A National Perspective on Land Use Policy Alternatives and Consequences at the Rural-Urban Fringe

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Introduction

This paper 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 non-central city metropolitan areas and non-metropolitan 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).

Sprawl occurs on a micro basis in almost every county of the United States (although it occurs in significant amounts in only about one-quarter of the nation's 3,000 counties). 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).

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 the citizens. 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.
- Fosters neighborhoods in which housing will appreciate.
- Fosters neighborhoods in which schools provide both education and appropriate socialization for youth.
- Requires lower property taxes to pay for local and school district operating expenses than locations closer in. (Burchell 1997)

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). Gated communities, farmettes, research parks, law offices, medical groups, mega-hardware 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 in

dustrial 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 was not developed as planned, but rarely has an economic entity failed in the United States because it was developed too far out.

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 area 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. Yet, 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 20 years.

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; 3 times what will be spent on health infrastructure, including all hospitals, institutions, and all water-sewer treatment systems; 10 times what will be spent on public safety, administration, and justice infrastructure; 15 times what will be spent on environmental protection infrastructure; and 25 times what will be spent on all cultural and recreational infrastructure.

Dually supporting and under-utilizing 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 forego 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:

- Not funding all infrastructure.
- Not fully funding developmental infrastructure.
- Not repairing or replacing most types of infrastructure.
- Not taking advantage of the technological improvements in rehabilitation, repair and provision of infrastructure that could be passed on to taxpayers as savings.

Thus, the primary concern about sprawl development, at a time when the average American is satisfied with its outcome, is cost. 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 for

mation; 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).

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 briefly overviewed below.

Definition and Overview

This section of the report reviews the literature of sprawl development versus compact growth as it relates to the consumption or cost of infrastructure, housing, land, and public services (municipal and school district operating costs).

Characteristics of Sprawl. Sprawl is "a development pattern characterized by scattered, unplanned, low-density development that is not functionally related to adjacent land uses" (Duncan et al. 1989). It is evident in low-density residential and nonresidential growth that spreads out from established urban areas, converting woodlands, wetlands, agricultural lands, and other natural habitat to urbanized uses. Development of this type typically includes subdivision-style residential development and strip nonresidential development consisting of skipped-over, noncontiguous residential land development, in the form of 0.25- to 0.50-acre lots, and nonresidential development of floor area ratios[1] of 0.20 or less. The pattern begins with single-family subdivisions, followed by shopping centers, office and industrial parks, entertainment centers, and discount stores (Burchell 1997). In many cases, the "new" growth is really a migration of residents and jobs from urban areas to suburbs and rural/undeveloped areas.

Sprawl occurs because land at the periphery of established development is relatively cheap. Land is consumed as if it has considerable supply and there are little costs in discarding or under-using old land in search of new. This approach to development often takes land in subdivision-scale parcel sizes to accommodate detached single-family homes and strip nonresidential centers along the outer beltways and spokes from the core of the metropolitan area. Lands are skipped over en route to rural and ex-urban locations as inner-core city lands are left behind. This pattern is not purposeful or intentional; it has developed because of the belief that there are no societal consequences for consuming land in this way. Land is cheaper there and it can and should be consumed. New infrastructure must be built to accommodate a scattered pattern of low-density land uses, while older infrastructure is under-maintained and abandoned.

Typical features of sprawl are as follows:

- Very low-density, new residential development.
- Automobile dependent.
- Uneconomical for utility expansion/extension of other public services.
- Scattered rural subdivisions.
- Strip residential development along county roads.

[1] Floor area ratio (FAR) is the gross floor area of all buildings and structures on a lot divided by the total lot area.

- Diminished rural character and small-town atmosphere.
- Suburbanization of landscape.
- Loss of unique character; transformation to "Anytown, USA."
- Reduced retail shopping opportunities downtown.
- Strip commercial development at the edges of town.
- Land consumption.
- Inefficient energy usage.
- High ratio of road surface to development served. (Michigan Society of Planning Officials)

Sprawl development leads to high public expenditures by local governments, due to the inefficiency involved in developing public infrastructure such as roads, schools, and sewer and water lines. These expenditures include not only the capital costs of providing facilities but also the operational costs. Although operational costs are affected by a variety of factors, including the demography of development, size of the unit developed, and income of the residents, where and how development takes place relative to other development is also very important. Inefficient development location or multiple small units to be serviced increase the recurring costs of providing operational services.

The capital costs of historical and current development patterns have usually been supported by the population at large. However, for about a decade, as new development costs have occurred, land development practice has sought to shift these costs to the specific part of the population that has caused them. This shifting of costs has occasioned a careful look at what contributes to them and whether they can be lessened. These considerations form the basis of an impact fee approach to future growth.

Characteristics of Compact Growth. The second alternative considered in this report is called compact growth, managed growth, or planned development. This type of development seeks to contain most new growth around existing centers and limit the intensity of development in rural and sensitive environmental areas. It also seeks to save more prime agricultural and fragile lands, prevent wetland encroachment, buffer streams and other water bodies, and protect open water and natural habitats. It further seeks to reduce road construction and water/sewer infrastructure provision through more contained cluster development and, in some cases, mixed-use development. These goals are pursued by increasing the share and density of development close to existing development and decreasing the share and density of development in the outer, more rural and undeveloped areas of the county or metropolitan area.

