APPENDIX B
Programmatic Environmental Assessment of Cumulative Effects of the 7(A) and 504 Small Business Loan Assistance Programs

SBA

U.S. Small Business Administration

Do SBA Loans Contribute to Sprawl?
Evidence from the Washington, DC Metropolitan Area

Prepared by: URS Corporation
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1.   Executive Summary

Two environmental organizations have recently alleged that the loan practices of the Small Business Administration (SBA) contribute to urban sprawl in the Washington, DC metropolitan area. The plaintiffs request that SBA incorporate "Smart Growth" principles into SBA loan approval process as a mitigation measure to address these significant impacts. The SBA has tasked the URS Corporation to review and evaluate these allegations. The URS Corporation has undertaken this assignment in five ways.

First, we have reviewed the mission of the SBA and the structure of the 7(a) and 504 loan programs at issue in the lawsuit1. We find that most SBA activity takes the form of loan guarantees, with private lenders providing the actual funds. The SBA provides such guarantees to lenders who provide loans to applicants who satisfy established criteria such as business size. These criteria typically do not take into account the proposed location of the business.

Second, we have reviewed academic, professional, and advocacy studies that define and analyze sprawl, its characteristics, and its causes. No standard definition of sprawl has yet been adopted by the advocacy and research community; definitions vary significantly from study to study. For that reason, analysts have had only limited success developing empirical measures of the extent of sprawl. Most empirical research has focused on measures that enable comparisons among metropolitan areas (e.g., to determine whether Los Angeles or Atlanta exhibits more characteristics of urban sprawl); thus, even less progress has been made developing measures that allow analysis of sprawl within a metropolitan area. These findings imply that significant limitations will confront any analysis that explores alleged linkages between SBA programs and urban sprawl within a particular metropolitan area.

Third, we have reviewed studies that analyze determinants of business location and employment patterns. Not surprisingly, businesses frequently choose their locations in order to have easy access to their customers, suppliers, and employees. In practice, this means that business location often follows residential location (to be near customers and employees) and often follows the location of major transportation networks. These findings suggest that sprawl may largely be determined by factors that influence residential and transportation location, rather than factors such as federal SBA loan programs that support small businesses.

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1 A complete overview of the SBA loan programs is provided in Section 2 of the PEA.

Fourth, we have reviewed the role of the federal government in local land use policy. We find that the delegation of powers in our federal system precludes federal government involvement in most local land use issues. Any possible federal role in contributing to urban sprawl must, therefore, be indirect. The linkage that plaintiffs have proposed in the current suit against the SBA is quite indirect; their allegation purports that federal loan guarantees to small businesses increase small business growth in sprawl areas, that such small business growth contributes to sprawl, and that it is the responsibility of federal agencies to control the resulting sprawl. Specific land use authorities have been delegated by the federal government to states, and most states have, in turn, delegated land use authority to the local level of government. In the case of SBA, their involvement in determining the location and nature of specific loan applications is far removed from the local governments that have the actual land use authorities to regulate urban sprawl.

Fifth, we have performed a variety of mapping and statistical analyses to determine whether SBA loans in the DC metropolitan area are a causal factor leading to urban sprawl (see Figure 1 Study Area). Our analyses reveal only a weak correlation between standard measurements of urban sprawl and the location of SBA loans. When brought together with the literature review on the causation of urban sprawl, we find there is no basis in the plaintiff's key argument that SBA loan practices significantly contribute to the problems of urban sprawl.

The remainder of this paper expands upon these points in greater detail: Section 2 evaluates the current literature on urban sprawl; Section 3 presents a statistical analysis on the relationship between SBA loans and urban sprawl in the Washington DC metropolitan area; and Section 4 concludes.

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Figure 1
Study Area

2. Literature Review

Academic, professional, and advocacy studies were reviewed to provide a background on sprawl-related issues and to aid in developing a research plan. The literature review discusses many aspects of sprawl, from its definition to the ways of measuring it. Sprawl related literature is extensive; the following sections summarize the major findings. The literature review begins with the various definitions of sprawl, describes the factors contributing to urban sprawl, and discusses the limited role that the federal government has in determining local land-use decisions. Finally, this section concludes with a discussion on the difficulties researchers have had in developing measurements of urban sprawl.

Definition of Sprawl

The word "sprawl," as used to describe chaotic, unplanned, and often unsightly suburban expansion, can be traced back to a 1937 speech by Earle Draper of the Tennessee Valley Authority (Wassmer, 2001a). More than sixty years later, the word "sprawl" has come to symbolize everything that is perceived as wrong with suburban living – traffic jams, strip malls, enormous "super-stores", and the lack of sense of community.

Sprawl has been defined in numerous ways. Definitions include: "low density development beyond the edge of service and employment, which separates where people live from where they shop, work, recreate, and educate..." (Sierra Club, 1998) and "dispersed development outside of compact urban and village centers along highways and in rural countryside" (Vermont Forum on Sprawl, 2001). In the current case plaintiffs suggest that sprawl is "low density, discontinuous, automobile-dependent, new development on the fringe of settled areas often surrounding a deteriorating city or town core" (FCC/FOE, 2000).

