL OWNERSHIP OR PLANNING	TRANSPORT DOMINANCE BY MOTOR VEHICLES	HIGHLY FRAGMENTED LAND-USE GOVERNANCE	GREAT VARIANCE IN LOCAL FISCAL CAPACITY	WIDESPREAD COMMERCIAL STRIP DEVELOPMENT	RELIANCE ON FILTERING FOR LOW-INCOME HOUSING
FUBLIC-PRIVATECAPITAL AND COPERATING COSTS										
Lower public operating costs	2	-	0	2	-	0	0	0	0	0
Less-expensive private residential and nonresidential development costs	2	2	0	2	0	0	0	0	0	0
Fosters efficient development of "leapfrogged" areas	-	-	0	2	-	0	-	0	·O	0
TRANSPORTATION AND TRAVEL COSTS										
Shorter commuting times	2	2	0	2	0	2	0	0	0	0
Less congestion	2	2	•	2	0	-	0	0	-	0
Lower governmental costs for transportation	2	2	0	2	-	2	0	0	0	0
Automobiles most efficient mode of transportation	2	2 -	2	2	0	2	0	0	2	0
*** L'ANDINATURAL HABITATE PRESERVATION										
Enhanced personal and public open space	2	2	0	2	0	-	0	0	0	0
OUALTR OFILIE										
Preference for low-density living	2	-	0	1	0	7	1	0	0	0
Lower crime rates	2	-	0	-	0	-	0	0	0	0
Reduced costs of public and private goods	2	-	0		0	-	0	0	2	0
Fosters greater economic well-being	0	-	-	-	2	0	2	2	0	0
SOBIAL ISSUES										
Fosters localized land use decisions	0	-	0	-	7	0	2	0	0	0
Enhances municipal diversity and choice	0	-	0	-	<b>1-</b>	-	2	2	0	1
LINKAGES TO THE STATE OF THE ST										
<b>3</b> 7		8	•	63	•	<b>30</b>	0	,	9	
THE THE THE THE TWO STANCES	2		8		<u>.</u>	4.15	. 2	8.0	F-2-1	%

2 = Major linkage 1 = Moderate or minor linkage

0 = No linkage

-2 = Negative linkage

Basically similar to the above, land and natural habitat preservation seems to be negatively impacted by leapfrog development, unlimited outward extension, and low-density traits of sprawl (which consume significant amounts of land) yet by few others. Quality of life is worse (poor aesthetics of development and lack of sense of community) due to widespread commercial strip development and leapfrog development. Social conditions are worse (less affordable housing, smaller tax base per capita, and an absence of regionally provided services) due to sprawl's reliance on filtering for housing, great variance in local fiscal capacity, and highly fragmented land-use governance.

Obviously, the above are primarily inferences—but intuitively, these inferences appear to stand up.

### Positive Impacts of Sprawl

The analysis further suggests (see Table 13) that the same three defining traits leapfrog development, low density, and unlimited outward extension—appear to be the most important in causing positive impacts as well. The above three traits each score in the twenties and rank 1, 2, and 3 respectively. Next in relative importance is transportation dominance by private motor vehicles, followed by highly fragmented land-use governance, and no central ownership and planning. These range in score from a high of 13 to a low of 8. Least significant are the use of filtering for low-income housing, spatially segregated land uses, great variance in fiscal capacity, and widespread commercial strip development. These range from a low of 1 to a high of 5.

In terms of the positive effects of sprawl, public and private capital and operating costs are lower (because they are not as complex and there is less demand on

them) due to leapfrog and low-density development, and unlimited outward extension. Transportation and travel costs are lower (due to suburban-to-suburban commutes, reduced inner-suburban congestion, and use of the automobile) as a result of the above three traits plus transport dominance by motor vehicles, spatially segregated land uses, and widespread commercial strip development. Quality of life is better (residents like where they live; communities have lower crime rates) again due to the above three traits (leapfrog development, low density, unlimited outward extension) as well as to transport dominance by motor vehicles. Social conditions are better (more municipal diversity and choice) due to highly fragmented land-use governance and no central ownership or planning.

Clearly, there is a great deal of similarity between the positive and negative matrices of sprawl (Tables 12 and 13) as shown in Table 14. Paradoxically, the traits that seem key causes of many of sprawl's negative impacts also appear to be key causes of many of its positive impacts. This is true for such impact categories as public-private capital and operating costs, transportation and travel costs, land and natural habitat preservation, and quality of life. The fact that sprawl can be simultaneously associated with both costs and benefits in relatively narrowly defined fields shows how complex the phenomenon of sprawl is. The literature synthesis is summarized in Table 15. Evident from Table 15 is that the field tends to be much more prolific on criticisms (27) leveled at sprawl rather than its defense (14). There are about twice as many allegations of sprawl's negative impacts as there are of its positive impacts.