If done correctly, compact growth simultaneously reduces public service costs and housing prices. Density increases and decreases are handled in a way that does not alter regional housing costs, increase public service outlays, or limit revenues of public service providers.

Typical components of compact--now often called "smart"—growth are as follows:

- Development is concentrated in suitable areas.
- Sensitive areas are protected.

- In rural areas, growth is directed to existing population centers, and resource areas are protected.

- Conservation of resources, including a reduction in resource consumption, is practiced.

- To assure the above achievements, economic growth is encouraged and regulatory mechanisms are streamlined.

- Funding mechanisms are addressed to achieve this type of growth. (Maryland Office of Planning)

Compact growth occurs when counties and municipalities adopt a proactive approach to planning and zoning that encourages infill and redevelopment of sites in older urban areas, mixed-use developments, and higher-density cluster-type development to preserve natural habitat and agricultural lands at the developed region's periphery. This approach selects land closer to existing development and seeks to avoid internal development in areas that lack public facilities and services. Compact growth has the potential to mitigate and reduce the impacts of development.

Impacts of Compact Growth

The purpose of examining sprawl versus compact growth is to classify and analyze what is known about compact growth's effect on:

- Land consumption.

- Public capital infrastructure construction costs.

- Private development (residential and nonresidential) costs.

- Fiscal impacts (public service costs).

Do the patterns of development created by compact growth reduce infrastructure costs? Do they drive up development costs? Do they reduce the amount of land, including fragile areas, taken for development? Do they contribute to a diminishment of local public service costs?

These four areas are defined as follows:

- *Public capital (infrastructure) construction* includes the capital improvements necessitated by increased demand for roads, utilities, schools, and other facilities (e.g., town hall, fire and rescue stations).

- *Private development costs, for residential and nonresidential land uses,* are typically considered on a cost-per-unit/1,000 square-foot basis for a variety of residential (single-family detached and attached homes, garden units, etc.) and nonresidential (office, retail and industrial) types.

- *Land consumption (including natural habitat losses)* involves the use of land to accommodate urban and suburban development, and focuses on overall quantity of land converted to development uses, as well as the conversion of agricultural acreage and the intrusion of development into fragile environmental areas.

- *Fiscal impacts to operationally service development* compare development in areas of excess service capacity with development in locations that would require the expansion of public services and infrastructure. Fiscal impacts include the longer-run savings in operating costs, both for non-educational and edu-

cational services (police, fire, public works, etc.).

Most studies summarized here contrast two alternative development futures. One alternative represents existing development patterns extended into the future; it is called current or sprawl development. This type of development has reportedly contributed to both higher capital costs for new development and negative fiscal impacts to host public service jurisdictions.

The second alternative—compact growth—takes the form of limiting overall and fragile land consumption related to development and lowering requirements for road and water/sewer infrastructure. Proponents of compact growth often describe the economic savings associated with this type of development as a prelude to the call for its adoption. For instance, a Florida study, after observing that compact, infill, and higher-density development is more efficient to serve than scattered, linear, and lower-density sprawl, asked for state growth management that would foster the development pattern (Duncan et al., p. 21). Similar statements appear in *The Costs of Sprawl* report, a study conducted more than two decades ago by the Real Estate Research Corporation, yet one that has been relied upon continuously and which is cited in some of the most recent studies of the disadvantages of current development.

The most comprehensive recent assessments of the economies afforded by compact development are those conducted by a team of academic and professional researchers from Rutgers University. These assessments were undertaken from 1992 to 1997 in New Jersey, Kentucky, the Delaware Estuary, Michigan and South Carolina. The first of these studies focused on the impacts of the then pending New Jersey State Development and Redevelopment Plan. Findings in this report indicated that the State of New Jersey could save $1.3 billion in infrastructure costs for roads, utilities and schools over a 20-year period if a state plan encouraging compact growth was followed, as opposed to the patterns of development evident at that time (Burchell 1992a). The Rutgers study was instrumental in fostering support for the plan, which ultimately was unanimously adopted by the New Jersey State Planning Commission in 1992.

Two other concepts must be understood at the outset. First, most of the literature to date has been able to portray two clearly different growth scenarios for communities under study. This may not be the case for the county subjurisdictions to be studied in South Florida. Thus, the results in this state may not be as clear-cut as they have been in other locations. Second, there is no wrong or right development pattern; it is a matter of choice. Development can be expensive to publicly-provided service if this is the desire of the local citizenry.

The Forces of Economic Growth

Relationships among Employment, Population and Income. Economic growth is the sustenance of employment, population and income of an area (Peterson and Vroman). In each component of economic growth, there is a natural increase and a migration factor. The first relates to the type and level of growth as a function of what already exists in an area; the second relates to what will be attracted to an area, either independently or through inducement. There is a lead-lag relationship between jobs and housing in which a certain critical mass of population is needed before a significant number of jobs arrive; yet, with the arrival of jobs, so, too, comes a new increment in population (Mills and McDonald).