We could go on to cite many other definitions. It is more productive, however, to note that most can be placed into one of six categories (Galster et al., 2001):

- Example: Sprawl is development such as a particular place (e.g., Los Angeles);
- Aesthetics: Sprawl is "unsightly" or "ugly" development;
- Cause of an externality: Sprawl is what causes automobile dependence[2], environmental pollution[3], further deterioration of inner city, etc.;
- Consequence of policy failure: Sprawl is the result of poor planning, local zoning practices, or highway expansion;

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[2] It has recently been suggested that sprawl is the result of automobile-based society (Glaeser and Kahn, 2003). This represents a reversal of the logic argued by Galster, et al. In either case, there is a clear intuitive connection between the automobile dependence and sprawl, regardless of the direction of causation.

[3] Although it is common to argue that sprawl causes environmental pollution, Glaeser and Kahn (2003, p.6) point out that "...current gas taxes already appear to cover most estimates of environmental damage."

o **Pattern of development:** Sprawl is a particular pattern of development, such as "discontinuous," "leap-frog," and strip development; and

o **Process:** Sprawl is a process occurring at certain stages of urban area expansion.

Sprawl, as defined above, is subjective and often based upon the individual's political, environmental, scientific, and even aesthetic views (Hess et al., 2001). The lack of an agreed definition of what is "density", "sprawl" or "compactness" prevents authoritative measurement of sprawl. Thus, without an agreed-upon definition, any suburban growth can be viewed as exhibiting a sprawl pattern of development (Heimlich and Anderson, 2001).

Several factors have been pointed out as causes for sprawl, including: people's preference to live on larger single-family lots in the suburbs as opposed to the denser multi-family residences in the central city; escape from the fiscal and social problems of central cities (high taxes, low quality public schools and public services, racial tensions, crime, congestion, and low environmental quality); and, people's preference to live among residents of similar income, education, race, and ethnicity (Mieszkowski and Mills, 1993). Individual causes of sprawl are not clear because so many factors contribute to sprawl and their relationship is so complex, that it is difficult to disentangle and isolate the impact of each factor, let alone quantify the level of influence each may have (USGAO, 1999; Wassmer, 2001b).

Factors Influencing Residential Development

Some consensus among researchers exists when it comes to factors that contribute to sprawling residential development. The most often cited factors are: growing population combined with shrinking household sizes; rising incomes; and falling transportation costs (Brueckner, 2000). However, consensus stops at this point. The federal government has been accused of contributing to sprawl through subsidies to highway construction and providing financial incentives for owning single-family dwellings through the mortgage insurance system and, until recently, through the capital gains tax (Snyder and Bird, 1998).

Certain researchers point to governmental subsidies for public infrastructure construction as a major contributor to sprawl by allowing people to locate in sprawling areas. This perspective certainly carried greater weight in the 60's and 70's when federal agencies provided a greater percentage of grant funding on growth-inducing transportation, public water and wastewater projects. However, others state that public infrastructure is built only after the population in a developing area is large enough to afford and justify such large expenditures (Heavner, 2000; Heimlich and Anderson, 2001).

Often, local governments are accused of contributing to sprawl through local zoning and subdivision regulations and building codes (Heimlich and Anderson, 2001). For example, large lot sizes are often dictated by the need to install septic

tanks and wells on property where public utilities are non-existent (Heavner, 2000; Heimlich and Anderson, 2001). Care must be taken in describing local government's contribution to urban sprawl because of the variety of local land-use practices across the country.

Factors Influencing Non-residential Development

While individuals moving to the suburbs may be looking to get away from congested cities, businesses are often looking to locate near potential customers and employees. Overall, changes in areas of technology, business organization, levels of taxation, and tax incentives influence business location and relocation decisions. Different businesses approach site selection from different perspectives depending for the most part on individual company's needs. For example, companies offering young products[4] are less sensitive to real estate costs than to availability of well-educated labor and choose to locate in urban areas with large pools of highly educated workers. While companies producing mature products are extremely sensitive to both real estate and labor costs, which may not be affordable in urban areas (Cohen, 2000).

It is important to make a distinction between location and site. Location refers to the general region and its characteristics, while a site is a specific parcel of land and/or building(s). Factors influencing location decisions are: skill level and suitability of the labor market; availability and cost of housing; adequacy of transportation systems; access to suppliers and contractors; proximity to natural resources; presence of competitors; positioning within the market for the company's product; and general taxation levels and tax policies of the state and local governments. Factors influencing site selection are: road/train/truck access, the presence or absence of tax liens, title complexities on the property, cost and availability of such services as water, sewer, solid waste disposal, telecommunication capacity, and the potential of environmental remediation (Cohen, 2000). During site selection, access to customers is important and can mean different things for different services and retailers: a street with moderate to heavy traffic flow is crucial to a gas station, large lunch-time crowds are important to a deli-style restaurant, while a relatively large number of young families in close proximity is vital to a childcare center (Hoover and Giarratani, 1999).

A question that has often been asked is – do people move to suburban areas to take advantage of the businesses located there or do businesses move to the suburbs to serve the needs of the people who have moved to the area? There is clear evidence in the literature that many types of economic activity, such as new retail, office, warehouse, and other commercial development *follow* in the wake of new housing development, to serve the new population and to employ the relocated labor force (Heimlich and Anderson, 2001; Brookings Institution, 1999; Rubin and Turner,

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[4] Young products are described as those in the research and development phase; such as software development, web-site design, and e-business. Mature products are described as those that are well established on the market; such as furniture, clothes, and small electronic goods.

1999). Thus, as population grows in the suburbs, the number of suburban grocery stores, dry cleaners, and gas stations grow as well.