With regard to recognition that "costs" of development exist, there is more agreement

TABLE 14

Categories of Alleged Negative Impacts	Key Defining Traits Underlying Those Impacts
I. Public-Private Capital and Operating Costs	Leapfrog Development Low Density Unlimited Outward Extension
II. Transportation and Travel Costs	Leapfrog Development Low Density Unlimited Outward Extension Transport Dominance by Motor Vehicles Widespread Commercial Strip Development
III. Land/Natural Habitat Preservation	Leapfrog Development Unlimited Outward Extension Low Density
IV. Quality of Life	Widespread Commercial Strip Development Leapfrog Development
V. Social Issues	Reliance on Filtering for Low-Income Housing Great Variances in Local Fiscal Capacity Highly Fragmented Land-Use Governance
Categories of Alleged Positive Impacts	Key Defining Traits Underlying Those Impacts
I. Public-Private Capital and Operating Costs	Leapfrog Development Low Density Unlimited Outward Extension
II. Transportation and Travel Costs	Leapfrog Development Low Density Unlimited Outward Extension Transport Dominance by Motor Vehicles Spatially Segregated Land Uses Widespread Commercial Strip Development
III. Land/Natural Habitat Preservation	Leapfrog Development Low Density Unlimited Outward Extension
IV. Quality of Life	Leapfrog Development Low Density Unlimited Outward Extension Transport Dominance by Motor Vehicles
V. Social	Highly Fragmented Land-Use Governance No Central Ownership or Planning

# TABLE 15

# MATRIX SYNTHESIS OF THE LITERATURE ON SPRAWL ORGANIZED BY SUBSTANTIVE AREAS

									_
	Does	Condition	Notably	Exist?	Is It	Is It Strongly Li	Linked To	Sprawl?	
	+2	+1	0	-2	+2	+1	0	7-	
	General	Some	No Clear	Substantial	General	Some	No Clear	Substantial	
Substantive Concern	Agreement	Agreement	Outcome	Disagreement	Agreement	Agreement	Outcome	Disagreement	
Public Priyate (Capital ands - : -									
Operating Costs									<del></del>
Alleged Negative Impacts									
Higher infrastructure costs	×					×			
Higher public operating costs		×					×		
More expensive private residential/									
nonresidential development costs		×					×		
More adverse public fiscal impacts		×				×			,
Higher aggregate land costs		X				×			
Alleged Positive Impacts					r.			1	
Lower public operating costs		×					×		<del>. ,</del>
Less-expensive private residential/									
nonresidential development costs		×			`	×			
Fosters efficient development of									
"leapfrogged" areas			×				×		
Transportation and Travel Costs									
Alleged Negative Impacts									
More vehicle miles traveled (VMT)	×				×				
Longer travel times			×				×		
More automobile trips	×	·			X	_			
Higher household transportation spending		×			. )	×			
Less cost-efficient and effective transit	×					×			. ,
Higher social costs of travel		×				×			- ,-
Alleged Positive Impacts									1,1
Shorter commuting times	٠		×				×		
Less congestion			×		×				
Lower governmental costs for			-				;		
transportation			×				×		
Automobiles most efficient mode of		. ;			,		-		
transportation		×			×				_

# TABLE 15 (continued)

# MATRIX SYNTHESIS OF THE LITERATURE ON SPRAWL ORGANIZED BY SUBSTANTIVE AREAS

	Does	s Condition	Notably	Exist?	Is It	Is It Strongly Linked To Sprawl?	inked To	Sprawl?
	+2	+1	0	-2	+2	+1	0	-2
	General	Some	No Clear	Substantial	General	Some	No Clear	Substantial
Substantive Concern	Agreement	Agreement	Outcome	Disagreement	Agreement	Agreement	Outcome	Disagreement
servation								
Alleged Negative Impacts								
Loss of agricultural land	×				×			
Reduced farmland productivity		×		,			X	
Reduced farmland viability			×				×	
Loss of fragile environmental lands	×		·		×			
Reduced regional open space			×			,	×	
,								
Enhanced personal and public open space		X					×	
Alleged Negative Impacts								
Aesthetically displeasing		×					×	
Lessened sense of community		X					×	
Greater stress		X				×		
Higher energy consumption			X				×	
More air pollution		X						×
Lessened historic preservation		×					×	
Alleged Positive Impacts								
Preference for low-density living	×					×		•
Lower crime rates		×					×	
Reduced costs of public and private goods		×					×	
onomic well-being		×				X		
Hosters cuburban exclusion		X						×
Forters cratial mismatch	×					×		
Fosters residential segregation		×					×	
Worsens city fiscal stress		×				X		
Worsens inner-city deterioration		X				X		
Fosters localized land use decisions	×					×	ŕ	
Enhances municipal diversity and choice	×					×		
					!			

(general agreement and some agreement categories combined) in the areas of public and private capital and operating costs, quality of life, and social issues than there is in travel and transportation costs, and land/natural habitat preservation. That these "costs" are linked specifically to sprawl (holding aside the issue of causality), there is more agreement on public and private capital and operating costs, transportation and travel costs, and social issues than there is on land/natural habitat preservation and quality of life. Thus, more impact categories identify themselves as being affected by development; fewer categories identify themselves as being impacted by a type of development that is akin to "sprawl."

### **Areas of Future Research**

The literature clearly signals areas of future research thrusts. On the "harder," more quantifiable, physical/engineering side—that is, the issues of infrastructure, transportation, and land consumption—the studies, to date, point to multiple

appropriate measures to be considered (e.g., vehicle miles traveled [VMT] and congestion), as well as important relationships to be examined (e.g., density's effect on modal choice and travel time). However, these analyses must be brought together more definitively, and areas of outstanding disagreement from prior work (e.g., are commuting times shorter or longer under sprawl) must be examined empirically so that answers can be had. The field must attempt to fill in the lingering gaps in knowledge concerning the effect of development patterns on operating costs, impact on productivity of farmland, and so on.

As to sprawl's effect on the "softer," less quantifiable, quality of life and social issues, the challenge to current research is even more formidable. Here, interrelationships are more complicated, measurement is more elusive, and the association with development pattern—whether sprawl or otherwise—much more obtuse.