In an ideal setting, growth is a relatively orderly process, and public and private institutions facilitate growth. Infrastructure is in place where needed and is neither overused nor under-maintained. Further, there

are reasonable relationships between existing and new growth (one does not cannibalize the other), and reasonable relationships exist between residential and nonresidential growth (i.e., the journey to work is relatively short and efficient). There is also an equitable balance of income groups paralleling job opportunities throughout the region. In other words, growth is both unfettered and efficient, so that the economic opportunity of the region is maximized. All of the development components directions are harmonious, and minimal conflict leads to maximum regional growth and productivity.

The Nature of Sprawl

The Costs of Sprawl. Sprawl development trends depart from the idealized state in that the competition for market share causes some inefficiency and waste, and the public and private sector institutional overlay contributes to a somewhat lethargic and unresponsive regulatory frame. For example, nonresidential commercial development is often free to locate along nearly any major road in the metropolitan area, maximizing vehicular access to the proposed facility. Similarly, office or industrial development in the form of an industrial park is frequently situated to maximize interstate road system access, placing it—in most cases—on the periphery of the metropolitan area (Cervero).

When both forms of nonresidential development are on or near the beltways or interstates of metropolitan areas, residential development is lured to a new outer ring of the metropolitan area to maximize access to jobs and shopping. Access from this new outer ring is increasingly oriented to state or interstate highway job locations rather than to central-core sources of employment.

Associated with this movement outward are both the requirement for more land and public infrastructure to service the radiating growth, and the increasing underuse of core land and infrastructure. This underused core infrastructure may not yet be paid for but, regardless, it must be regularly repaired and maintained, even when surrounding neighborhoods become partially abandoned.

Also associated with this movement outward is the creation of edge cities, often at the intersection of interstate roadways. These are the new centers of commerce and communication of the region (Garreau). The string beltway employment and edge cities stimulate the growth of bedroom counties and communities, whose sole purpose is to service the new peripheral employment locations by providing sites of even more peripheral residence. This latter phenomenon occurs because land is least expensive the farther the distance from the center of the metropolitan area.

As a result, the metropolitan area (except for the core) becomes homogeneous, with industrial, commercial and residential development on or near the main road spokes radiating from the core on or near the beltways around the core linking these radial spokes. The core of the metropolitan area, absent redevelopment, is abandoned by most blue-chip economic activities and becomes a home by default for poor residents who cannot follow (because of income or infirmity), or who are not allowed to follow (because of exclusionary zoning) upper-income residents to the suburbs. Even with redevelopment, the central core is a struggling entity with no soft-goods retail anchors, no quality supermarkets or movie theaters, a downwardly mobile population, public school systems replaced by private schools and increasingly higher property taxes to pay for rising public service costs (Downs).

The dual costs of providing new infrastructure for those who are moving outward, and maintaining the old infrastructure for the population and economic entities left behind cause taxes and development costs to rise throughout the region. These dual costs, in turn,

cause an increase in the costs either to do business or to reside in the area. As a result, wage and product costs increase and companies and regions become less competitive. Poorly planned growth in a metropolitan area brings about a type of economic triage wherein a finite amount of money is allocated to prepare and access new areas while old areas are left to die. These are the middle-stage signs of a region that is becoming non-competitive and whose end state is a major loss of economic tenants.

The Benefits of Sprawl. Current development trends occur because, in the short run, they appear to provide some benefits for the region. Current development is an efficient distributor of economic activities in a micro sense (Muller). Firms and people are distributed to localities that minimize individual out-of-pocket costs.

Current development also has a cleansing and regenerative effect. It provides a new alternative when existing economic entities become dated or inconvenient to access. Further, current development is a bellwether for change. Developers sense the desires of consumers and provide new development at preferred locations. Moving outward from a dated or inconvenient core is the easiest individual solution and provides what consumers seek in most marketplaces. The larger societal costs or impacts of these development patterns are not considered by the firms or individuals who choose them. For these reasons, any alternative that attempts to address the larger issues of development must also consider the impacts on individual, short-term benefits of current or traditional development.

The Nature of Compact Growth

Compact growth attempts to limit costs by mitigating the impacts of inevitable growth and by encouraging containment of growth within locations that are more efficient to service. A by-product of compact growth is the saving of fragile and other undeveloped lands. The underlying idea is that water and sewer services, road repair and maintenance, municipal functions, school facility development, and solid-waste collection should be contained near existing development since most urban scale development projects cannot take place without these services. These types of development controls limit the unrestrained use of undeveloped peripheral land and also limit the costs of providing public infrastructure to this land (Duncan). The controls further help to retain a market for existing or core locations by creating a more limited range of alternatives to the undeveloped peripheral locations. Even with compact growth, the forces of current development are usually strong enough to create edge cities in spite of relatively tight observance of urban service districts.

Compact growth, in an economic sense, is not restraint of the locational forces of market growth but, rather, their channeling (Delaware Estuary Program). Most of the employment and population growth that would have taken place—under current development trends—in leapfrog fashion to the outer reaches of metropolitan areas or counties is contained around already-developed centers or crossroads that are efficient to service with public infrastructure. The savings that are achieved can be plowed back into core areas to renew decaying neighborhoods, to provide incentives for private development of new and modern replacement structures, additional street-level parking, and enhanced public safety, and to return these areas to a position that is competitive with growing peripheral areas. In the final equation then, there is a more orderly and less wasteful relationship between old and new development under compact growth. Old areas are not ignored because they are no longer desired; they are refurbished and upgraded. Peripheral areas are not uniformly sought as the new Triple A locations. Rather, there is a more controlled approach to slicing off addi

tional land segments for primarily residential development. As a result, the contrast between old and new is lessened, and old locations with rejuvenation money have a chance to compete with the new peripheral locations. This approach allows less new land to be consumed and less additional funding to be allocated to new infrastructure (Hartshorn and Muller).

