Development at the Urban Fringe and Beyond: Impacts on Agriculture and Rural Land. By Ralph E. Heimlich and William D. Anderson. Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 803.

Abstract

Land development in the United States is following two routes: expansion of urban areas and large-lot development (greater than 1 acre per house) in rural areas. Urban expansion claimed more than 1 million acres per year between 1960 and 1990, yet is not seen as a threat to most farming, although it may reduce production of some high-value or specialty crops. The consequences of continued large–lot development may be less sanguine, since it consumes much more land per unit of housing than the typical suburb. Controlling growth and planning for it are the domains of State and local governments. The Federal Government may be able to help them in such areas as building capacity to plan and control growth, providing financial incentives for channeling growth in desirable directions, or coordinating local, regional, and State efforts.

Keywords: land development, sprawl, large-lot housing, land zoning, population growth, housing, specialty agriculture, high-value agriculture, rural amenities, smart growth

Contributors

Charles Barnard—Wrote sections on costs of use value assessment and purchase of development rights, the effect of technology on employment location, and metropolitan agriculture.

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Dedication

This report is dedicated to the memory of Robert Otte, who died November 6, 2000. As Chief of the Land Resources Branch of the Economic Research Service's Natural Resource Economics Division in the late 1960's, Dr. Otte pioneered early research on the urbanization of agricultural land. He authored *Farming in the City's Shadow* in 1974, and was co-author of ERS's first study of land use change in urbanizing areas, *Dynamics of Land Use in Fast Growth Areas* in 1976. Dr. Otte was a gentleman, a generous colleague, and a mentor to many land economics researchers, in ERS and other institutions, who followed in his footsteps.

William D. Anderson

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Summary

In the early 1970's, bipartisan legislation was introduced in Congress to establish a national land-use policy, but failed after extensive debate. In the decades that followed, the urbanized area in the United States has more than doubled. Public concerns about ill-controlled growth once again have raised the issue of the Federal role in land-use policy. While anecdotes are legion, there are surprisingly few places to find a comprehensive picture of land-use changes in urbanizing areas, relative to the rural landscape. This report describes the forces driving development, its character and impacts on agriculture and rural communities, the means available to channel and control growth, and the pros and cons of potential Federal roles. The report also provides detailed, documented, objective evidence culled from the literature and from original analyses.

What Is Sprawl?

This report is about urban development at the edges of cities and in rural areas, sometimes called "urban sprawl." Because "sprawl" is not easily defined, this report is couched in the more neutral terms "development" or "growth," without making implicit judgments about the quality or outcomes of that development or growth. Concerns about development around urban areas are not new, but have arisen periodically during most of the last century, and certainly since automobile ownership became widespread after World War II. What lessons have been learned about urban development and the Federal role in managing it?

The processes of land-use change are well understood and flow predictably from population growth, household formation, and economic development— Changes in land use are the end result of many forces that drive millions of separate choices made by homeowners, farmers, businesses, and government. The ultimate drivers are population growth and household formation. Economic growth increases income and wealth, and preferences for housing and lifestyles, enabled by new transportation and communications technologies, spur new housing development and new land-use patterns. Metropolitan areas grow organically, following well-known stages of growth.

There are two kinds of growth, but both affect the amount and productivity of agricultural land and create other problems—Our existing urban areas continue to grow into the countryside, and more isolated large-lot housing development is occurring, generally beyond the urban fringe.

Development imposes direct costs on the communities experiencing it, as well as indirect costs in terms of the rural lands sacrificed to it—A number of studies show that less dense, unplanned development requires higher private and public capital and operating costs than more compact, denser planned development. Residential development requires $1.24 in expenditures for public services for every dollar it generates in tax revenues, on average. By contrast, farmland or open space generates only 38 cents in costs for each dollar in taxes paid.

Continued demand for low-density development despite negative consequences for residents can be understood as a market failure—Consumers, businesses, and communities fail to anticipate the results of development because they often lack information on potential or approved development proposals for surrounding land. Often, communities fail to plan and zone to provide an institutional framework within which development can proceed. Real estate markets are based on many small decisions which, when taken without an overall context, produce results that can neither be envisioned by nor anticipated by consumers and developers. Inaccurate judgments about future landscapes are locked in because development is irreversible.

Urban growth and development is not a threat to national food and fiber production, but may reduce production of some high-value or specialty crops— Despite doubling since 1960, urban area still made up less than 3 percent of U.S. land area in 1990 (excluding Alaska). Developed area, including rural roads and transportation, made up less than 5 percent in 1992. The increase in urban area in the United States poses no threat to overall U.S. food and fiber production, but some crops in some areas are particularly vulnerable to development.

Agriculture can adapt to development, but does so by changing the products and services offered— Low-density, fragmented settlement patterns leave room for agriculture to continue. Farms in metropolitan areas are an increasingly important segment of U.S. agriculture, making up 33 percent of all farms, 16 percent of cropland, and producing a third of the value of

U.S. agricultural output. However, to adapt to rising land values and increasing contact with new residents, farmers may have to change their operations to emphasize higher-value products, more intensive production, enterprises that fit better in an urbanizing environment, and a more urban marketing orientation.

Benefits of conserving rural land are difficult to estimate and vary widely depending on the circumstances—Based on information and assumptions about the number of acres likely subject to development in the future, and limited studies of residents' willingness to pay to conserve farmland and open space, we estimate that households would be willing to pay $1.4-$26.6 billion per year to conserve rural lands. This equals $13.5 to $255.8 billion in present value. Conserving land for agriculture helps preserve farming in the rural economy, and is often seen as a bulwark against the worst effects of development.

Local governments generally do not develop adequate capacity to plan for and manage growth until it is too late to effectively channel development— Because urban growth processes are well understood, strategically directing development to the most favorable areas well in advance of urban pressures offers the greatest hope for controlling growth. Local governments often fail to appreciate impending growth facing them, and generally lack capacity to develop adequate responses before growth overwhelms them.

State governments can do more to deal with growth strategically—Increasingly, States are realizing that local governments cannot adequately address growth pressures that transcend local boundaries. Some of the more progressive States have adopted "smart growth" strategies that actively direct transportation, infrastructure, and other resources to channel growth into appropriate areas.

The cost of effective land conservation incentives would be large, but if resources were redirected, almost one-third of the cropland with the greatest development potential could be protected—Purchasing the development rights to rural land effectively protects it from being developed, while continuing farm use. We estimate the cost to purchase development rights on cropland most likely subject to urban pressure over the next 30 to 50 years at $87-$130 billion. If tax expenditures currently devoted to use-value assessment were redirected to purchase of development rights, almost one-third of the cropland with greatest potential for development could be protected.

There are neither clear requirements for nor restrictions on Federal roles in managing growth—Historically, authority over land-use decisions has been reserved to the States, which have delegated these powers to local governments. However, the evolution of environmental policy shows an expanding Federal involvement in site-specific, local circumstances that recur across the Nation. The Federal Government has no constitutional mandate to take action on urban growth and development issues, but it can define an appropriate role for itself.

Potential Federal roles include:

- Helping Increase State and Local Planning Capacity
- Coordinating Local, Regional, and State Efforts
- Coordinating Federal Development Activities and Growth Management Goals
- Funding Monetary Conservation Incentives
- Conserving Rural Amenities as Part of Greater Agricultural and Trade Policy Goals.

Development at the Urban Fringe and Beyond

Impacts on Agriculture and Rural Land

Ralph E. Heimlich and William D. Anderson

I. Overview

In the early 1970's, bipartisan legislation was introduced in Congress to establish a national land-use policy, but failed after extensive debate. In the decades that followed, urban area in the United States has more than doubled. Public concerns about ill-controlled growth once again have raised the issue of the Federal role in land-use policy.

Purpose of This Report

Although land-use issues have traditionally been the prerogative of State and local government, policymakers at the Federal level are increasingly urged to respond to concerns about development and growth, particularly with regard to their impacts on agriculture and rural land uses. While anecdotes are legion, and much has been written by commentators, advocates, and experts, there are surprisingly few places to find a comprehensive picture of land-use changes in urbanizing areas, relative to the rural landscape. This report responds to that need in two ways.

This overview provides a summary of our findings about the forces driving development, its character and impacts on agriculture and rural communities, the means available to channel and control growth, and the pros and cons of potential Federal roles.

The following chapters provide the details, presented in a documented, objective way that make the case for the arguments presented here. A consensus culled from the literature supports some of the points, while original analyses presented in this report have not been published elsewhere.

What is Sprawl?

This report is about urban development at the edges of cities and in rural areas, sometimes called "urban sprawl." With no widely accepted definition of sprawl (U.S. GAO, 1999; Staley, 1999), attempts to define it range from the expansive to the prescriptive.

Most definitions have some common elements, including:

- Low-density development that is dispersed and uses a lot of land;
- Geographic separation of essential places such as work, homes, schools, and shopping; and
- Almost complete dependence on automobiles for travel.

Without an agreed definition, any growth in suburban areas may be accused of "sprawling."

Short of a return to a form of urban living not seen since before World War II, it is not clear how growth can be accommodated at suburban densities without incurring the worst features of "sprawl." Because "sprawl" is not easily defined, this report is couched in the more neutral terms "development" or "growth," without making implicit judgments about the quality or outcomes of that development or growth. See *Trends In Land Use: Two Kinds of Growth* p. 9.

How To Think About Development

Concerns about development around urban areas are not new, but have arisen periodically during most of the last century, and certainly since automobile ownership

became widespread after World War II. Amid the environmental concerns during the 1970's, bipartisan legislation was introduced in Congress to establish a national land-use policy. Recognizing the primacy of State authority over land use, the legislation sought to provide Federal grants to States to strengthen their ability to plan for development and channel growth. After 5 years of debate, the legislation was passed in the Senate, but narrowly defeated in the House on June 11, 1974. What lessons have been learned about urban development and the Federal role in managing it in the 26 years since then?

There are two kinds of growth, but both affect the amount and productivity of agricultural land and create other problems—Our existing urban areas continue to grow into the countryside, and more isolated large-lot housing development is occurring, generally beyond the urban fringe.

At the urban fringe—The urban "fringe" is that part of metropolitan counties that is not settled densely enough to be called "urban." Low-density development (2 or fewer houses per acre) of new houses, roads, and commercial buildings causes urban areas to grow farther out into the countryside, and increases the density of settlement in formerly rural areas. The extent of urbanized areas and urban places, as defined by the Bureau of Census, more than doubled over the last 40 years from 25.5 million acres in 1960 to 55.9 million acres in 1990, and most likely reached about 65 million acres by 2000.