To succeed, small businesses need to be located near potential customers. Unlike large retail stores such as "Wal-Mart", small businesses such as a restaurant franchise or a beauty salon are rarely seen by consumers as a "destination-point" for which they are willing to travel long distances. As a result, grouping small businesses together to offer a variety of goods or services at one location creates a larger volume of customers and boosts sales. As a result, many such activities are now clustered in suburbs, along major transportation corridors, in large shopping malls or in smaller strip commercial centers (Hoover and Giarratani, 1999).

While a business location decision is left to the company, local zoning laws often dictate specific site selection. Development patterns within a community are largely determined by the decisions of local or regional planning agencies, and in some cases the state planning agencies. These decisions are reflected in comprehensive plans, zoning regulations, site reviews, and permitting requirements. The federal government has very limited involvement in local business location and site selection decisions.

The Federal Government's Role in Land-Use Regulation

Under our federalist system, state governments have retained the power to regulate land uses within their borders. Local-land use regulation is a state prerogative, not a federal one.

In practice, states typically delegate regulatory authority to regional or local governments. Responsibility for zoning, for example, typically resides with these lower levels of government. Local and regional governments make most decisions about what land uses are allowed, where they are allowed, and at what intensity they are allowed. The federal government plays little role in making these decisions.

The federal government does play some role in determining the intensity of development for certain infrastructure projects that it partially funds; most notable are investments for highway construction, mass transit, and public water and wastewater systems. Even in these cases, however, a portion of the decision-making authority resides with state, regional, and local governments because they not only manage these projects but also initiate them and decide when and how to pursue federal funding (USGAO, 1999).

With few exceptions, therefore, land-use regulation in the United States is the responsibility and authority of local, regional, and state governments. The few exceptions generally involve situations in which local land-use decisions have multi-jurisdictional implications of national significance. Some examples include: the Historic Preservation Act of 1966, as amended, preserves historic sites,

buildings, and objects of national, state, or local significance; Section 404 of the Clean Water Act regulates wetlands which are part of a larger ecosystem that provides regional benefits (Federal Water Pollution Act of 1972, as amended); the Endangered Species Act of 1973, as amended, restricts development of certain critical habitat that supports endangered species of concern across the nation; and National Environmental Policy Act of 1969, as amended, requires Environmental Impact Statements for major federal actions that may have significant environmental impacts.

In the Washington DC metropolitan area, this responsibility resides in a hierarchy of authorities that regulate local land uses, evaluate the benefits and costs of new development, and, more generally, consider the many issues related to urban sprawl. These authorities include the State of Maryland, which has recently launched a Smart Growth initiative to evaluate sprawl and growth management issues; the Metropolitan Washington Council of Governments, which studies regional issues in DC, Maryland, and Virginia, and proposes policies to address them; the Maryland-National Capital Park and Planning Commission which serves as the planning agency for Montgomery and Prince George's Counties; and a host of local governments that control zoning in their communities. If there are concerns about sprawl in the metropolitan Washington area, these authorities have the responsibility and capability to address them.

The delegation of powers in our federal system precludes the federal government from authority in most local land-use issues. Any possible federal role in contributing to urban sprawl must, therefore, be indirect. The linkage that the plaintiffs have proposed is quite indirect; their allegation supposes that federal loan guarantees to small businesses increase small business growth in sprawl areas, that such small business growth contributes to sprawl, and that the state, regional, and local authorities who actually have authority over land-use decisions are somehow powerless to control the resulting sprawl.

In the past, advocates have made somewhat similar allegations that particular federal programs contribute to urban sprawl. In the 1950s, for example, advocates argued that home mortgage insurance sponsored by the federal government contributed to sprawl by encouraging development of single-family homes. In the 1960s, many argued that the interstate highway system increased sprawl (Mieszkowski and Mills, 1993). These programs, and other federal programs alleged to contribute to sprawl (see USGAO 1999), involved both individually and cumulatively substantially larger amounts of money than the SBA loan guarantee programs at issue in the current litigation. Nonetheless, researchers have been unable to demonstrate that these programs have actually contributed to sprawl.

A 1999 Government Accounting Office (GAO) study is the most comprehensive analysis to date of the federal influence on urban sprawl. The GAO found that while the federal government may influence urban and suburban growth, the extent or magnitude of its contribution is not clear (USGAO, 1999). The GAO reviewed

studies of major federal assistance programs[5] and interviewed urban growth experts and government officials to assemble the evidence that may exist on the influence of current programs and policies on urban sprawl. The study found, among other things, that:

- So many factors contribute to urban sprawl and their relationship is so complex, that it is difficult to disentangle and isolate the impact of each factor, let alone quantify the level of influence each may have, and

- While many experts believe that federal actions contribute to urban sprawl, for the most part, only anecdotal evidence exists to confirm such beliefs. For example, there is little quantitative evidence linking federal assistance for water and sewer systems to urban sprawl.

The GAO report reviewed major programs and found little evidence that federal programs were a major factor in causing urban sprawl. The GAO report did not evaluate federal support in promoting small business creation. In fact, none of the literature that we reviewed mentioned small business creation, or any federal support for small businesses for that matter, as a factor in contributing to urban sprawl patterns.

Measuring Sprawl

Recent heightened public awareness of sprawl and subsequent important changes in state policies regarding growth management makes it necessary to find ways to measure sprawl. As a result, recent literature is moving away from simply describing sprawl and its characteristics to defining ways of measuring sprawl.