The Forces Against Change

Why is compact growth not pursued as a matter of course and called traditional development? The answer, as outlined below, is complex.

First, current development continues to be popular because of the short-term benefits that accrue to households and businesses as opposed to the long-term costs that accrue to society.

Second, current development is closely aligned with traditional American land conversion that has been characterized as a prairie philosophy. According to this philosophy, land is available in unlimited supply to be converted to developed uses, and it is the responsibility of both political jurisdictions and professionals in the development arena to ensure that land is ready for development, regardless of cost (Delafons). Economic uses will reside on this land, pay taxes to support required services, and an economic base will develop. Depending upon situation and location, this base will be more or less full, and more or less diverse. The problem, however, is that this pattern often results in sprawl that is not fully paid for by those creating it.

A third factor that operates in favor of continuing current development trends is that the costs of this type of development have not been made explicit to the public. Sprawl is a build now, pay later land-use pattern, as opposed to the pay as you grow land-use pattern of compact growth (Michigan Society of Planning Officials). That is, the physical and social costs of current development have been and will be borne by current and future populations. As a result, to the individual, they appear small. There are some hard choices associated with compact growth, affecting where we live and at what density. If handled correctly, costs emerging from these choices can be minimized and a large share borne by those who create them. These costs are both societally and individually small.

THE LITERATURE OF LAND AND NATURAL HABITAT CONSUMPTION

Overview

Perhaps the least quantified cost of sprawl is its impact on the consumption of natural resources. Land under current development trends is either consumed in increasing bites, or it is ignored and wasted due to uncontrolled conversion of less expensive peripheral development sites (Mills). As these lands are used for development, natural habitats for flora and fauna are consumed at significant rates (Dahl; Nelson). Forest and agricultural lands may be prematurely sacrificed while other, more centrally-located lands remain undeveloped.

A 1992 New Jersey Study

The Rutgers University impact assessment conducted by Burchell et al. examined overall land consumption under the two development scenarios of current and compact growth, and further, considered the relative conversion of agricultural acreage and impacts on fragile lands (Burchell 1992a, 1992b). Agricultural lands included such categories as cropland that is harvested, pastured lands in permanent pasture, and woodlands that could be used for agricultural purposes. Fragile lands encompassed floodplains and wetlands, acreage with steep slopes or with critical habitat designa

tion, aquifer recharge areas and critically sensitive watersheds, and stream buffers.

The analysis employed a land-consumption model at the local or community level to look at differences between the current and compact growth scenarios. This model allowed future projections of households and jobs to be converted to the demand for residential and nonresidential structures and, ultimately, to the demand for residential and nonresidential land. Historical rates of farmland development were applied to land consumed under the sprawl development future, and goals of farmland retention were applied under the compact growth scenario. A similar procedure was used for fragile land-consumption comparisons. The model, using different densities, development locations, and housing types for current versus compact growth analysis, calculated the total agricultural and fragile lands consumed under each development alternative and expressed these, as well as their differences in acres.

The analysis found that there was more than enough land statewide to accommodate the projected 20-year development (1990-2010) of persons (520,000), households (431,000), and employees (654,000) under both current and compact growth alternatives. As of 1990, there were 2 million acres available for development in the state of New Jersey. Of these 2 million acres, development between 1990 and 2010, under current conditions, would consume 292,079 acres, whereas compact growth that accommodated the same level of growth in terms of persons, households, and jobs would consume only 117,607 acres—174,472 fewer than under current development (Burchell 1992b). Thus, compact growth's overall land drawdown was 60 percent less than that of current development.

The impact assessment further found that compact growth would have the environmental advantage of preserving greater levels of fragile and agricultural lands. Reflecting historical rates of loss, under current conditions, 36,482 acres of fragile lands would be consumed for development. By contrast, under compact growth, the consumption of these lands would drop to 7,150 acres or by 80 percent. Thus, compact growth in New Jersey could not only accommodate future development but also preserve 30,000 acres of fragile environmental lands. In a similar vein, the study found that under current development, 108,000 agricultural acres would be consumed during the period 1990-2010, while under compact growth, only 66,000 agricultural acres would be converted. This represented a savings of 42,000 acres, or 39 percent of prime agricultural land.

A 1995 California Study

A study conducted by the University of California Berkeley employed the California Urban Futures (CUF) model of the San Francisco Bay Area to tabulate land consumed under three scenarios:

- Business as usual.
- Maximum environmental protection.
- Compact cities.