Beyond the urban fringe—Another kind of development often occurs farther out in the rural countryside, beyond the edge of existing urban areas and often in adjacent nonmetropolitan counties. Development of scattered single-family houses removes land from agricultural production and changes the nature of open space, but is not "urban." Large lots dominate this process, and growth in large-lot development has accelerated with business cycles since 1970. Nearly 80 percent of the acreage used for new housing construction in 1994-97—about 2 million acres—is outside urban areas. Almost all of this land (94 percent) is in lots of 1 acre or larger, with 57 percent on lots 10 acres or larger. About 16 percent was located in existing urban areas and 5 percent was on farms. See *Two Kinds of Growth,* p. 12.

Growth in developed areas is increasing, but at rates only slightly higher than in the past—Urbanized areas and urban places increased at about the same 1 million acres per year between 1960 and 1990. Developed land, including residential and other development that is not dense enough to meet urban definitions, increased from 78.4 million acres in 1982 to 92.4 million acres in 1992, and was estimated to be about 107 million acres in 2000. The rate of increase in developed land grew from 1.4 million acres per year to about 1.8 million acres. See *Two Kinds of Growth,* p. 12.

The processes of land-use change are well understood and flow predictably from population growth, household formation, and economic development—Changes in land use are the end result of many forces that drive millions of separate choices made by homeowners, farmers, businesses, and government. The ultimate drivers are population growth and household formation. Economic growth increases income and wealth, and preferences for housing and lifestyles, enabled by new transportation and communications technologies, spur new housing development and new land-use patterns. Metropolitan areas grow organically, following well-known stages of growth.

Almost alone among developed nations, the United States continues to add population from high fertility rates, high immigration, and longer life expectancy, increasing 1 percent per year, or another 150 million people by 2050. Average household size has dropped to 2.6 persons, creating about 1 million new households, the unit of demand for new housing, each year in the 1990's.

Increased income and wealth increased the number of new houses constructed each year by 1.5 million units, faster than the rate of household formation. Two-thirds of these houses are single-family dwellings. While average lot sizes have been dropping near cities as owners turn to townhouses and condominiums, a parallel growth in large-lot (greater than 1 acre) housing has occurred beyond the urban fringe.

Metropolitan expansion since 1950 has occurred because rural people moved off the farms, and residents of the densely populated central cities dispersed to surrounding suburbs. Urbanized areas (excluding towns of 2,500 or more) increased from 106 to 369 and expanded to five times their size. Population density in urbanized areas dropped by more than 50 percent, from 8.4 to 4 people per acre, over the last 50 years. Growth is spilling out of metropolitan areas, as population disperses to rural parts of metropolitan counties and previously rural nonmetropolitan counties.

Enabling this dispersion are investments in new infrastructure such as roads, sewers, and water supplies. New information and communication technologies, such as the Internet and cellular telephone networks, facilitate population in rural areas, and free employment to follow. New retail, office, warehouse, and other commercial development follows in the wake of new housing development, to serve the new population and to employ the relocated labor force. See *Driving Forces,* p. 15.

There are benefits of low-density development that attract people—Living beyond the edge of the city is a lifestyle much sought after by the American people. While 55 percent of Americans living in medium to large cities preferred that location, 45 percent wanted to live in a rural or small town setting 30 or more miles from the city (Brown et al., 1997). Of those living in rural or small towns more than 30 miles from large cities, 35 percent wanted to live closer to the city. The urban fringe is thus under development pressure from both directions. The most obvious benefit is that growth in rural areas has allowed many people, including those who cannot afford city real estate, to buy single-family homes because land costs are cheaper on the fringe than in the core.

The automobile imposes private and social costs in exchange for the comfort, flexibility, low door-to-door travel time, freight-carrying capacity (for shopping trips), cheap long-distance travel, and aesthetic benefits of extensive, automobile-dependent development. Air quality improvements may also result from decentralizing population and employment, because emissions are dispersed over larger rural airsheds and are reduced by higher speeds. Automobile pollution is more strongly related to the number of trips than to the length of each trip, with a major part of auto pollution deriving from cold starts.

Not everyone wants to live the rural lifestyle. The "new urbanism" school of urban design is redesigning conventional suburban developments as small towns and finding a market (Chen, 2000; Duany et al., 2000). In 1992, 55 percent of those surveyed living in large cities (over 50,000) preferred that type of community (Brown et al., 1997). See *Demand for Low-Density Development,* p. 17.

Development imposes direct costs on the communities experiencing it, as well as indirect costs in terms of the rural lands sacrificed to it—A number of studies show that less dense, unplanned development requires higher private and public capital and operating costs than more compact, denser planned development. Eighty-five studies gauging the cost of community services around the country have shown that residential development requires $1.24 in expenditures for public services for every dollar it generates in tax revenues, on average. By contrast, farmland or open space generates only 38 cents in costs for each dollar in taxes paid. See *Impacts on Taxpayers,* p. 28.

Finally, development can disrupt existing social, community, environmental and ecological patterns, imposing a variety of costs on people, wildlife, water, air, and soil quality. Agricultural production has its own negative environmental impacts, but these are generally less severe than those from urban development. See *Impacts on Landscape, Open Space, and Sense of Community,* p. 31.

However, does moving out into the "country" ultimately destroy all the good things that prompt that move? In the words of the National Governor's Association, "In the context of traditional growth patterns, the desire to live the 'American Dream' and purchase a single-family home on a large lot in a formerly open space can produce a negative outcome for society as a whole" (Hirschorn, p. 55).

Continued demand for low-density development despite negative consequences for residents can be understood as a market failure—Consumers, businesses, and communities fail to anticipate the results of development because they often lack information on potential or approved development proposals for surrounding land. When communities fail to plan and zone, there is no institutional framework within which development can proceed, and little information to help housing buyers anticipate their future landscape setting.

Spillovers from development include the loss of rural amenities, open space, and environmental goods when previously existing farms and rural land uses are developed. Negative spillovers from increased housing consumption in developing areas can include traffic congestion, crowding, and destruction of visual amenities. If the landscape features that contribute to rural amenity were marketed in developments, housing prices would be higher.

Real estate markets are based on many small decisions which, when taken without an overall context, produce results that can neither be envisioned by nor anticipated by consumers and developers. Cumulative impacts

from this myriad of decisions can be large, but are not reflected in market prices until disamenities become large. Inaccurate judgments about future landscapes are locked in because development is irreversible. See *An Economic Interpretation of the Demand for Low-Density Development,* p. 36.

Urban growth and development is not a threat to national food and fiber production, but may reduce production of some high-value or specialty crops— Despite doubling since 1960, urban area still made up less than 3 percent of U.S. land area in 1990 (excluding Alaska). Developed area, including rural roads and transportation, made up less than 5 percent in 1992. Development affects local agricultural economies and can cause other environmental and resource problems in local areas, but the increase in urban area in the United States poses no threat to U.S. food and fiber production. Some crops in some areas are particularly vulnerable to development. For example, 61 percent of U.S. vegetable production is located in metropolitan areas, but vegetable production takes up less than 1 percent of U.S. cropland. See *Consequences for Farming,* p. 38.

Agriculture can adapt to development, but does so by changing the products and services offered— Low-density, fragmented settlement patterns leave room for agriculture to continue. Farms in metropolitan areas are an increasingly important segment of U.S. agriculture. They make up 33 percent of all farms, 16 percent of cropland, and produce a third of the value of U.S. agricultural output. However, to adapt to rising land values and increasing contact with new residents, farmers may have to change their operations to emphasize higher value products, more intensive production, enterprises that fit better in an urbanizing environment, and a more urban marketing orientation.

Development can be profitable for farmers who can see and take advantage of opportunities in the new situation. Forces of urbanization allow a variety of farm types to coexist. Farms in metropolitan areas are generally smaller, but produce more per acre, have more diverse enterprises, and are more focused on high-value production than nonmetropolitan farms. Metropolitan agriculture is characterized by recreational farmers who follow both farm and non-farm pursuits; a smaller group of adaptive farmers who have accommodated their farm operation to the urban environment; and a residual group of traditional farms that are trying to survive in the face of urbanization. Both of the latter types are generally working farms. See *Consequences for Farming,* p. 38.

Benefits of conserving rural land are difficult to estimate, and vary widely depending on the circumstances—Because there are no markets for some characteristics of land, such as scenic amenity, there are no observable prices apart from the land's value for development. Lacking prices, it is difficult to develop economic benefit measures for policymaking.

Rural lands in a working landscape provide economic benefits as resources for agricultural production, as sources of employment, and through property and income taxes. Working landscapes are defined as farm, ranch, and forest lands actively used in agricultural or forestry production. While agricultural production can create environmental problems of its own, properly managed farmlands provide nonmarket benefits from improving water and air quality, protecting natural biodiversity, and preserving wetlands relative to development. They create aesthetically pleasing landscapes and can provide social and recreational opportunities. The rural landscape reflects and conserves rural culture and traditions, and maintains traditions of civic leadership and responsibility in voluntary rural institutions, such as fire companies and village boards. See *Impacts on Landscape, Open Space, and Sense of Community,* p. 31.

Based on information and assumptions about the number of acres likely subject to development in the future, and on limited studies of residents' willingness to pay to conserve farmland and open space, we estimate that households would be willing to pay $1.4-$26.6 billion per year to conserve rural lands. In addition, another $0.7-$1.1 billion in sediment and water quality damages would be avoided if the land were prevented from being developed. Conserving land for agriculture helps preserve farming as a part of the rural economy, and is often seen as a bulwark against the worst effects of development. See *Benefits of Farmland and Open Space,* p. 44.

Local governments generally do not develop adequate capacity to plan for and manage growth until it is too late to effectively channel development— Because urban growth processes are well understood, strategically directing development to the most favorable areas well in advance of urban pressures offers the greatest hope for controlling growth. Planning and zoning have generally been upheld by the courts as valid regulation so long as a reasonable basis for them is laid

out. If planning is not in place as development begins to occur, property owners' expectations about higher land values can exacerbate property rights conflicts and complicate subsequent growth-control efforts. Local governments often fail to appreciate impending growth facing them, and generally lack capacity to develop adequate responses before growth overwhelms them.

Better planning and zoning is central to the ability to respond to growth. A U.S. General Accounting Office survey found that 75 percent of the communities that were concerned with "sprawl" were highly involved in planning for and managing growth (U.S. GAO, 2000, p. 99).

However many cities and counties may be falling short of what is needed to control and manage growth effectively. A recent survey of Alabama's mayors and county commissioners found that only a minority of the responding officials (18 percent of the mayors and 19 percent of the commissioners) believed they currently had the necessary staff and resources to plan and manage growth effectively. High-growth communities were only somewhat more likely to have the capacity to manage growth than were other communities.