Most of the papers dealing with sprawl concentrate on one or at most only a few indicators of sprawl (Malpezzi and Guo, 2001). Individual indicators of sprawl include: population density, population density gradient, concentration, compactness, centrality, proximity, land consumption, separation of land uses/accessibility, retail activity in central places, and temporal development patterns. Often, papers have been reluctant to provide a specific criterion as to what is defined as sprawl. A few of the specific definitions include: residential development at less than three dwelling units per acre (USEPA, 1993); less than 12 people per acre (Snyder and Bird, 1998); and housing density of less than 1,360 units per square mile (Gordon and Richardson, 1997). Although specific residential densities have been commonly cited in the literature, they are often arbitrarily chosen and may not be an accurate measure given the wide range of settlement patterns across the nation.

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[5] The GAO looked at the influence of the following select federal programs and policies on urban sprawl: agriculture, environmental protection, housing, location of federal facilities, taxation, transportation, utility pricing, and water-sewer infrastructure.

Of the sprawl indicators cited in the literature, it was found that indicators such as population density and population density gradient performed reasonably well when measuring sprawl (Malpezzi, 1999; Malpezzi and Guo, 2001). For that reason, in the statistical analysis of SBA loan activities in the Washington metropolitan region, described in Section 3 and more fully in Appendix A, the URS Project Team uses a population density function to measure sprawl (Clark, 1951). The population density function measures the degree to which population is centered in a particular area. Sprawl is characterized in the model as the low-density urban fringe areas that are experiencing increasing population density.

Other researchers have used a number of different indicators to measure sprawl. This argument follows along the line that sprawl can have a number of dimensions and that cities might sprawl differently along these dimensions, which can be captured using a number of indicators (Galster et al., 2001; Hess et al., 2001). This method is often used to compare sprawl characteristics across cities. Another common measure of sprawl is the employment gradient, or the level of centralization of employment in a city. Glaeser and Kahn (2003, p.9) find that "...the cities that are centralized along one dimension are centralized along both." This indicates that the use of population density as opposed to another measure of sprawl is likely to yield similar results. Therefore, it is methodologically sufficient to focus on one measure of sprawl. This analysis uses population density as it has been found to perform well (Malpezzi, 1999; Malpezzi and Guo, 2001) and is the most commonly used measure of sprawl (Glaster et al., 2001).

Sprawl is often seen as progression of certain development characteristics over time. However, many individual sprawl indicators are not able to capture this change. Wassmer (2001a) offered a couple of methods that can be used to identify the presence of and to measure sprawl over time; these include: examining the percentage change of an urbanized area's population and land area contained in its central places, and calculating the index of the degree of sprawl by dividing the percentage change in urban fringe land (non-central place) by percentage change in urban population.

Given all of these measurement techniques, it must be emphasized that there is still no universally accepted way to measure urban sprawl and researchers vary widely in their opinions when measuring it. Several of the methods described above work well only for a monocentric city model, where there is one central city, however many metropolitan areas have more than one central city (Malpezzi, 2001).

This study focuses on the monocentric model. It can be argued that a monocentric model should be applied because of the central role that Washington, DC plays in the regional economy. With public administration jobs accounting for almost one quarter of all jobs in the region and a wide variety of private sector enterprises that rely on the presence of the federal government (Rubin and Turner, 1999), the growth of these job centers is inevitably tied to central Washington, DC. Others have argued that the monocentric model no longer applies to the Washington, DC

region because of emerging new job centers, such as Tyson's Corner and Reston/Herndon in Virginia, and Rockville and Gaithersburg-Germantown in Maryland (Brookings Institution, 1999). Although both are valid arguments, the monocentric model offers a simpler method to analyze the questions at hand. An alternative analysis could chose a polycentric model, but the expected results would find dampened effects of programs on sprawl. The polycentric model, by definition, assumes multiple central cities, each with their own urban fringe. Areas that could be considered urban fringe in a monocentric model may not be considered fringe in a polycentric model. It follows that a program deemed to affect sprawl would show a greater affect in a monocentric model.

3. STATISTICAL ANALYSIS

This section provides a statistical analysis of the relationship between SBA loans and development patterns in the Washington, DC metropolitan region. The analysis considered two regression[6] models, each providing insight into a different aspect of the location of SBA loans. The two models are not meant to stand alone, but rather be interpreted together, such that the models provide greater insight to a possible relationship between SBA loans and sprawl. The goal of the first model was to determine where the SBA loans are going. It attempts to answer the question: How well can sprawl and other factors predict number of loans across census tracts? This will shed light on whether there is any underlying statistical bias[7] in the location of loan placements. The second model was designed to determine what characteristics are correlated to sprawl. It attempts to answer the question: How well can change in sprawl be predicted from SBA loans and other factors? It is difficult to prove causation in any relationship of variables. As a result, the two models are used together in order to gain additional insight as compared to a stand-alone model. See Appendix A for a more technical discussion of the methodology and analysis.

The study area was defined as the Washington DC metropolitan area (Figure 1). This area includes Washington, DC and the following counties in Maryland and Virginia: Montgomery County, MD, Prince Georges County, MD, Frederick County, MD, Anne Arundel County, MD, Howard County, MD, Arlington County, VA, City of Alexandria, VA, Fairfax City, VA, Fairfax County, VA, Loudon County, VA, Prince William County, VA, Stafford County, VA, Manassas, VA, and Manassas Park, VA. This is the same study area used by the plaintiffs in their evaluation of SBA loan practices in the Washington region.