These scenarios were differentiated, respectively, by:

- Not restricting development either within the city or within unincorporated areas.
- Applying a range of environmental restrictions to both locations, but not restricting growth per se.
- 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 the second and third scenarios was 75,000 acres and 46,000 acres, respectively. The second scenario saved nearly 60,000 acres of prime agricultural land, 10,400 acres of wetlands, and 2,800 acres of steep-sloped land. The third scenario saved 28,000 acres of prime agricultural land, 10,400 acres of wetlands, and 8,000 acres of steep-sloped lands (Landis).

THE LITERATURE OF PUBLIC CAPITAL (INFRASTRUCTURE) COSTS

Overview

Probably the largest single sector of the literature on costs and benefits of current development is related to capital and operating costs, both public and private. Public capital and operating costs of sprawl usually refer to roads, water and sewer infrastructure, and public buildings, as well as annual expenditures to maintain them (in both small enclaves in remote locations of the region where population is growing, and central cities from which some of the population growth is being drawn).

A 1989 Florida Study

A large-scale study, *The Search for Efficient Growth* (Duncan et al. 1989), was conducted in Florida. This analysis encompassed detailed case studies of the actual costs (and revenues) incurred by several completed residential and nonresidential projects throughout the state. The projects chosen were representative of five different development patterns ranging from "scattered" to "compact." While the Florida study did not intend a current development-compact growth analysis, it is possible to group its five patterns into the two aggregate development profiles of current development and compact growth. The former includes the Florida development patterns of "scattered," "linear," and "satellite;" the latter includes the Florida "contiguous" and "compact" categories. With this grouping, the relative capital costs of current development trends versus compact growth can be determined from Florida case study information on incurred infrastructure expenses. The total capital cost for a detached unit built under current development trends in Florida approached $16,000; under compact growth, capital costs were about $10,400, or roughly 65 percent of current development. Major costs in both cases were roads and schools—in combination representing 80 percent to 85 percent of all expenditures. Capital costs related to roads were reduced by 60 percent under the compact growth scenario; school capital costs were reduced by just 7.4 percent (see Table 1).

Viewed in reverse fashion, the costs of compact growth relative to current development were less: 40 percent of current development costs for roads, 93 percent for schools, 60 percent for utilities, and slightly more (102 percent) for other capital outlays.

Two 1992 New Jersey Studies

As noted earlier, both the first and second Rutgers impact assessments considered the consequences to the State of New Jersey of a compact growth strategy versus current development trends across numerous substantive dimensions. The second study's major findings are contained in Table 2 and summarized in Table 3. To illustrate, while a similar level of growth would occur in New Jersey under both scenarios from 1990 to 2010 (an increase of 520,000 persons, 431,000 households, and 654,000 jobs), there would be significant savings under the compact growth approach with respect to infrastructure. Over the period 1990 to 2010, compact versus current development would require $699 million less investment in roads ($2,924 million

Table 1. Florida Growth Pattern Study: Capital Facility Costs Under Current Development Trends Versus Compact Growth (per dwelling unit; 1988 dollars).

Category of Capital Costs	Average of Case Studies Under Current Development Trends[1]	Average of Case Studies Under Compact Development[2]	Current Development Trends Versus Compact Development	
			Number	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. Current development, as defined here, includes 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 (e.g., 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 (e.g., Countryside, Downtown Orlando, and Southpoint).

Source: Memorandum from James Duncan and Associates to Robert W. Burchell and David Listokin, May 8, 1990; and James E. 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 FL: Department of Community Affairs, 1989

for current development versus $2,225 million for compact growth), or a 24 percent savings, $561 million less investment in water and sewer (utility) costs ($7,424 million for current development versus $6,863 million for compact growth), or a 7.6 percent savings, $173 million less investment in schools ($5,296 million for current development versus $5,123 million for compact growth), or a 3.3 percent savings.

The infrastructure model used in this study relates development density and housing type, respectively, to the demand for local/state roads and water/sewer infrastructure. In the first case, development density is directly correlated to road density in terms of lane miles of road required for two-lane (local) and four-lane (state) roads. Usually, there are significantly more local road lane-miles necessary under current versus compact development, but only small increases in state road lane-miles.

In the second case, housing type (and by association, density), is related to the amount of water and sewer use (in gallons) by development type. Usually, these differences are small. Larger and more significant are the differences observed in water/sewer infrastructure and costs. This is related to the number of subdivisions from the trunk line. The cost of ongoing water and sewer operations is a function of the number of service lines. Thus, if service lines can be saved by clustering, mixed-use, and multifamily development, long-run operating costs also should be less.

Table 2. New Jersey Impact Assessment: Summary of Impacts for Current Development Trends Versus Compact Growth.

Growth/Development Impacts[1]	Current Development[2] Trends	Compact Growth	Current Development Trends Versus Compact Growth (1990-2010)	
			Number	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	0
IV. Infrastructure ($ million)[3]				
A. Roads				
Local	$ 2,197	$ 1,630	$ 567	25.8
State	727	595	132	18.2
Total Roads	$ 2,924	$ 2,225	$ 699	23.9
B. Utilities				
Water	$ 634	$ 550	$ 84	13.2
Sewer	$ 6,790	$ 6,313	$ 477	7.0
Total Utilities	$ 7,424	$ 6,863	$ 561	7.6
C. Schools	$ 5,296	$ 5,123	$ 173	3.3
D. All Infrastructure (sum of A-C)	$ 15,644	$ 14,211	$ 1,433	9.2
V. Land Consumption (acres)				
A. Overall Land	292,079	117,607	174,472	59.7
B. Fragile Lands	36,482	6,139	30,343	83.2
C. Agricultural Lands	108,000	66,000	42,000	38.9
VI. House Price				
A. Median Cost Per Unit (1990 Dollars)	$172,567	$ 162,162	$ 10,495	6.1
B. Housing Index (Higher is More Affordable)	118	126	8	6.7

Notes: 1. For current development trends, see text.