Most of the smaller rural towns do not have a full-time planner. To meet their planning needs, these communities may be served by a circuit riding planner, or several towns and a county may combine their efforts to set up one planning office to serve their joint needs. Even at the county level, rural planners often must spend part of their time doing other duties. See *Local Responses to Growth*, p. 50.

State governments can do more to deal with growth strategically—Our Constitution reserves control of land use to the States, which usually have delegated the responsibility to local governments. Increasingly, States are realizing that local governments cannot adequately address growth pressures that transcend local boundaries. Some States have adopted "smart growth" strategies that actively direct transportation, infrastructure, and other resources to channel growth into appropriate areas.

The term "smart growth" is a catch-all phrase used to describe a group of land-use planning techniques that influence the pattern and density of new development. In general, smart growth strategies represent a movement away from State-imposed requirements for local compliance with State planning goals. Because smart growth strategies tend to use financial incentives to encourage voluntary adoption, they are generally supported by a broad spectrum of interest groups. These strategies also garner support because they direct, rather than inhibit, growth and development. There's no 'one size fits all': the specific smart-growth strategies that have been adopted vary by location but often share common elements. Smart-growth principles favor investing resources in center cities and older suburbs, supporting mass transit and pedestrian-friendly development, and encouraging mixed-use development while conserving open space, rural amenities, and environmentally sensitive resources (Hirschhorn 2000). These strategies also typically remove financial incentives provided by State funding to develop outside designated growth areas. In essence, smart growth encourages development in designated areas without prohibiting development outside them. See *Slow Growth, No Growth, and Smart Growth,* p. 55.

Existing monetary incentives for conserving rural land are not as effective as they could be—Use-value assessment, enacted in every State, is one of the most widespread public policies aimed at conserving rural land. Under use-value assessment, the owner is taxed based on what the land could earn in agriculture, rather than the higher developed value. We estimated the cost of tax reductions under use-value assessment nationally at $1.1 billion per year.

However, most students of use-value assessment acknowledge that it is not effective at preventing development. use-value assessment spreads resources over all qualifying rural land, providing a small incentive to conserve land to all landowners. The size of the tax reduction is insufficient to keep land with the highest development potential from conversion, while tax expenditures to less developable land produce little result. Redirecting tax expenditures on use-value assessment could increase the resources available for incentives to conserve the most developable land, but could make some land currently getting the tax subsidy more vulnerable to urbanization and would face stiff opposition from property owners currently enjoying the tax reduction. See *Monetary Incentives for Conserving Farm and Forest Land,* p. 57.

The cost of effective incentives would be large, but if resources were redirected, almost one-third of the cropland with the greatest development potential could be protected—Purchasing the development rights to rural land effectively protects it from being developed. The landowner retains ownership and can continue to farm the land, but the deed restriction con-

tinues indefinitely. The implicit economic value of the easement is the difference between the unrestricted or market value of the parcel and its restricted or agricultural value.

Nineteen States have State-level PDR (purchase of development rights) programs using public funds to compensate landowners for the easements on otherwise private farm or forest land. In addition, at least 34 county programs in 11 States operate separate programs. The American Farmland Trust estimates that, nationwide, PDR programs have cumulatively protected 819,490 acres of farmland with an expenditure of $1.2 billion.

We estimate the cost to purchase development rights on cropland most likely subject to urban pressure over the next 30 to 50 years at $88-$130 billion. If tax expenditures currently devoted to use-value assessment were redirected to purchase of development rights, almost one-third of the cropland with greatest potential for development could be protected.

Targeting funds to land under less development pressure could protect the same amount of land at lower cost. For example, development rights on the 25 million acres under medium urban pressure are estimated to cost $25 billion, less than one-third the cost of the 33 million acres under heaviest development pressure. Selecting land with lowest current development pressure would reduce costs to $18 billion.

Even if funds were available to purchase development rights, it may not be desirable to do so. The development pressure exerted on this land will not disappear if this cropland is protected. While some growth might be accommodated in existing urban areas, demand for other rural land would intensify, and growth could fragment even more as development moves out farther into the rural countryside. Purchasing development rights is also no guarantee that the land will be used for working agricultural enterprises. The perpetual deed restrictions could prevent future desirable adjustments in land-use patterns. See *Monetary Incentives for Conserving Farm and Forest Land,* p. 57.

There are neither clear requirements for nor restrictions on Federal roles in managing growth—Historically, authority over land-use decisions has been reserved to the States, who have delegated these powers to local governments. However, the evolution of environmental policy shows an expanding Federal involvement in site-specific, local circumstances that recur across the Nation. The Federal Government has no constitutional mandate to take action on urban growth and development issues, but it can define an appropriate role for itself. See *Potential Federal Roles,* p. 65.

Federal activity in the potential roles identified below is described and pros and cons of expanding each role are enumerated.

Potential Federal Roles

Helping Increase State and Local Planning Capacity—The Federal Government has had a long history of programs to improve the planning capabilities of State and local governments. Perhaps the most notable of these efforts was the HUD 701 planning grant program, established in 1954 (40 USC 461). As late as 1975, the HUD 701 program spent $100 million per year paying as much as two-thirds of the costs of an "ongoing comprehensive planning process" required of all grant recipients. However, the budget was cut to $75 million in 1976 and was gradually phased down until eliminated in the early 1980's.

Within the U.S. Department of Agriculture, the Rural Development Act of 1972 established the Section A-111 Rural Development Planning Grants, also funded into the 1980's. In 1996, the farm bill established new authority for the Rural Business Opportunity Grant program (RBOG), which received $3.5 million in FY2000 appropriations. RBOG provides money to nonprofits, public bodies, Indian tribes, and cooperatives for planning and technical assistance to assist economic development in rural areas. FY 2001 appropriations legislation increased the funding for RBOG to $8 million. Several other smaller USDA grant programs could potentially assist local communities with planning, but they are not specifically directed at planning to guide growth and development and are not integrated into a coordinated program.

Pros—Funding requirements for such programs would be relatively small, and could potentially leverage significant impacts. Impacts from limited funding for such programs could be increased by targeting them to the areas most likely affected by growth in the medium term. Limiting program activities to those most directly relevant to guiding new growth and development would also increase the impact of the program.

Cons—Failures in past programs were attributed to wide use of consultants who provided little service for the money spent, and who did little to add permanently

to local government planning capacity. Emphasis on "paper plans" did little to actually direct growth. Targeting funds to areas immediately affected by development wasted resources on efforts that were already too late, while spreading funding widely included areas with little development pressure in reasonable timeframes.

Coordinating Local, Regional, and State Efforts— Urban growth processes often create multi-jurisdictional impacts. Federal coordination and integration have been exercised in other areas of environmental concern, such as water quality, water quantity, and air quality. In addition, the U.S. Office of Management and Budget Circular A-95 review process formerly guided Federal agencies for cooperation with State and local governments in the evaluation, review, and coordination of Federal assistance programs and projects. A-95 review is no longer mandated by the Federal Government, although the process is still voluntarily practiced by some States. USDA has had a long history of area-wide coordination, dating back to efforts like the Great Plains Agricultural Council, the Resource Conservation and Development Council (RC&D), the Small Watershed Program (PL-566), and various river basin planning processes. While these have generally been focused on agricultural, resource, or rural development concerns, their extension to urban development and growth control issues would be reasonable.

Pros—Past Federal funding for transportation, water, and sewer construction and other major infrastructure projects has been identified as a major driver in growth and development. Explicitly monitoring and reviewing potential impacts on urbanization from such investments could, at a minimum, defuse these accusations. Federal funding could serve as a rationale for efforts to coordinate State and local growth control activities, especially where these cross jurisdictional boundaries. Such efforts would cost very little, but would leverage existing expenditures.

Cons—Without convincing resolution to reduce or deny funding to State and local governments that do not cooperate, attempts at coordination could prove futile and frustrating. Congressional attempts to obtain additional funding for local constituents can be at odds with Executive branch notions of coordination and integration.

Coordinating Federal Development Activities and Growth Management Goals—Lines between areas needing development assistance and those suffering from problems of growth and development are geographic ones, and are often exceedingly fine, and shift over time. The Federal Government has had a long history of programs to foster development, and less experience at helping control it. The superficial dichotomy disappears when considered in the context of directing growth and development to appropriate places and under an appropriate timetable, which serves both sets of interests.

Pros—A wide array of rural development and economic development activities in the Departments of Agriculture and Commerce, abetted by less direct activities in the Departments of Housing and Urban Development, Transportation, and Defense, date at least to the War on Poverty and related efforts of the 1960's. The existing institutional structure of these programs could be redirected to growth control and management, but would require new visions by leadership. Some existing resources could be leveraged.

Cons—These programs have become entrenched and rather balkanized and may be difficult to integrate into an effort of sufficient weight to effectively deal with the problem. While pro- and anti-growth interests would hopefully recognize common ground in well-planned and appropriate development, extremes on both sides may be difficult to persuade, and both sides may be suspicious of Federal help.

Funding Monetary Conservation Incentives—The Federal Government has often been enlisted as an ally with deep pockets, and analogous programs for soil and water conservation, wildlife habitat acquisition, and other land resource issues have existed since the 1930's. USDA's Farmland Protection Program was authorized in the 1996 Farm Act for up to $35 million in matching funds for State programs over 6 years. The initial funding was $33.5 million and it was spent to protect 127,000 acres in over 19 States. The goal of the program is to protect between 170,000 and 340,000 acres of farmland. An additional $10 million was appropriated in FY2000. Direct Federal acquisition of easements is included in USDA's Conservation Reserve Program and Wetland Reserve Program, as well as in several of the U.S. Fish and Wildlife Service's habitat programs.

Pros—Limited Federal funding for farmland protection easements could act as seed money for programs in States with no current program, or as a bonus for States doing a particularly effective job. Utilizing existing State programs may be cost-effective because it both

avoids creating a new bureaucracy within the Federal Government and provides an incentive to States that have not yet developed a program to do so. By carefully specifying rules for matching State funding, such a program could avoid discouraging State effort, and could maximize the incentive for new programs.

Cons—As outlined above, the amount of land and resources subject to development is large and State programs are relatively small, posing questions about the effectiveness of a small Federal program and larger questions about the ultimate size needed to make an impact. While the marginal benefits of a small program at this point are likely to be greater than the costs, the wisdom of a larger program becomes problematic. Questions about the displacement of growth and the longrun fate of protected land become more significant as the amount of land protected increases.