Data

In order to measure changes across the study area and to provide a sufficient number of observations to perform a regression analysis, census tracts were selected as the unit of observation. A census tract is defined by the U.S. Census Bureau to be a geographical area that generally contains between 1,500 and 8,000 people. There are approximately 900 census tracts in the study area, with an average size of 9.4 square kilometers (median tract size of 2.4 km^2). For each census tract, data were collected for population and population density from the 1990 and 2000 censuses. Data were also collected for the distance from the census tract to the urban center (Washington, DC) and the distance from the census tract to the nearest major road. The major roads chosen were all major arterial roads and U.S. Interstate highways.

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[6] A regression model is an equation that shows how changes in one variable correlate to changes in other variables.

[7] A statistical bias may be defined as a deviation from the expected value.

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Data were needed to estimate the overall business growth in each census tract. By failing to account for the naturally occurring business growth, this analysis runs the risk of producing a much stronger statistical relationship than may actually exist. Efforts were made to collect data on the number of both existing and new businesses in each census tract; however, these data were not readily available. Research has shown that as business activity increases in an area, unemployment decreases (Okun, 1962). Therefore, this analysis substituted unemployment as a proxy for growth.

Address information for each approved SBA loan between 1990 and 2000 was used to determine in which census tract the loan was located (see Figure 3 for loan locations). The number of loans in each census tract was then determined. Figure 2 shows a distribution of loans across the census tracts. As the chart shows, most census tracts in the study area have three or less loan placements throughout the 1990's.

FIGURE 2: Distribution of Loans across Census Tracts
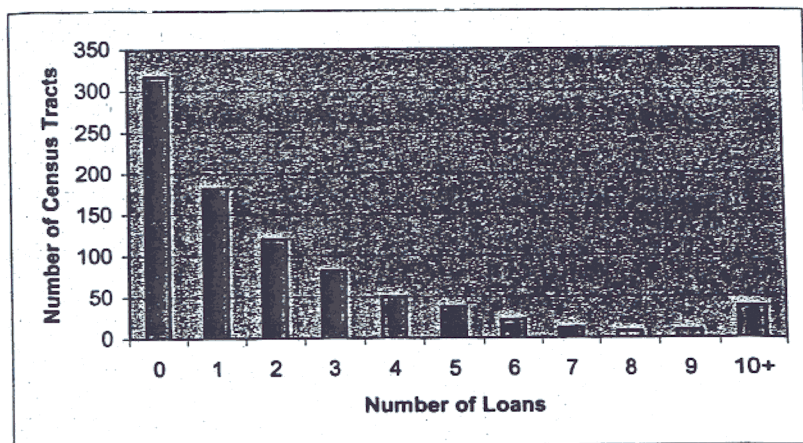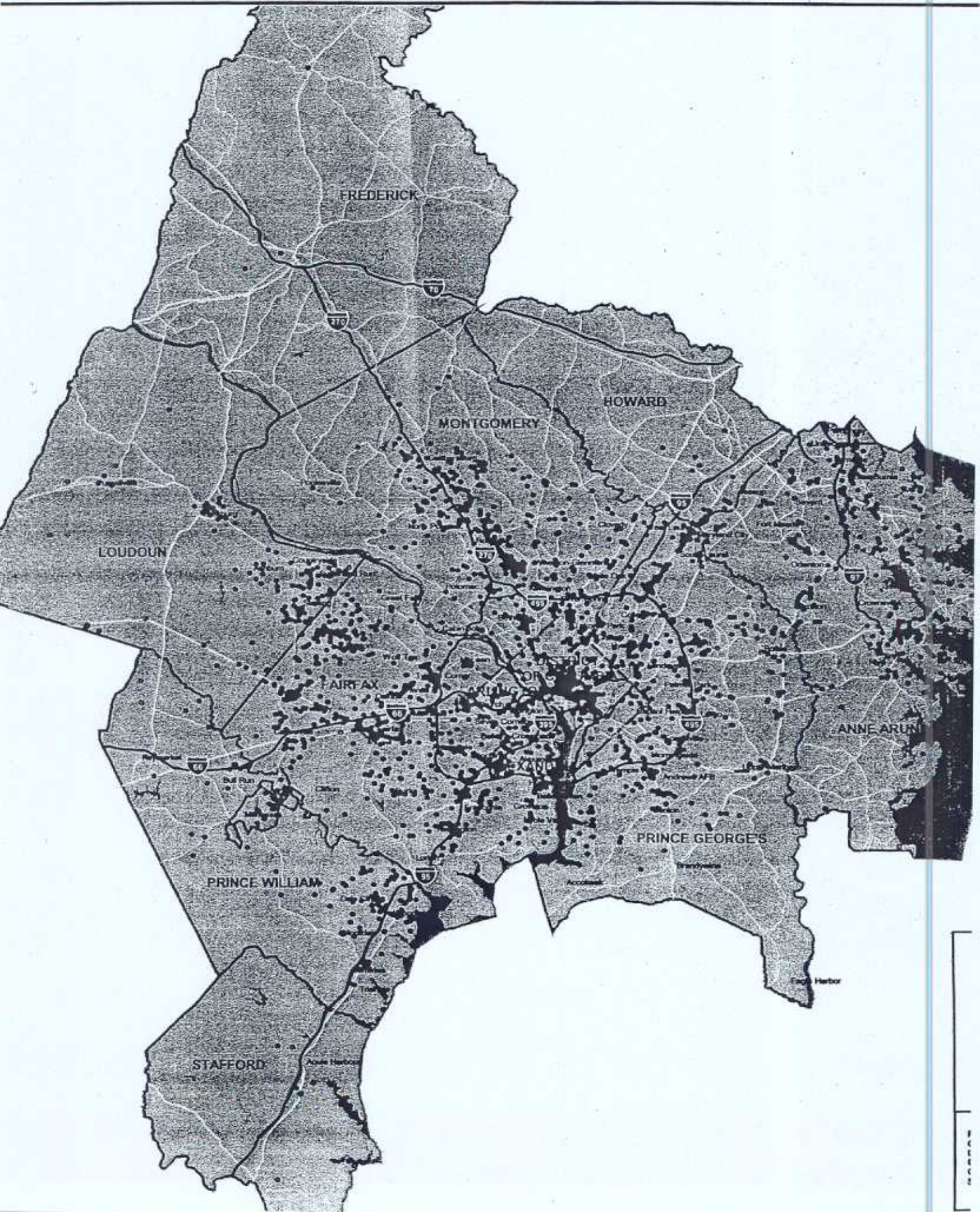
Modeling and Results