2. For compact growth, see text.

3. In millions of 1990 dollars.

Source: Robert W. Burchell. *Impact Assessment of the New Jersey Interim State Development and Redevelopment Plan. Report III: Supplemental* AIPLAN *Assessment.* Report prepared for the New Jersey Office of State Planning, 1992b.

Table 3. Relative Infrastructure Costs of Current Development Trends Versus Compact Growth from Four Major Studies.

Cost Category	Current Development Trends	Compact Growth: Findings from Four Major Studies (in percent, relative to sprawl)				Compact Growth: Synthesis from Four Major Studies (in percent, relative to sprawl)[2]
		National Study	Florida Study[1]	New Jersey Study[4]	Michigan Study[5]	
Roads	100%	40%	73%	76%	90%	75%
Schools	100%	93%	99%	97%	NA	95%
Utilities	100%	60%	66%	92%	93%	85%
Other	100%	102%	NA	NA	NA	100%

Notes:
1. This is calculated from the base Frank findings as follows:
2. Represents a synthesis or consensus from the three studies noted in the text.
3. Derived from the Burchell et al. New Jersey impact assessment study (1992a).
4. Derived from the Burchell et al. New Jersey impact assessment study (1992b).
5. Derived from the Burchell et al. Michigan fiscal impact study (1997). (local and state roads combined; water and sewer combined).

When all components of infrastructure were summed (roads, utilities and schools), the Rutgers impact assessment found that current development patterns would necessitate a statewide infrastructure outlay of $15.6 billion from 1990 to 2010. By contrast, opting for more compact development would reduce the necessary capital investment over the two-decade period from $15.6 to $14.2 billion—representing a savings of $1.4 billion, or just under 10 percent (Table 2).

Since the focus of this analysis and the original assessment was a simultaneous comparison of the impacts of current development trends versus the impacts of compact growth, the capital infrastructure profile of these two scenarios is readily available. Compact growth relative to current development required 76 percent of the capital costs for roads, 97 percent for schools, and 92 percent for utilities (see Table 3). (The other capital category was not examined.) In short, the Rutgers study reached a conclusion similar to earlier investigations with respect to infrastructure—compact versus current development can realize savings in capital extensions required to service growth.

As would be expected, the findings from these major studies differ somewhat. For instance, compact growth allows for a 7 percent school infrastructure saving according to Duncan, while Frank and Burchell find a 1 percent savings and a 3 percent saving, respectively (Table 3). The commonalities in the direction and order of magnitude of the findings are much stronger, however, than these individual differences and are shown in Table 3 as synthesis findings from the three major studies. Findings include the following: relative to sprawl development, compact growth requires 75 percent of the infrastructure cost for roads; 95 percent of the infrastructure costs for schools; 85 percent of the infrastructure costs for utilities; and is at rough parity (100 percent) for the other capital category (Table 3).

THE LITERATURE OF DEVELOPMENT COSTS

Overview

The literature of development cost increases as a function of sprawl or compact development deals almost exclusively with residential studies. Nevertheless, the conclusions derived from comparisons of sprawl development versus compact growth in the residential studies also would be applicable to nonresidential development.

The growth control studies cited earlier in the literature review deal with the price effects of growth controls in a given community. What about overall development costs in a larger area governed by compact growth, where development would be restricted in certain localities (e.g., areas with fragile lands) while encouraged in others (areas with existing or excess infrastructure capacity, such as urban centers or suburban infill locations)? The only study to date that has considered housing affordability under compact growth on such a wide geographic basis is the impact assessment study for New Jersey conducted by Robert W. Burchell at Rutgers University.

A 1996 Michigan Study

Burchell and Neuman applied the Rutgers housing-cost model to the 18 study communities in Michigan. To calculate the effects of compact versus current development trends, the values of various types of new housing were established for each of the 18 study communities. The 1996 values by structure type, including the value of multifamily units determined by multiplying monthly rent by 100, were further disaggregated into land and structure components. On average, the land cost for a single-family home is about 25 percent of total costs; for a townhouse/duplex, it is 20 percent; and for a multifamily unit, land represents 10 percent of total costs. Thus, if the cost of a new single-family home was $150,000, $112,500 was assumed to be structure cost and $37,500 was land cost.

Residential cost changes relative to compact growth comprise primarily the land component of overall costs (Pollakowski and Wachter). If housing density is increased near areas of existing development, residential costs will theoretically decrease since land costs become a smaller proportion of total costs. On the other hand, if housing density is reduced in peripheral or rural areas, housing costs would rise as land costs become a larger proportion of total costs.