Conserving Rural Amenities as Part of Greater Agricultural and Trade Policy Goals—Conserving the amenities provided by rural land is no longer a matter of merely domestic concern. Proposals to direct agri-environmental assistance are widespread in the European Union and other Organization for Economic Cooperation and Development (OECD) countries. Such efforts meet the "green box" requirements for acceptable agricultural policies under agricultural trade reforms in the Uruguay Round of the General Agreement on Tariffs and Trade (GATT). Some proponents of greater Federal involvement in rural land conservation believe that a larger share of Federal funding for agriculture could be directed toward land conservation through agri-environmental payments designed to preserve more of the multiple functions of agriculture in an urbanizing context. While not required by trade agreements to date, such proposals are allowed by them and may garner support from constituents in urbanizing areas, the urban fringe, and among agricultural communities.

Pros—Frameworks for agri-environmental payments have already been proposed in the form of the Conservation Security Act of 2000 (S.3260/H.R. 5511), introduced by Senator Harkin and Congressman Minge, and in the Clinton Administration's proposal for a Conservation Security Program in October 2000. While not explicitly addressing farmland protection, eligible land in urbanizing areas could be included. This kind of program helps align U.S. agricultural support programs with legitimate purposes recognized in trade liberalization agreements.

Cons—The farmland conservation issues in Europe and the United States are fundamentally different. While European efforts are largely aimed at keeping economically marginal farmland from abandonment, U.S. concerns are with preventing otherwise viable farms from being developed. The latter is a far more expensive proposition. Channeling large amounts of assistance to farms in urbanizing areas risks losses if incentives are not sufficiently large to prevent development, and may be pyhrric if protected farms cannot viably continue in operation, despite protection. On balance, preventing the environmental problems from losing farms in urbanizing areas may not yield benefits as large as correcting environmental problems from farming in more rural areas.

Organization of the Remainder of the Report

The remainder of the report provides a more in-depth, documented discussion of this overview. The next two chapters describe trends in land use and the two kinds of growth that are occurring around cities, then enumerate the driving forces behind these trends. The fourth chapter describes the costs of growth in rural areas, including public and taxpayer costs, and the environmental and other benefits of conserving farmland. The fifth chapter outlines consequences for agriculture and looks at the problems and opportunities presented by urbanization. A partial estimate of the nonmarket benefits of farmland conservation is derived from the literature on willingness-to-pay for farmland preservation. The sixth chapter looks at State and local responses to urban development, provides information on local capacity to deal with growth, and summarizes the new State initiatives characterized as "smart growth." The final chapter ends the report with an assessment of potential Federal roles.

II. Trends in Land Use: Two Kinds of Growth

In the early 1970's, bipartisan legislation was introduced in Congress to establish a national land-use policy. The proposals, recognizing the primacy of State authority over land use, would have provided Federal grants to States to better manage growth and development. The bills were debated for 5 years and passed by the Senate, but died on a narrow vote in the House on June 11, 1974.

In the decades that followed, urban area in the United States has more than doubled. Some of this growth has been at low densities, with little planning, and has fragmented the rural landscape, prompting communities, States, and the Federal Government to examine more closely unplanned development and its consequences, including the loss of productive farmland. Public concerns about the consequences of ill-controlled growth once again have raised the issue of the Federal role in land-use policy.

Anecdotes of uncontrolled growth across the Nation abound:

- From 1950 to 1990, St. Louis experienced a 355-percent growth in developed land even though population increased by just 35 percent (Missouri Coalition for the Environment).
- Between 1970 and 1990, Kansas City's population grew by 29 percent while developed land increased by 110 percent (Missouri Coalition for the Environment).
- Between 1990 and 1996, the Denver metropolitan region increased by 66 percent. If each county in the Denver metro area grew based on its current comprehensive plan, Denver's urbanized area would swell to 1,150 square miles, an area larger than California's major cities combined (Sierra Club, 1998).
- The Chicago metropolitan area now covers over 3,800 square miles. Over the last decade, the population of the area grew by only 4 percent, but land occupied by housing increased by 46 percent and commercial land uses by 74 percent (U.S. OTA, 1995).
- From 1950 to 1980, population in the Chesapeake Bay watershed increased by 50 percent, while land used for commercial and residential activity climbed 180 percent (EPA, 1993).
- Philadelphia's population increased 2.8 percent between 1970 and 1990, but its developed area increased by 32 percent (U.S. OTA, 1995).

While anecdotes are legion, and much has been written by commentators, advocates, and experts, there are surprisingly few places to find a comprehensive picture of land-use changes in urbanizing areas, relative to the rural landscape. This report responds to that need.

What Is Sprawl?

This report is about urban development at the edges of cities and in rural areas, often referred to as "urban sprawl." There is no widely accepted definition of sprawl (U.S. GAO, 1999; Staley, 1999). Definitions range from the expansive…

> "When you cannot tell where the country ends and a community begins, that is sprawl. Small towns sprawl, suburbs sprawl, big cities sprawl, and metropolitan areas stretch into giant megalopolises—formless webs of urban development like Swiss cheeses with more holes than cheese."
>
> U.S. House, 1980.

> "Cities have become impossible to describe. Their centers are not as central as they used to be, their edges ambiguous, they have no beginnings and apparently no end. Neither words, numbers, nor pictures can adequately comprehend their complex forms and social structures. …It's almost as if Frank Lloyd Wright's 1932 tract against the metropolis, *The Disappearing City*, has been vindicated, and the diffusionary proposal of Broadacre City has become the de facto ideology of urbanism."
>
> Ingersoll, 1992.

to the prescriptive…

> "…a spreading, low-density, automobile dependent development pattern of housing, shopping centers, and business parks that wastes land needlessly."
>
> Pennsylvania 21st Century Environment Commission cited in Staley, 1999.

Burchell et al. (1998) devote the first chapter of their report, "The Costs of Sprawl – Revisited," to defining the elusive term. Commonly cited are several features

that are captured in urban economist John F. McDonald's characterization:

- Low-density development that is dispersed and uses a lot of land;
- Geographic separation of essential places such as work, homes, schools, and shopping; and
- Almost complete dependence on automobiles for travel.

Myers and Kitsuse (1997) point out that "the very lack of agreed definition about what constitutes density, sprawl or compactness prevents any authoritative measurement." Any growth in suburban areas may be accused of "sprawling." Planned developments at relatively high densities can be accused of accelerating sprawl. As Ewing (1997) points out,

> . . sprawl is a matter of degree. The line between scattered development, a type of sprawl, and multicentered development, a type of compact development by most people's reckoning, is a fine one. . . Equally elusive is the line between leapfrog development and economically efficient 'discontinuous development', or between commercial strips and 'activity corridors'.

Ewing also suggests that his notion of compact development—which is multicentered, has moderate average densities, and is continuous except for permanent open spaces or vacant lands to be developed in the near future—is not all that different from Gordon and Richardson's (1997) definition of sprawl.

Short of a return to a form of urban living not seen since before World War II, it is not clear how growth can be accommodated at suburban densities without being accused of being "sprawl."

Some people oppose any change in established land uses and react just as negatively to well-planned, rea-

Metropolitan, Urban, and Rural Geography

Statistics describing trends in land use are based on one or another geographic entities defined by the U.S. Bureau of the Census (see U.S. Census, Geographic Areas Reference Manual), the USDA National Resources Inventory (NRI), or the American Housing Survey (AHS).

Census of Population (these concepts are shown schematically in figure 1)

***Metropolitan/Nonmetropolitan Area*—**a core area containing a large population nucleus, together with adjacent communities that have a high degree of economic and social integration with that core. Metro areas are defined in terms of entire counties (except in New England, where towns are used). Metropolitan areas contain a mix of land uses, ranging from deserts, forests, and farms, to suburban landscapes, and include the densest urban core. In 1990, there were 274 metropolitan areas, containing 198.2 million people (80 percent of the total U.S. population) and covering 20 percent of U.S. land area.

***Urban/Rural*—**Census defines urban as comprising all territory, population, and housing units located in urbanized areas (UAs), defined in terms of census tracts, and in places of 2,500 or more inhabitants outside of UAs. In 1990, 187 million people (75 percent of the total) lived in 8,510 places of 2,500 or more covering 2.5 percent of U.S. land area.

Urbanized Areas (UAs) are continuously built-up areas with a population of 50,000 or more, comprised of one or more places—central place(s)—and the adjacent densely settled surrounding area consisting of other places and territory not in defined places.

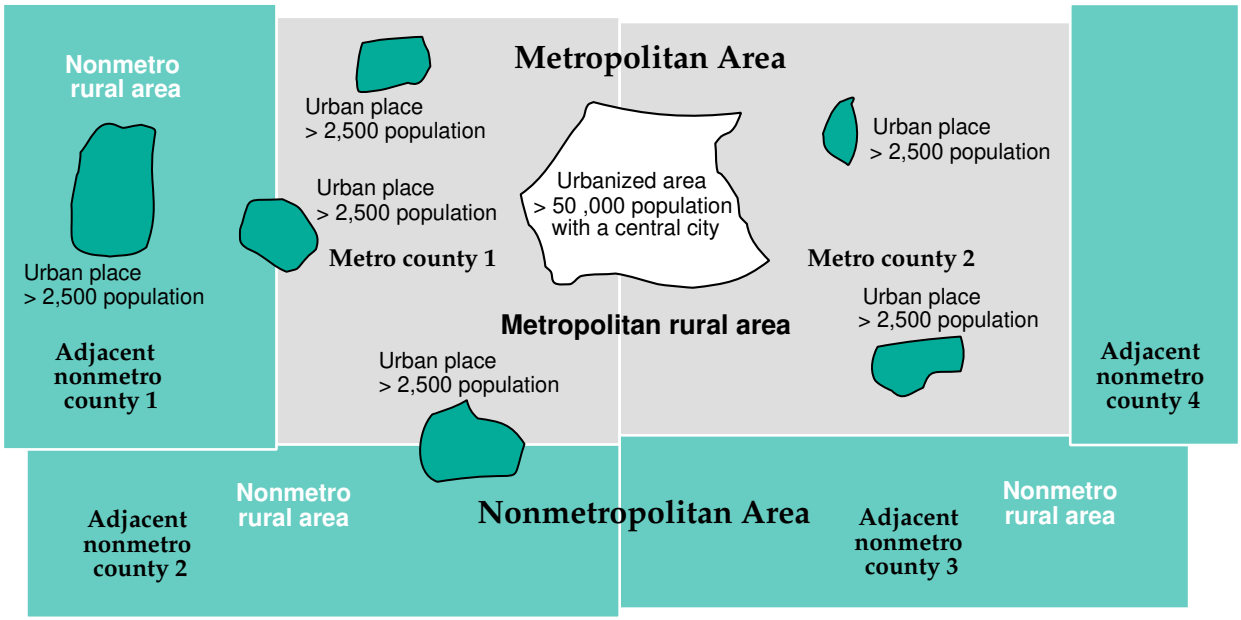
Urban Places Outside of UAs are any incorporated place or Census-designated place (CDP) with at least 2,500 inhabitants.