Two regression models were developed to address different aspects of SBA loans and sprawl.

Model 1: Relation of Number of Loans per Census Tract to Population Density, Distance to Urban Center, and Distance to Nearest Major Road

The goal of the first model was to investigate where SBA loans are going. It attempted to answer the question: How well can sprawl and other factors predict the number of loans across census tracts?

The dependent variable (the variable that is being observed and measured) in the first model was the number of loans in each census tract in the study area. The explanatory variables (the variables used to explain changes in the dependent variable) were selected to address questions concerning where loans are going. The explanatory variables tested in the model were:

- Population density in each census tract in 1990
- Distance to the urban center (natural logarithm[8])
- Distance to the nearest major road (natural logarithm)

Model 1 looks at whether the loan placements were biased. The reason we used only 1990 Census data for this was because that would tell us about the population density before the loans were placed, and allow us to determine if the loans were going, on average, to higher or lower density areas. The results show that there is a small correlation between the placement of loans and low population density, but a larger correlation between the placement of loans and the location of major roads. The magnitude of these correlations is determined from the coefficients in Table 1. The second model, discussed later, accounts for the change in population density over the 10-year period and 2000 Census data is included in that model.

The results of model 1 indicate a statistically significant negative correlation between the number of loans in a census tract and population density. That is to say, as population density increases, loans per tract decrease. However the strength of effect is very small (as indicated by the coefficient in Table 1). The standard error and probability measures shown in the table allow us to conclude that the coefficient estimates are statistically significant. The results indicate that--if one were to hold all the other variables in the model constant--as the number of people per square kilometer is reduced by 10,000, there are less than one percent more SBA loans awarded. This result shows the tenuous relationship between population density (used in Model 1 as an indicator of urban sprawl) and SBA loans. Also, it

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[8] The natural logarithm is a transformation of the data to create a data series with the appropriate characteristics to fit the assumptions of the model being used.

must be remembered that even though there may be a statistically significant correlation (although small) between variables, it does not indicate that the relation is one of causation. In fact, the relationship shown in this model is small enough to be considered negligible. The coefficient indicates that a change in the population density of 10,000 people per square kilometer has almost no affect on the number of loans placed in a census tract. This is based on the fact that there is an average of less than two loans per census tract, and the change in population density shows an affect of less than one percent to the average. This becomes a very small affect in absolute terms.

No statistically significant correlation was found between the distance to the urban center of Washington, DC and the number of SBA loans. If SBA loans were significantly contributing to urban sprawl then there should be a strong correlation between the number of loans and increasing distances from the center of Washington, D.C. This was not reflected in the analysis and is important because it indicates that the locations of SBA loans are dependent upon other things besides distance to the city center. As discussed earlier, the Washington D.C. metropolitan area was assumed to have a monocentric pattern of development.

A statistically significant correlation exists between the location of SBA loans and the distance to a major road. This result reflects small business location preferences for good accessibility to major highways. The negative sign of the coefficient indicates that the closer a census tract is to a major road, the more likely it is to have an SBA loan.

The R^2 of the model is 0.03 indicating that only 3% of the variability in sprawl could be explained by population density, distance to the urban center, or distance to the nearest major road[9]. Thus, 97% percent of the variability can be explained by other factors not modeled in the current analysis. Because a large portion of the variation could not be accounted for, it is assumed that there are other factors contributing to the number of loans per census tract that are not being captured by this model. Note that although the R^2 of the model is low, the high number of observations (N = 878) contributes to statistically significant results.

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[9] The R^2 is a measure used to describe the validity of the regression model as a whole. A low value does not necessarily mean that the model is invalid, but rather that there is a good deal of other information not captured in this model that explains the patterns of SBA loan placement.

Table 1: Results for Model 1
Dependent Variable = Loans per Census Tract
$R^2 = 0.03$
Number of Observations = 878

Independent Variable	Coefficient[10]	Standard Error[11]	Probability[12]
Constant	1.893490*		0.0055
Population Density 1990	-0.0000714*	0.0000195	0.0004
Distance to City Center (log)	-0.005111	0.074124	0.9534
Distance to Major Road (log)	-0.126190*	0.043244	0.0047

* Statistically significant at 95% level.

Model 2: Relation of Sprawl to Number of SBA Loans, Distance to Urban Center, Distance to Nearest Major Road, and Change in Unemployment Rate

The goal of the second model was to determine what factors are correlated to sprawl. As an indicator of sprawl, the variable tested in this model was the change in population density--natural log of people per square kilometer--of each census tract over a 10-year time period (1990 – 2000) (Clark, 1951; Malpezzi, 1999; Malpezzi and Guo, 2001). The model attempted to answer the question: How well can change in sprawl be predicted by SBA loans and other factors? This model included only those census tracts in the study area where there was an increase in population density (i.e., sprawl was occurring).