Across the 18 study communities, housing costs were typically lower near existing development than in peripheral areas. The comparison between current trends and compact growth showed that weighted average housing costs would be, on average, $10,500 less under compact growth. This, applied against a weighted average new housing cost of $162,800 (in constant 1996 dollars) under current development trends, resulted in savings of about 6 percent.

Other Studies

A number of other studies reveal that housing prices increase in the immediate area where there are compact development requirements (Fischel). For instance, Schwartz, Hansen and Green (1981) followed the effects over time of the Petaluma (California) Plan. This plan limited building permits—favoring dwellings with costly design features and developer-provided amenities and services to the community. Using a recurring (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 compact growth measures during the period. They found that after several years, Petaluma's housing prices had risen 8 percent above those of Santa Rosa.

Schwartz, Zorn and Hansen (1989) conducted a similar study of the compact growth measures in Davis, California, comparing house prices in Davis to those in a control sample of other Sacramento suburbs. They found that growth controls caused house prices in Davis to be 9 percent higher in 1980 than they would have been without them.

In Petaluma (Schwartz, Hansen and Green 1981) and in Davis (Zorn, Hansen and Schwartz 1986), 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 had dropped significantly below that of the control group (Fischel).

In Davis, on the other hand, growth controls required that those who received building permits construct a percentage of units earmarked for low-income people. Thus, the limited growth that did occur in Davis contained both low-income and high-income housing. According to Fischel, however, an unanticipated offset to this apparent success occurred. The authors noted that existing housing in Davis increased in price, reflecting the overall increase in quality. Fischel's interpretation of this outcome was that older housing was filtering up and being improved in the process. Katz and Rosen 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 was recently or currently in effect. According to Fischel, this study is particularly valuable since, unlike the above California studies, it does not focus on just a single community. The authors found that the price of houses sold in the growth-controlled communities was higher than those sold in non-growth-controlled communities.

Summary of Findings

In short, when the overall picture is examined with respect to residential construction costs under compact growth versus current sprawl development trends, the finding is that compact growth can moderate, rather than increase, the cost of housing. This is taking into account both instances of rising and lowered costs, as was done in the New Jersey impact assessment.

On the other hand, where building permits are limited and there is no attempt to offset this with the provision of affordable housing or housing at higher densities, housing costs will rise under compact growth schemes.

THE LITERATURE OF FISCAL IMPACTS

Overview

Fiscal impacts are the public costs versus revenues associated with land development (Burchell and Listokin 1978). How much does the new land use increase public service costs—as measured by services to new residents, workers and school children—versus the increase in revenues from property tax levies on the structures these people occupy, and non-tax and intergovernmental revenue sources as well?

A 1992 New Jersey Study

In one of the only studies since the Real Estate Research Corporation's *The Costs of Sprawl* to view the effects of different development patterns on public service costs, the Rutgers study by Burchell et al. used a fiscal model to view the effects of current versus compact development. The Rutgers fiscal impact model estimated the number of people, employees, and students that would be attracted by development under different development scenarios and projected future

costs versus revenues. While at the regional and state levels, population and employment projections did not vary between alternatives, at the municipal level, there were significant differences. In the scenarios analyzed for compact growth, urban communities with slack service capacity received more growth than rural areas with lesser amounts of public service infrastructure. The reduced infrastructure provision and the potentially reduced annual maintenance on this infrastructure led to more positive fiscal impacts for compact growth.

The Burchell 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 (compact growth) offered an annual $112 million (or 2 percent) fiscal advantage to municipalities. This advantage reflects the ability under the managed growth scenario to draw on usable excess operating capacity in already-developed areas as well as efficiencies of service delivery. For instance, fewer lane-miles of local roads would have to be built under the compact growth alternative, thus saving municipal public works maintenance and debt service costs. Public school districts would 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 via compact growth. Thus, municipal and school district providers of public services could be ahead fiscally by close to $400 million annually under compact versus current development, while supplying a similar quality of services.

Under current development, the State's school districts would have to provide 288,000 pupil spaces to the year 2010 (365,000 gross need less 77,000 usable excess spaces); for compact development, the need was a somewhat lower 278,000 pupil spaces, reflecting some excess space in central locations. Overall, if new space had to be built to accommodate all new students, costs of new school facilities would be approximately $5.3 billion under current development trends and $5.1 billion under compact development. Thus, $200 million (or approximately 3 percent) is potentially saved due to somewhat more excess capacity in closer-in areas being drawn upon by compact growth as opposed to what can be drawn upon by current development trends in suburban and rural areas (Burchell 1992b).

A 1996 Michigan Study

The Michigan study used the Per Capita Multiplier Method developed by Burchell and Listokin (1978), and currently used throughout the United States as the most basic form of fiscal evaluation. This method projects public service demand units in the form of future residents and workers, and these are multiplied by the current average cost per unit to provide such services. The results showed that annual municipal costs for 2020 would be $55.4 million under current development and 7 percent less, or $51.7 million, under compact growth. These costs represented annually recurring expenditures in 1996 dollars. Total annual public revenues for 2020 would be $51.0 million versus $49.2 million for current trends and compact growth, respectively. Thus, compact growth generated about 4 percent less in annual revenues. The net fiscal impacts also favored compact growth. Under current development trends, growth-generated costs exceeded revenues by $4.4 million. Under compact growth development, the figure was only $2.6 million. The overall difference, favoring compact development, was $1.8 million annually (about 3.2 percent of current costs) in 2020.