Rural Places and Territory not classified as urban are classified as rural. For instance, a rural place is any incorporated place or CDP with fewer than 2,500 inhabitants that is located outside of a UA. A place is either entirely urban or entirely rural.

Urban Fringe consists of rural areas in metropolitan counties. The part of the urban fringe nearest to existing UAs and urban places is likely to grow the fastest and eventually be absorbed when densities rise to urban levels.

***Places*—**Census defines a place as a concentration of population, with a name and local recognition, that is not part of any other place. A place either is legally incorporated under the laws of its respective State or a statistical equivalent that the Census Bureau treats as a Census-designated place (CDP). Not everyone resides in a place; in 1990, approximately 66 million people (26 percent) in the United States lived outside of any place, either in small settlements, in the open countryside, or in the densely settled fringe of large cities in areas that were built-up, but not identifiable as places. Most Census places (19,289 out of a total of 23,435 in 1990) are incorporated.

Figure 1
Schematic diagram of urban geography



Metropolitan, Urban, and Rural Geography (continued)

National Resources Inventory (NRI)

Developed land in the National Resources Inventory consists of urban and built-up areas and land devoted to rural transportation.

Urban and built-up areas consist of residential, industrial, commercial, and institutional land; construction and public administrative sites; railroad yards, cemeteries, airports, golf courses, sanitary landfills, sewage plants, water control structures, small parks, and transportation facilities within urban areas.

Large urban and built-up areas include developed tracts of 10 acres and more.

Small built-up areas include developed tracts of 0.25 to 10 acres, which do not meet the definition of urban area, but are completely surrounded by urban and built-up land.

Rural transportation land includes highways, roads, railroads and rights-of-way outside of urban and built-up areas.

American Housing Survey (AHS)

The American Housing Survey, conducted every 2 years by the Bureau of the Census represents all housing units for the entire Nation, including housing lots on farms. The AHS started the current series in 1980.

Residential area is land devoted to residential housing lots, both urban and rural, based on respondents' estimates of lot size for their house. Sample-based responses are expanded to area totals.

Comparison

Due to differences in data collection techniques and definitions, the NRI estimates of "large urban and built-up areas" are usually higher than the Census "urban area" estimates for nearly all States. The Census urban area series runs from 1950, while the NRI started providing a consistent series in 1982. Prior to the 1982 NRI, Census urban area was the only reliable national source of urban area data available.

The American Housing Survey residential area is the sum of acres in lots used for housing units. While the data have limitations and are not available by State, the series does allow compilation of two important estimates. First, an estimate of the residential component of urban land shows how much land is used for housing in urban areas versus land used for all other urban purposes, such as commercial and industrial sites, institutional uses, urban parks, and all other non-housing urban uses. Second and more important, an estimate is made of land used for residences in rural areas. Recently there appears to be a growing trend toward an increasing demand for more and larger housing lots outside of urban areas. The AHS residential area does not include non-residential areas shown in the Census and NRI, but does include a large area of rural residential land not found in either the Census or the NRI.

sonably dense and compact development as others do to "sprawl." Because "sprawl" is so hard to define, we use it only when citing others and set it off in quotation marks. We couch our discussion in the more neutral terms "development" or "growth," without making implicit judgments about the quality or outcomes of that development or growth.

Two Kinds of Growth

Government officials, housing consumers, farmers, and other interest groups appear to be concerned about two kinds of growth. First is the continuing accretion of urban development at the fringes of existing urban areas in rural parts of metropolitan counties. A second kind of growth is the proliferation of more isolated large-lot housing development (1 acre or more) well beyond the urban fringe and into adjacent nonmetropolitan counties. Growth at the edge of existing developed areas gradually shades out into more and more fragmented developments, farther out in the countryside, so there is no clear geographic dividing line between the two kinds of growth. While related, these two forms of growth have qualitatively different causes and have different consequences, especially for agriculture and the environment.

Trends at the Urban Fringe

Even low-density development (2 or fewer houses per acre) of new houses, roads, and commercial buildings at the fringe of existing urban areas can cause greater traffic congestion, loss of open space, loss of agricultural land, and impacts on the natural environment.

The amount of land in urban and developed land uses is measured in different ways, all of which have specific denotations (see box "Metropolitan, Urban, and Rural Geography" and figure 1). The concept of "urbanized area," defined by the Bureau of Census, includes the densely settled areas within and adjacent to cities with 50,000 people or more, while "urbanized places" include populations of 2,500 people or more that are outside of urbanized areas. Urbanized areas alone increased from 15.9 million acres in 1960 to 39 million acres in 1990, increasing 2.5 times. Total Census urban area (urbanized areas and urban places) more than doubled over the last 40 years from 25.5 million acres in 1960 to 55.9 million acres in 1990. These two categories of urbanization likely reached about 65 million acres by 2000 (table 1; figure 2; Daugherty, 1992).

"Urban and built-up areas" counted in USDA's National Resources Inventory (NRI) include those measured by the Census Bureau, as well as developed areas as small as 10 acres outside urban areas, encompassing some large-lot development. NRI urban and built-up area increased from 51.9 million acres in 1982 to 76.5 million acres in 1997, and likely rose to about 79 million acres by 2000 (table 1 and figure 2). "Developed land" defined by NRI adds the area in rural roads and other transportation developments. By this definition, developed area increased from 73.2 million acres in 1982 to 98.3 million acres in 1997, and likely reached 107 million acres by 2000.

Census-defined urban area has grown by about a million acres per year since 1960, an increase of about 4 percent per year. The rate of increase dropped from 3.5 percent per year in the 1960's and 1970's to 1.8 percent per year in the 1980's. NRI urban and built-up area increased faster than Census urban area in the 1980's, rising 2.9 percent. Much of the increase in NRI urban and built-up area is in less dense, extensive large-lot development beyond the urban fringe and in nonmetropolitan counties. This kind of development will not meet the population density criteria for Census-defined urban area for many years.

Despite doubling since 1960, urban areas still made up less than 3 percent of U.S. land area (excluding Alaska) in 1990 (figure 3). Developed areas, including rural roads and transportation, made up less than 5 percent in 1992. Both kinds of growth (on the metro fringe and large-lot development) take land irreversibly out of commercial agricultural production that might otherwise be available for use. Growth causes social and environmental problems in local areas, but the increase in urban area in the United States poses no threat to U.S. food and fiber production capacity (Vesterby et al., 1994; USDA, 2000).

Table 1—Trends in U.S. urban development, 1960-2000

Year	Census urban	NRI urban and built-up	NRI developed
		Million acres	
1960	25		
1970	34		
1980	47		
1982		52	73
1987		58	80
1990	56		
1992	57	65	87
1997 [1]	62	76	98
2000 [1]	65	79	107

Sources and definitions: See box " Metropolitan, Urban, and Rural Geography."

[1] Census urban for 1997 estimated; all data for 2000 estimated

Trends Beyond the Urban Fringe

Another kind of development occurs beyond the existing urban fringe, often far out in the rural countryside of metropolitan counties or adjacent nonmetropolitan counties. Development of new housing on large parcels of land is growth with a different character than that occurring at the city's edge. Instead of relatively dense development of 4-6 houses per acre, exurban development consists of scattered single houses on large parcels (often 10 acres or more). Rural large-lot development is not a new phenomenon, although it may be getting more attention than in the past. Growth in the area used for housing rose steadily throughout the last century (figure 4, Peterson and Branagan, 2000).