The explanatory variables attempted to address different questions about what characteristics might be important in an area where the population density was increasing. The explanatory variables included in the model were:

- Number of SBA approved loans per census tract
- Distance to the urban center (natural logarithm)
- Distance to the nearest major road (natural logarithm)
- Change in the unemployment rate for each census tract

The regression results indicate a statistically significant correlation between sprawl and the number of SBA loans, however, the effect is small (Table 2). This does not mean that SBA loans <u>cause</u> an increase in the population density; this just shows the relationship.

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[10] The coefficient explains the magnitude and direction of the estimated relationship between the variables.
[11] The standard error is one measure that is used to explain the accuracy of the coefficient. When the standard error is large it indicates that the estimates are less reliable.
[12] Probability is the chance that a given event will occur (Webster, 1976). Here, the probability is the chance that the estimated coefficient is reliable.

No statistically significant correlation was found between the distance to the urban center of Washington, DC and increases in population density. This indicates that sprawl did not occur in patterns related to the distance to downtown DC.

The model showed a statistically significant correlation between the distance to the nearest road and sprawl. That is to say, those areas closer to major roads showed the highest increases in population density between 1990 and 2000.

The model showed an inverse relationship between unemployment and changes in population density. This means that as unemployment increased, sprawl decreased. This is reasonable because the presence of jobs can contribute to population increases.

The R^2 of the model is 0.16 indicating that only 16% of the variability in sprawl could be explained by this set of predictors. Thus, 84% percent of the variability can be explained by other factors not modeled in the current analysis. Because a large portion of the variation could not be accounted for, it is assumed that there are other factors that contribute to the change in population density that are not being captured by this model. Note that although the R^2 of the model is low, the high number of observations (N = 561) contributes to a statistically significant result.

<div align="center">

Table 2: Results from Model 2
Dependent Variable = Sprawl (Truncated at 0)
$R^2 = 0.16$
Number of Observations = 561

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Independent Variable	Coefficient	Standard Error	Probability
Constant	-5.530839*	1.377395	0.0001
Loans per Census Tract	0.049013*	0.016991	0.0039
Distance to City Center (log)	0.221677	0.147222	0.1321
Distance to Major Road (log)	0.295730*	0.123353	0.0165
Change in Unemployment	-30.15699*	3.864262	0.0000

* Statistically significant at 95% confidence level.

4. Concluding Remarks

In our attempt to determine the impacts SBA loan practices may have on sprawl, this report reviewed the current literature on urban sprawl. The literature review indicated that there are a number of factors that contribute to sprawl and that it is difficult to disentangle these factors to measure their individual impact. However,

none of the articles reviewed indicated that small business location was considered to be a significant contributor to urban sprawl.

The statistical analysis did not show any strong correlation between the location of SBA loans and a commonly used measure of urban sprawl (the change in population density). The analysis found that there is a small correlation between SBA loans and sprawl, but this does not imply causation. Based on these analyses, it can be concluded that the SBA loan practices have had very little impact on the fragmented, low-density pattern of land development that has occurred in the urban fringes of the Washington, DC metropolitan area.

The results of Model 1 show that the number of SBA loans is correlated to population density in each census tract in 1990 and the distance to the nearest major road. It is not related to the distance to the urban center. However, although the model is valid, the low R^2 indicates that many other variables besides those tested contribute to the number of SBA loans issued. The analysis indicates that the overall effect of any one variable in the model is weak.

The results of Model 2 show that sprawl is correlated to the number of SBA approved loans per census tract, the distance to the nearest major road, and the change in the unemployment rate for each census tract. It is not related to distance to the urban center. Like Model 1, Model 2 is valid but weak. The analysis indicates that the overall effect of any one variable in the model is weak. Many other variables besides those tested contribute to sprawl. This is consistent with the literature review and the consensus of multiple factors contributing to sprawl, such as the use of the automobile, rising incomes, and the escape of social problems of the inner city. It is certainly possible that these factors contributing to sprawl also make loan placement more favorable on suburban areas. It is logical that the current suburban growth patterns are causing the placement of SBA loans in locations where small businesses can benefit from these patterns.

It is crucial to note that even if a statistically significant correlation was found during the analysis, it does not necessarily indicate causation. An analysis of the causes of sprawl would require a much different approach, including more detailed time-series data and the analysis of many more explanatory variables than are available. Another approach could include the use of other quantitative measures of sprawl. The results of the literature review point to a large number of factors that could have a statistically significant effect on the measures of sprawl. This analysis tested only those factors for which there were readily available data. Almost any variable associated with growth, or any factor contributing to the growth of cities could be found to be correlated with sprawl as sprawl has become the standard form of growth.

References

Brookings Institution. 1999. "A Region Divided. The State of Growth in Greater Washington, D.C." Washington, DC: Brookings Institution. Accessed Oct. 2001. Available at http://www.brook.edu/es/urban/webregiondivided.pdf.

Brueckner, Jan K. 2000. "Urban Sprawl: Lessons from Urban Economics." Working Paper. Department of Economics, University of Illinois at Urbana-Champaign. Accessed Nov. 2001. Available at http://www.cba.uiuc.edu/jbrueckn/lessons.pdf.

Clark, Colin. 1951. "Urban Population Densities." *Journal of the Royal Statistical Society Series A* 114: 490-496.