SUMMARY OF IMPACTS

Development Pattern Impacts

This summary has reviewed the literature with regard to compact growth versus current development trends for land consumption, private development costs, public capital costs (infrastructure requirements), land consumption, and fiscal impacts. The most extensive literature concerns public capital needs/costs. The empirical investigations with respect to the remaining three subject areas are more sparse. The findings are summarized as follows:

Land Consumption. Compact growth relative to current development consumes:

- 40 percent as much land overall.
- 60 percent as much of agricultural acreage and 17 percent the level of fragile lands.

Public Capital (Infrastructure) Costs. Compact growth relative to current development is:

- 75 percent as expensive with respect to roads.
- 95 percent as expensive with respect to schools.
- 85 percent as expensive with respect to utilities at parity with respect to other infrastructure.

Development Costs. Compact growth relative to current development:

- Does not increase housing costs and, in fact, may afford a small (i.e., less than 6 percent) saving.

Fiscal Impacts. Compact growth relative to current development:

- Is less costly on an annual basis to both municipality and school district by about 2 percent to 3 percent.

The Fiscal Impact Hierarchy

Up to now, this literature review has focused on the impact of development patterns on natural (land) and man-made (roads, water/sewer) infrastructure as well as public operating costs and private housing costs. Public operating costs are much more impacted by the type of residential and nonresidential development than they are by the development pattern of either. As such, fiscal impacts and the technique that estimates them, fiscal analysis, require special attention.

Costs to service people, workers and school children vary with the size of the facility brought in and with the wealth of the district (Burchell, Listokin and Dolphin 1993). Larger residential and nonresidential facilities cost a jurisdiction more, and wealthier jurisdictions tend to spend more. The form of growth (compact growth versus current development patterns) does not impact public service costs to the degree that structure type, size and location do. There are some small savings relative to the form of growth which have been discussed previously. It is now necessary to review and summarize the fiscal impacts of various types of land use, whether they are the product of current development trends or compact growth.

Generally, some types of land uses are better than others from a fiscal perspective. Nonresidential land uses, for the most part, have been shown to be superior; most standard forms of residential land uses, inferior (Table 4) (Burchell and Listokin 1994a). The fiscal impact hierarchy extends from research office parks at the top to mobile homes at the bottom. Somewhere in

Table 4. The Fiscal Hierarchy of Land Uses.

MUNICIPAL BREAK-EVEN	Research Office Parks
	Office Parks
	Industrial Development
	High-Rise/Garden Apartments (*Studio/1 Bedroom*)
	Age-Restricted Housing
	Garden Condominiums (*1-2 Bedrooms*)
	Open Space
SCHOOL DISTRICT BREAK-EVEN	Retail Facilities
	Townhouses (*2-3 Bedrooms*)
	Expensive Single-Family Homes (*3-4 Bedrooms*)
	Townhouses (3-4 Bedrooms)
	Inexpensive Single-Family Homes (*4+ Bedrooms*)
	Garden Apartments (*3+ Bedrooms*)
	Mobile Homes

Notes: The above list contains too many disclaimers to include here. Suffice it to say that fiscal impacts must always be viewed relative to the context of other properties' impacts in the jurisdiction of development. On the above list, the higher the position, the more positive the impact.

the middle are open-space lands or undeveloped and unimproved property. The hierarchy takes both costs and revenues into account. It shows which land uses—after all costs and revenues are considered—are more profitable than others. It also takes into account the number of districts for which revenues are generated as opposed to the number of districts in which costs occur. In the case of nonresidential uses, costs occur primarily in one district (municipal) while revenues are generated for two districts (municipal and school).

For the most part, although the amount of surplus or deficit for a particular land use may vary from district to district, its relative position on the fiscal hierarchy often does not vary.

CONCLUSIONS

This paper has sought to present what the literature has found about the costs of two alternative growth patterns (current development versus compact growth) and to answer questions about the impacts of various types of land uses. Of particular significance is the finding that by choosing compact growth, citizens making decisions about future public policy could po

tentially reduce land consumption and road building in their living environment by orders of magnitude of 60 percent and 25 percent, respectively (see Table 3). These are very significant societal accomplishments by any measure.

Ongoing operating costs for roads and infrastructure might also be reduced if a community's capital commitments were ultimately diminished. Additionally, by preserving land in the process of development, under compact growth, there is less need to acquire land for parks and recreation as it becomes less plentiful and more costly (see Table 2). Finally, by containing development around existing centers, these centers might be maintained as healthier entities—better able to pay their taxes in full. All of this could contribute to lower taxpayer costs in the region.

With regard to the second issue of fiscal impacts of alternative land uses, the fiscal hierarchy consisting of lightly occupied, high-value research factories at the top and intensively occupied, low-value residential structures at the bottom, holds for most land uses in most jurisdictions (Burchell and Listokin 1994a). However, most tax increases do not occur as a result of a municipality's having either the wrong or right type of land uses. Instead, increased taxes are generated by increased services that outstrip the growth in the tax base of communities, or by cutbacks in services that lag the decline of the tax base of communities.

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