Figure 2
Trends in developed land use, 1960-2000

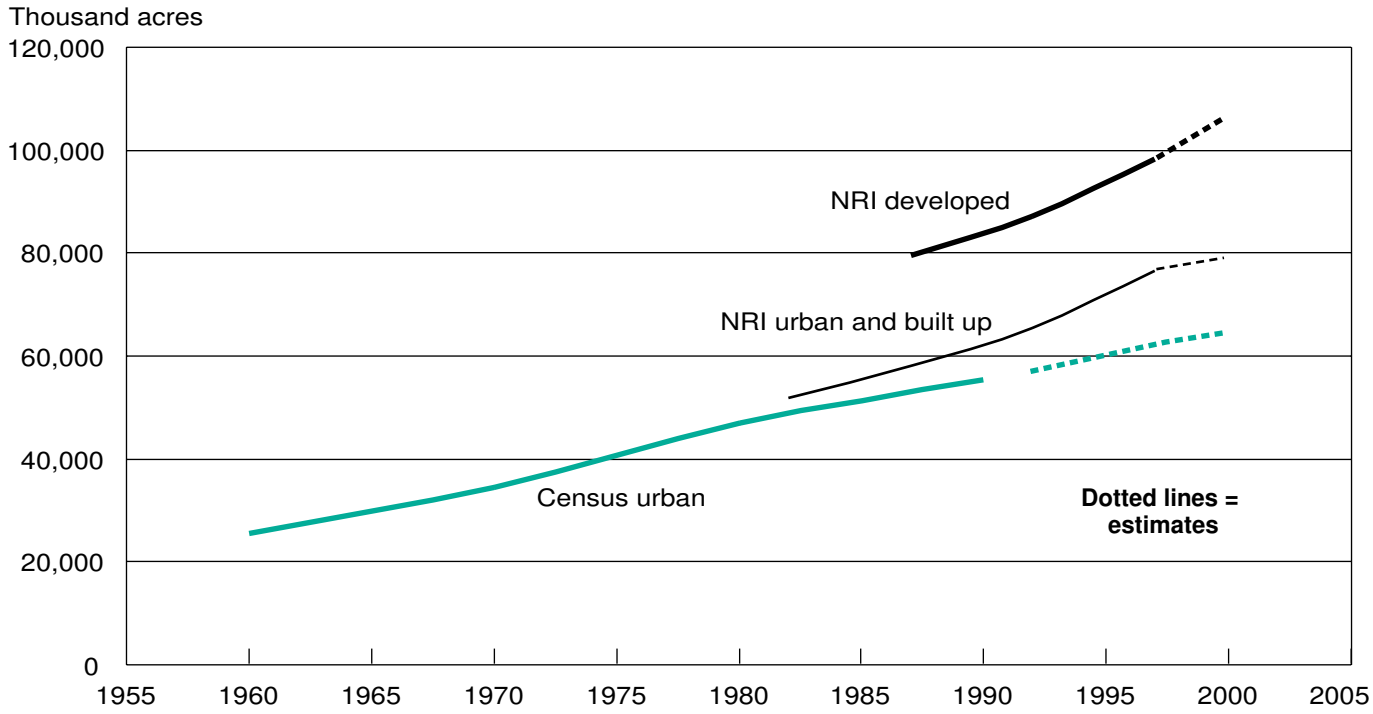
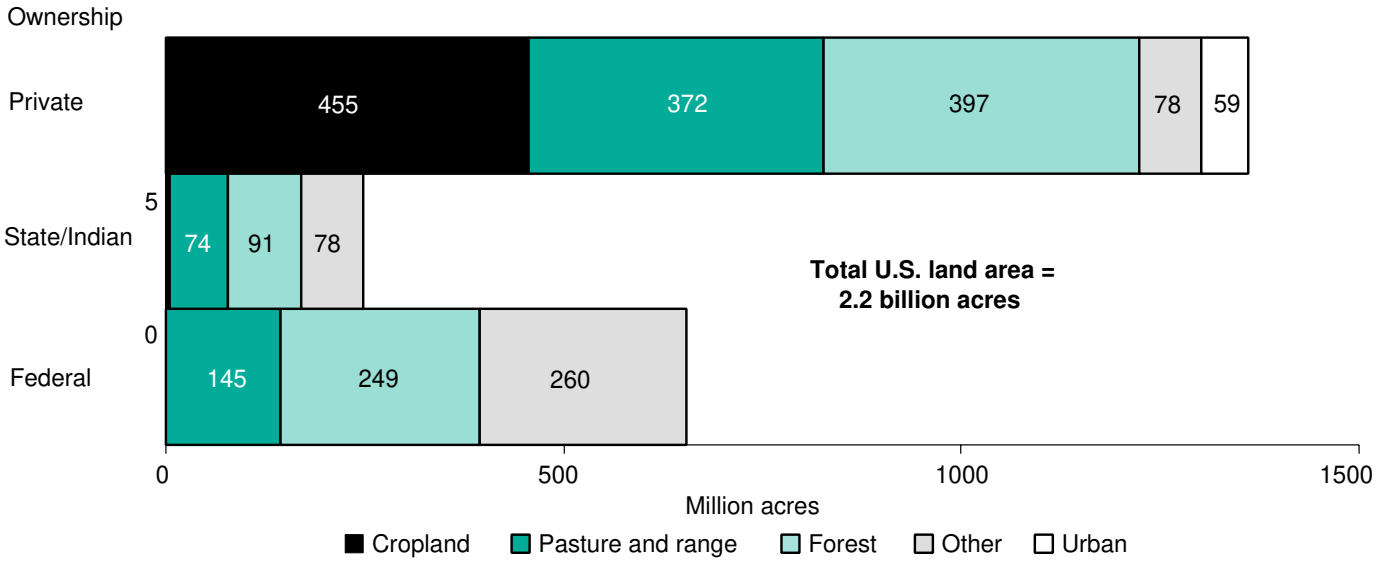


Figure 3
Land base of the United States, 1992

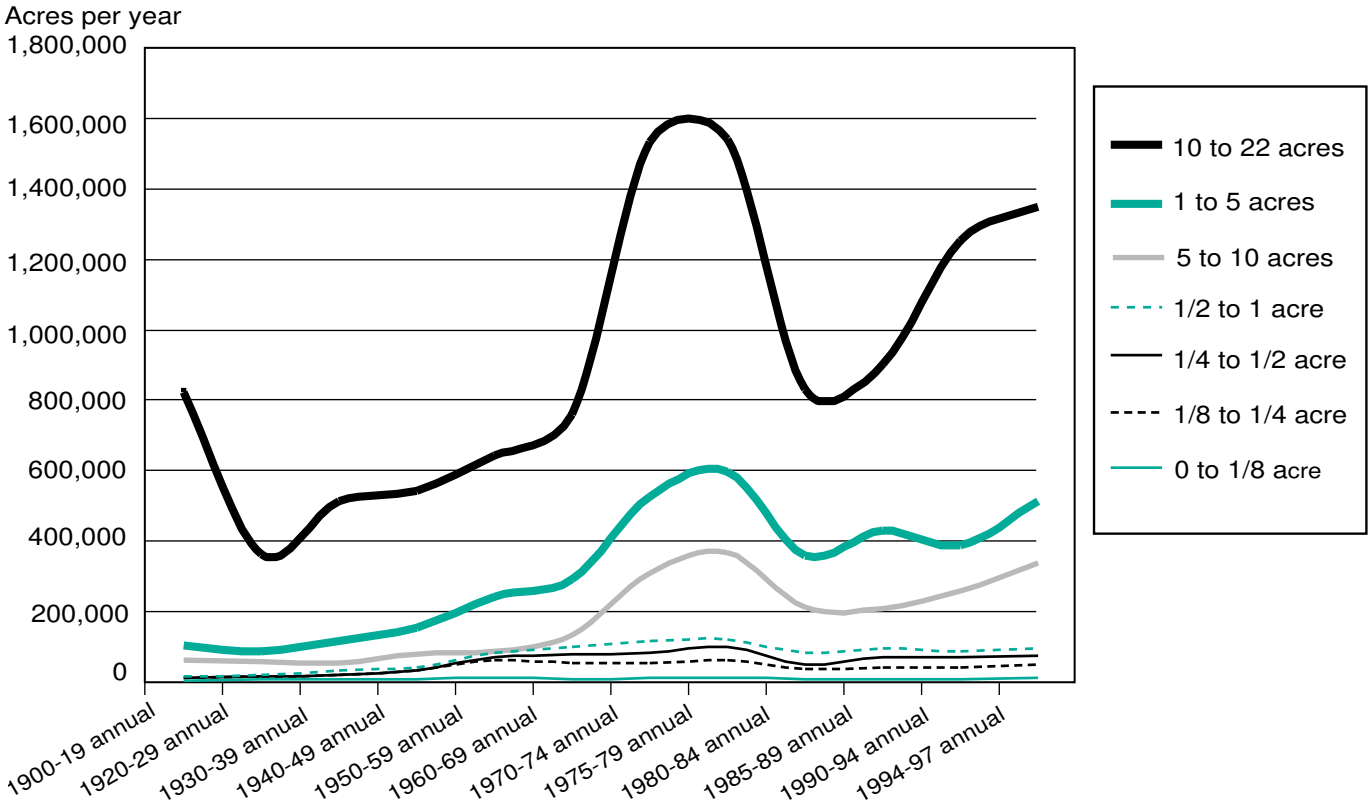


Source: Daugherty, 1995.

Large-lot categories dominate this process, and growth in large-lot development has accelerated with periods of prosperity and recession since 1970. The largest lot size category (10-22 acres) accounted for 55 percent of the growth in housing area since 1994, and lots greater than 1 acre accounted for over 90 percent of land for new housing. About 5 percent of the acreage used by houses built between 1994 and 1997 is for existing farms, and 16 percent is in existing urban areas within Metropolitan Statistical Areas (MSAs) defined by the Bureau of the Census. Thus, nearly 80 percent of the acreage used for recently constructed housing—about 2 million acres—is land outside urban areas or in non-metropolitan areas. Almost all of this land (94 percent) is in lots of 1 acre or larger, with 57 percent on lots of 10 acres or larger.

The people who move into these new houses may be pioneers moving from cities that once seemed distant. They may be pioneers in another sense: Areas experiencing this kind of development may be just starting on a gradual process of infill and expansion that will gradually transform the once-rural countryside into suburban and urban settlements resembling the existing urban fringe.

Figure 4
Annual additions to housing area, by lot size, 1900-97



Source: ERS analysis of American Housing Survey, 1997 data.

III. Driving Forces

Changes in land use are the end result of a variety of forces that drive the millions of separate choices made by individuals and governments. In this chapter, the driving forces behind the trends in land use are carefully laid out in a way that shows the links between them at each step in the development process.

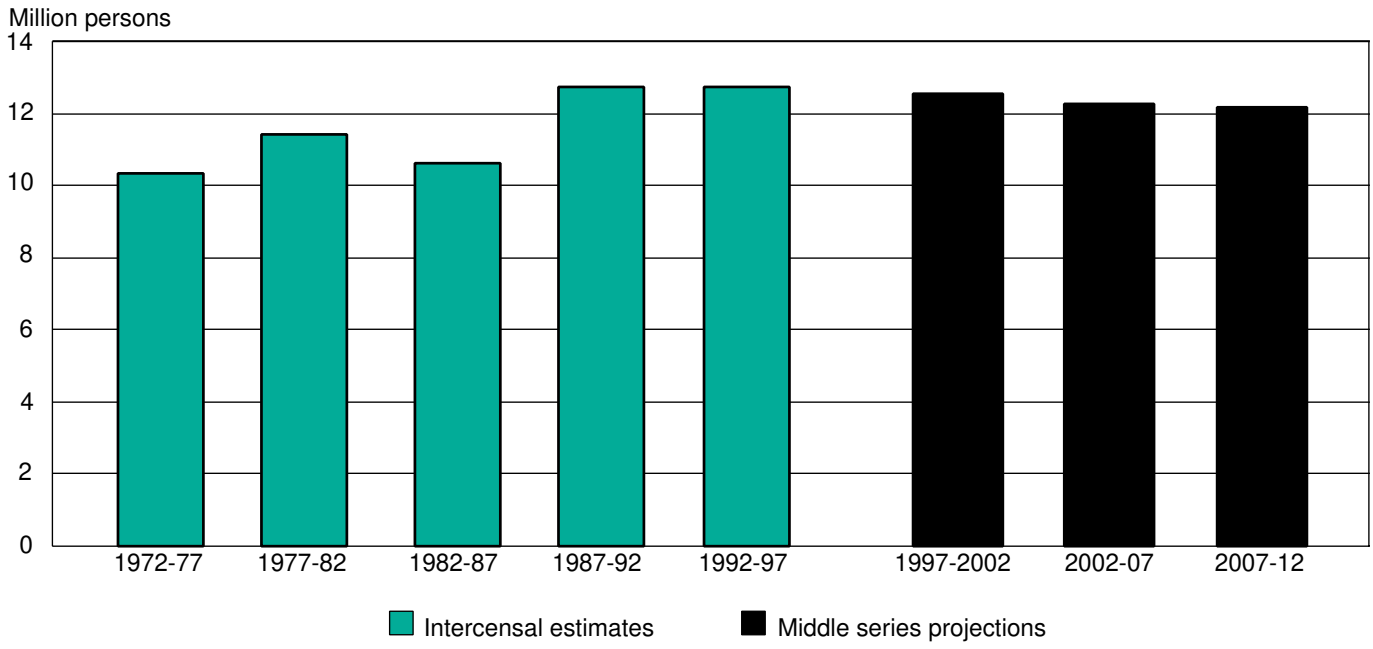
The forces that drive urban growth are well known and fairly well understood. The ultimate driver is population growth and household formation, which, when combined with growth in income and wealth, spurs new housing development and consumption of land for housing. Population growth in outlying areas is most often the result of redistribution of the metropolitan population, but may result from new influxes of population from outside the area. Metropolitan areas grow organically, like a living thing, with stages of growth that are palpable and predictable. After the new housing developments are built and occupied, the new residents realize they need new schools and improvements in the roads, sewers, and water supplies servicing the new housing; the expanded infrastructure then attracts more housing at higher densities. When a critical mass is reached, shopping centers and businesses follow the population, to serve them and to be closer to the labor force.