Cohen, Natalie. 2000 "Business Location Decision-Making and the Cities: Bringing Companies Back." Working Paper. Washington, DC: Brookings Institution. Accessed Nov. 2001. Available at http://www.brook.edu/es/urban/cohen.pdf.

Forest Conservation Council/Friends of the Earth. 2000. *FCC/FOE v. SBA*. Washington, DC: Federal District Court.

Galster, George, Royce Hanson, Hal Wolman, and Stephen Coleman. 2001. "Wrestling Sprawl to the Ground: Defining and Measuring and Elusive Concept." *Housing Policy Debate*, Volume 12, Issue 4, Fannie Mae Foundation, Washington, DC.

Glaeser, Edward L. and Matthew E. Kahn. 2003. "Sprawl and Urban Growth." NBER Working Paper Series, working paper 9733, National Bureau of Economic Research, Cambridge, Massachusetts.

Gordon, Peter and Harry W. Richardson. 1997. "Are Compact Cities a Desirable Planning Goal?" *Journal of the American Planning Association* 63(1): 96-107.

Heavner, Brad. 2000. "Paving the Way: How Highway Construction has Contributed to Sprawl in Maryland." Baltimore, MD: MaryPIRG Foundation.

Heimlich, Ralph E. and William D. Anderson. 2001. "Development at the Urban Fringe and Beyond: Impacts on Agriculture and Rural Land." Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 803. Accessed Nov. 2001. Available at http://www.ers.usda.gov/publications/aer803/aer803.pdf.

Hess, George R. et. al. 2001. "Just What Is Sprawl, Anyway?" North Carolina State University. Accessed Oct. 2001. Available at http://www4.ncsu.edu:8030/~grhess/papers/sprawl.pdf.

Hoover, Edgar M. and Frank Giarratani. 1999. An Introduction to Regional Economics. 3rd Edition. Regional Research Institute, West Virginia University. Accessed Oct. 2001. Available at http://www.rri.wvu.edu/WebBook/Giarratani/chapterseven.htm.

Malpezzi, Stephen. 1999. "Estimates of the Measurement and Determinants of Urban Sprawl in U.S. Metropolitan Areas." Draft. Madison, WI: Center for Urban Land Economics Research, University of Wisconsin. Accessed Oct. 2001. Available at http://www.bus.wisc.edu/realestate/pdf/9906a.pdf.

Malpezzi, Stephen and Wen-Kai Guo. 2001. "Measuring 'Sprawl': Alternative Measures of Urban Form in U.S. Metropolitan Areas." Working Paper. Madison, WI: Center for Urban Land Economics Research, University of Wisconsin. Accessed Oct. 2001. Available at http://www.bus.wisc.edu/realestate/docs/Alternative%20Measures%20of%20Urban%20OForm.doc.

Mieszkowski, Peter and Edwin S. Mills. 1993. "The Causes of Metropolitan Suburbanization." The Journal of Economic Perspectives 7(3): 135-147. Accessed Nov. 2001. Available at http://www.jstor.org.

Okun, Arthur. 1962. "Potential GNP: Its Measurement and Significance," Proceedings of the Business and Economic Statistics Section: 98-104.

Rubin, Mark and Margery Austin Turner. 1999. "Current Patterns of Employment Location in the Washington Metropolitan Area." Washington, DC: The Urban Institute Accessed Oct. 2001. Available at http://www.brookings.edu/es/urban/rubin&turner.pdf.

Sierra Club. 1998. "The Dark Side of the American Dream: The Costs and Consequences of Suburban Sprawl." Washington, DC. Accessed Oct. 2001. Available at http://www.sierraclub.org/sprawl/report98/report.asp.

Snyder, Ken and Lori Bird. 1998. "Paying the Cost of Sprawl: Using Fair-Share Costing to Control Sprawl." Energy Efficiency Center of Excellence for Sustainable Development, U.S. Department of Energy. Accessed Oct. 2001. Available at http://www.sustainable.doe.gov/articles/sprawl.shtml.

U.S. EPA. (1993). "Cost of Providing Government Services to Alternative Residential Patterns." Annapolis, MD: Chesapeake Bay Program, U.S. Environmental Protection Agency. Accessed Nov. 2001. Available at http://www.chesapeakebay.net/search/pubs.htm

U.S. General Accounting Office. 1999. "Community Development: Extent of Federal Influence on "Urban Sprawl" is Unclear." GAO/RCED-99-87. Accessed Oct. 2001. Available at http://www.frwebgate.access.gpo.gov/cgi-bin/useftp.cgi?IPaddress=162.140.64.21&filename=rc99087.txt&directory=/diskb/wais/data/gao.

Vermont Forum on Sprawl. 2001. Accessed Oct. 2001. Available at
http://www.vtsprawl.org/sprawldef.htm.

Wassmer, Robert W. 2001a. An Economist's Perspective on Urban Sprawl, Part I.
Defining Excessive Decentralization in California and Other Western States." California
Senate Office of Research. Accessed Nov. 2001. Available at
http://www.sen.ca.gov/sor/sprawlreport.pdf.

Wassmer, Robert W. 2001b. An Economist's Perspective on Urban Sprawl: With an
Application to Metropolitan Areas in the American West." Working Paper. Sacramento,
CA: California State University. Accessed Nov. 2001. Available at
http://www.csus.edu/indiv/wassmerr/EconPerspJuA.pdf.

Websters New Collegiate Dictionary. 1976. G. & C. Merriam Company, Springfield,
MA.