U.S. Population Growth and Household Formation

Almost alone among developed nations, the United States continues to experience a high rate of population growth, adding 1 percent per year to a large base population (Riche, 2000, p. 5). Population grew from 150 to 250 million people between 1950 and 1990 and is expected to add another 150 million by 2050 (U.S. Census Bureau, 2000). The number of people added to the U.S. population during 1987-92 and 1992-97 (each over 12 million) was the highest of any recent 5-year period, and the rate is expected to stay high (figure 5). Increasing immigration and higher life expectancy have helped maintain high growth levels. Immigration levels today are similar to those in 1900. Then, as now, about a third of new population was due to movement from abroad. Fertility levels have declined since the 1950's but remain higher than those in other developed countries: on average, U.S. women are currently bearing close to 2.1 children, the number necessary for a population to replace itself, compared with 1.6 children per woman in Europe.

Household formation (marriages, divorces, moving out) and the demand for new land for housing is affected by population growth, but is also strongly influenced by

Figure 5
Additions to U.S. population, 1972-2007



Source: U.S. Census Bureau.

social and cultural trends and economic conditions. Employment opportunities and increases in wealth affect how and when new families and individuals move into separate housing and when established families upgrade to larger houses. Thus, the rate of household formation, and consequently the demand for land for new housing, fluctuates with cyclical economic conditions as well as long-term social and demographic trends.

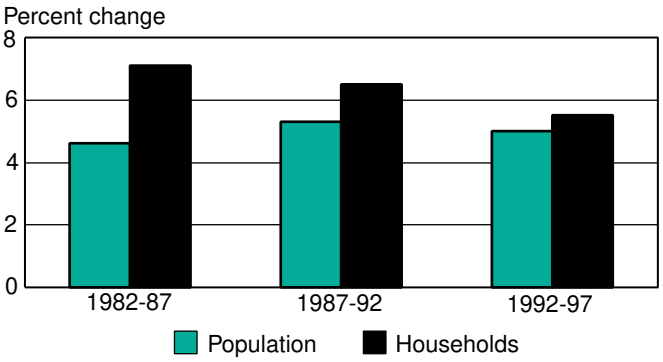
Changing household size can have a bigger impact on the housing market and the demand for land than overall population growth. The rate of household formation has been outpacing population growth as average household size dropped from 3.7 in 1950 to 2.6 today; the same number of people now require up to 30 percent more housing (figure 6).

Growth in household formation increased in the early 1960's to a peak of 1.7 million per year in the late 1970's. Factors contributing to this peak included a downward shift in average household size in the 1970's when the baby boom generation entered the housing market, and a rapid increase in the elderly population. In the 1980's, housing demand began to shrink with the maturing of the baby bust generation (born during the low-birth years of the 1960's and 1970's); but during 1982-87, household numbers grew by 7 percent, while population grew by only 4.5 percent. With fewer young adults and retirees creating a smaller pool of housing consumers (reducing especially the number of new, single-person households), household growth dropped to 5.5 percent during 1992-97 as average household size stabilized. Household formation in the 1990's averaged less than 1 million per year, rising late in the decade.

Household Land Consumption

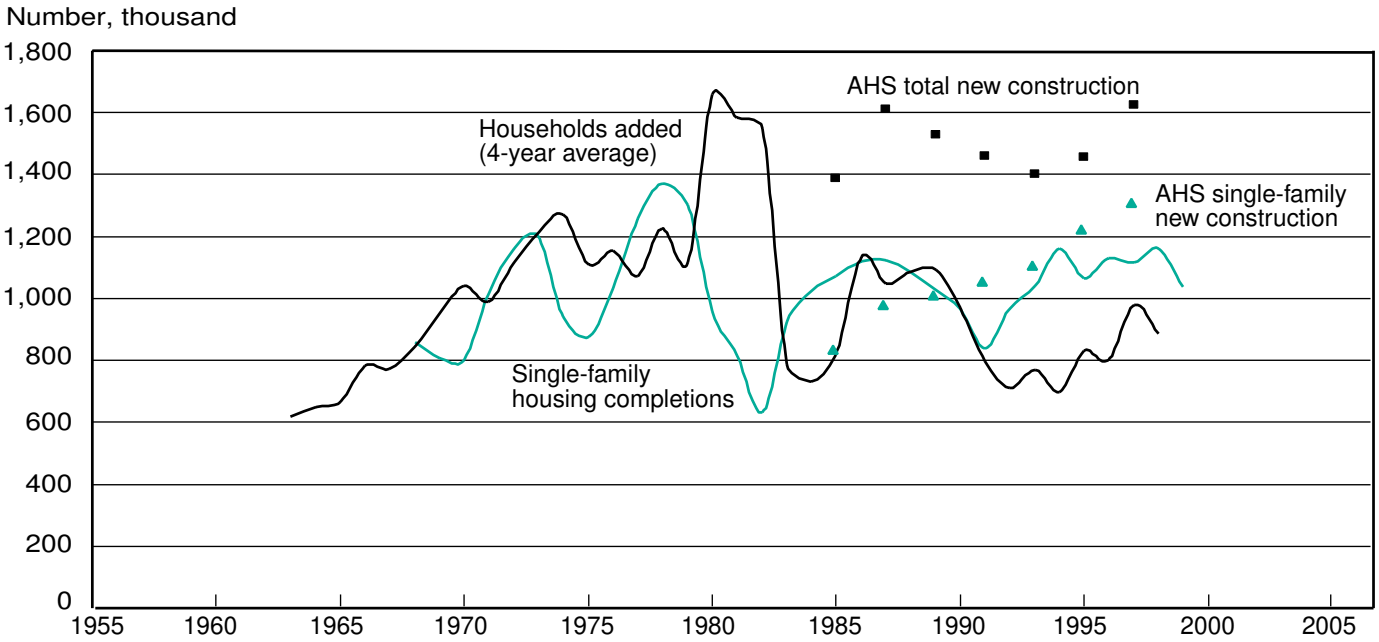
The total number of housing units completed mirrored household formation, with peaks in the mid-1970's, late 1970's, and mid-1980's (U.S. Census Bureau, 2000c; figure 7). These data are from developers and largely reflect tract housing, primarily built at the urban fringe. However, household formation in the 1990's averaged

Figure 6
U.S. population and household change, 1982-97



Source: U.S. Census Bureau.

Figure 7
Household formation and housing completions, 1960-97



Source: ERS analysis of U.S. Census of Population, Construction Series C-22, and American Housing Survey data.

826,000 per year, but total new construction averaged about 1.5 million units per year, with single-family new construction at more than 1 million per year.

Household formation and housing construction are often out of sync when poor economic conditions prevent new households from purchasing new housing (such as 1968-1971,1974-78, and 1980-83 in figure 7), followed by better times when pent-up demand is met (1976-79, 1983-87, and since 1992). Data from the American Housing Survey also show that total new construction (including apartments, condominiums, and mobile homes) followed the pattern of household change, and mirrored housing completions recorded in Census housing construction statistics (USDC, 1999). However, single-family housing reported in the American Housing Survey (AHS) rose from the mid-1980's through the 1990's. Thus, new housing outstripped basic household formation, particularly in the kind of housing likely to be built in exurban locations. Favorable economic conditions drove homeownership to a record high of 66.8 percent in 1999, with over 8.7 million new home-owning households since 1992 (U.S. HUD, 2000, p. 58). While central city homeownership also increased to 50.4 percent, many of the new homes are in outlying areas.

Average lot size for new single-family houses has decreased for much of the new housing built in urban areas and the urban fringe, as new owners turn to condominiums, townhouses, and larger houses on smaller lots. The average lot size of tract housing dropped from 0.4 acre in the mid-1970's to 0.3 acre in the 1990's.

Median lot size in the American Housing Survey has been about 0.5 acre, dropping slightly from the late-1980's. However, the average lot size has increased to almost 2 acres because of growth in large-lot housing of 5 and 10 acres or more. Much of this large-lot construction has occurred beyond the urban fringe and farther out in nonmetropolitan counties. Large-lot housing, as a proportion of new construction in rural areas, rose from 40 percent in 1980-93 to 45 percent in 1994-97. Median lot size of new construction in central cities was 0.23 acre, but averaged 0.78 acre, while median lot size outside Metropolitan Statistical Areas (MSAs) was 1.6 acres, and averaged almost 3 acres. While average land consumption per new housing unit decreased for most new housing added at the urban fringe, the amount of land consumed in relatively small numbers of new large-lot housing units located beyond the fringe grew. Most of the land developed for housing is not urban, as defined by Census, but occurs beyond the urban fringe in largely rural areas.

Large-lot zoning is not entirely a matter of preference or markets. Zoning laws are part of the land-use guidance institutionalized by government and put constraints, either in terms of minimum or maximum lot sizes, on developers and consumers (Haar, 1976). Large-lot zoning, requiring a minimum lot size of 3 to 20 or more acres, was an early attempt to limit development (Coughlin and Keene, 1981, p. 21). Large-lot zoning is now recognized as being ineffective in reducing development, and actually contributes to significant loss of farmland. However, setting minimum acreages applying to subdivision control regulations that more actively guide development has inadvertently resulted in de facto large-lot zoning since developers can choose a lot size just above the minimum and avoid the more stringent controls. Subdivision control regulations are limited to parcels of 5 acres or less in Ohio, 10 acres or less in Michigan, and 25 acres or less in Colorado (Libby, 2000).

Demand for Low-Density Development

There is an undeniable appeal of extensive single-family housing development for the American people. Surveys ratify the prevailing U.S. consumer preference for single-family detached housing surrounded on all sides with yards (Fannie Mae, 1996). A 1988 survey showed that 70 percent of Americans preferred a rural or small town setting within 30 miles or more of a city over 50,000 in population (Fuguitt and Brown, 1990). And, 35 percent of those living in a rural or small town more than 30 miles away from a city stated a preference for the same type of setting within 30 miles. So pressure on fringe development in the form of stated locational preferences comes from both ends of the rural-urban spectrum. The survey was repeated in 1992-93 and confirmed the initial findings. While most people prefer the residence situation they are living in, those who would rather live elsewhere are more likely (by a 2 to 1 margin) to prefer a less densely populated setting (Brown et al., 1997).

Surveys undertaken by the Federal National Mortgage Agency (Fannie Mae Survey of Residential Satisfaction of Housing Occupants) during the mid-1990's reveal that personal open space is highly desired by most Americans. In terms of buying preference, single-family detached housing was more popular during the mid-1990's than it was a decade earlier. In the Novem-

ber 2000 election, anti-sprawl measures in Arizona and Colorado were opposed by 70 percent of voters (*Washington Post,* November 10, 2000).

As metropolitan areas grow in population, there are only two basic choices for urban form: grow outward at similar or lower densities, or grow upward at higher densities. Beyond a certain size, an urban form with multiple centers is more efficient than a compact, highly centralized monocentric form, because it allows the clustering of land uses to reduce trip lengths and congestion (Haines, 1986; Steiner, 1994). What has been called the "New Urbanism" is a school of urban design that counters conventional suburban development in favor of design elements that mimic features of small towns (Chen, 2000; Duany et al., 2000). These developments emphasize a more traditional grid layout, walkability, and more compact design. Some new developments designed using these principles in Florida, Virginia, and Kentucky have been commercially successful.

Potential benefits from lower density development at the city's fringe include access to employment, access to open space amenities, lower crime rates, lower housing costs, better air quality, more flexible transportation by auto, and preferred separation of residences from commercial and industrial activities (Gordon and Richardson, 1997; Peiser,1989).

The most obvious benefit is that low-density development in rural areas has allowed many people, including those who cannot afford city real estate, to buy single-family homes because land costs are cheaper on the fringe than in the core. Many people are willing to pay both the private and social costs of such auto-dependent development in exchange for the automobile's comfort, flexibility of use, low door to-door travel time, freight-carrying capacity (for shopping trips), and cheap long-distance travel, as well as the aesthetic benefits of separated land uses associated with such development (U.S. OTA, 1994). Benefits to society include increased location options for businesses, greater consumer access to shopping centers and superstores with greater economies of scale and lower prices, and commuter freedom from dependence on the timetables of public transit systems, allowing more flexible work schedules. Decentralizing both homes and work may decrease some commutes, saving both time and energy (Gordon and Wong, 1995). So far there is no evidence this has happened, mostly because of increased cross-commuting between one suburb and another (Downs, 1994).

Low density and fragmentation, it is argued, are not problems because leaving parcels of land undeveloped in the urban area in the short run will increase land densities over the long term, as these parcels increase in value and, eventually, become developed for more intensive use. Peiser (1989) examined this hypothesis in Fairfax County, Virginia; Dallas, Texas; and Montgomery County, Maryland. Montgomery County did not show evidence of infill development because its land-use regulations do not allow higher densities on the leapfrogged parcels. The infill parcels in Fairfax did generally conform to the hypothesis with higher densities, and the results from Dallas were mixed.

Residents may also enjoy air quality improvements from decentralizing population and employment. Bae and Richardson (1994) note that greater automobile use does not necessarily lead to worsening air quality. Lower per capita emissions at high densities have more environmental impact than higher per capita emissions in a low-density environment because of the ability of local airsheds to absorb pollutants, and the fact that pollution levels increase exponentially, not linearly, as the percent of capacity absorbed rises. Automobile pollution is more strongly related to the number of trips and to the hours of driving, rather than to the length of each trip in miles. A major part of auto pollution derives from cold starts. A recent study in San Diego found that by balancing jobs and housing, a 5- to 9-percent reduction in miles traveled would reduce traffic congestion by 31-41 percent, but vehicle emissions would be cut by only 2 percent (San Diego Assn. of Govts., 1991). The New Jersey State Planning Agency found that a more compact urban development scenario did not significantly improve air quality over that in low-density development (Burchell, 1992). New Jersey officials found that improvements in air quality from cleaner fuels, more efficient engines, more stringent emission inspection, and more cars with anti-pollution devices dwarfed any improvements derived from land use.

Metropolitan Expansion

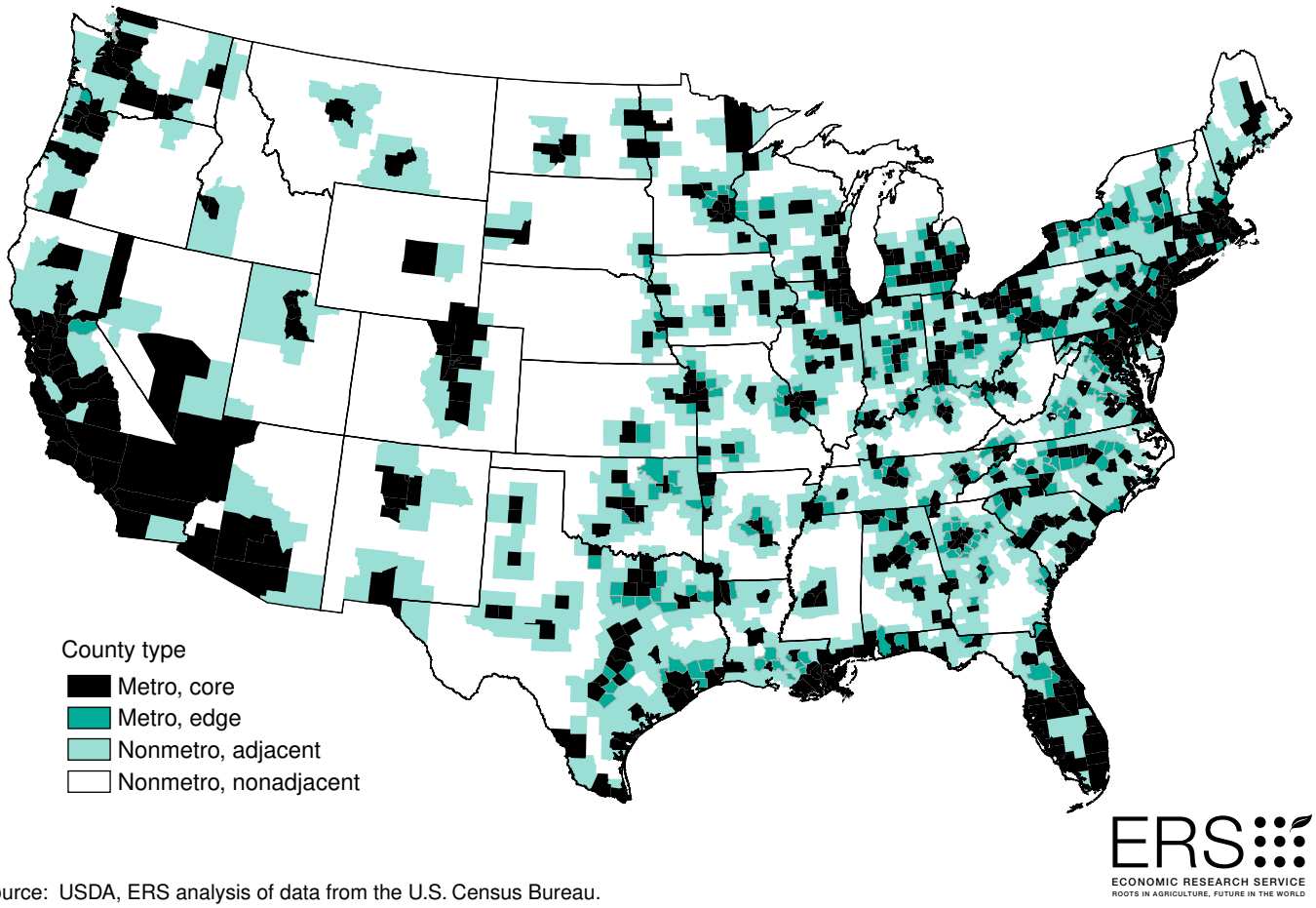
The concentration of population into ever-expanding urban centers was the most important development in population distribution in the first half of the 20th century. While rural people moved into metropolitan areas, the dense populations of central cities emptied out into the surrounding countryside. The automobile helped trigger both a rural-to-urban migration, and a city-to-suburb relocation, resulting in settlement patterns today that conform more to commuting, recreation, and

retirement than to farming, mining, or logging. Many areas once entirely rural have been absorbed into thriving metropolitan regions. Retail centers and office parks have followed housing out to the urban fringe, greatly expanding commuting patterns. Urbanized areas, including the central cities and adjacent, densely settled territory at the core of metropolitan areas, have grown in number from 106 to 369, since 1950, nearly quintupling in area to 39 million acres (1.7 percent of total land area). The same number of people now require more land: Population density in urbanized areas has dropped by more than 50 percent, from 8.4 to 4 people per acre over the last 50 years (U.S. HUD, 2000; U.S. Bureau of the Census).

Changes in the U.S. settlement pattern have combined population concentration into metropolitan areas and population deconcentration toward the metropolitan fringe and nearby nonmetropolitan territory (U.S. HUD, 2000). Metropolitan population grew at more than twice the rate of nonmetropolitan areas in the 1950's and 1960's and again in the 1980's. The expansion of the interstate highway system, the extension of public utilities, advances in telecommunications technology, the availability of standardized consumer goods, and life-style changes oriented toward lower density settings laid the groundwork for expanded nonmetropolitan growth in the 1970's. These advantages gave way temporarily under economic recessions, a farm debt crisis, movement of manufacturing jobs overseas, and other "period" effects in the 1980's. The 1990's witnessed a rebound in growth outside metropolitan areas, and rural experts once again are predicting a permanent, gradual dispersion of the population, brought about by improved transportation, telecommunications, and other technological innovations (Johnson, 1999c).

The highest rates of population growth are occurring at the edges of metropolitan areas, in the predominantly rural counties that have already been absorbed into the metropolitan area through increased commuting (figure 8). Population growth at the metropolitan fringe increased from 7.1 percent during 1982-87 to over 10

Figure 8
County typology, 1990



Source: USDA, ERS analysis of data from the U.S. Census Bureau.

percent during 1992-97, while growth in the metropolitan core dropped (figure 9). Adjacent nonmetropolitan counties now have a higher rate of growth than metro core areas as people move even farther out in search of less expensive land for housing. Areas far removed from metropolitan influence lost population during the 1980's, but in the 1990's entered a period of general population gain.

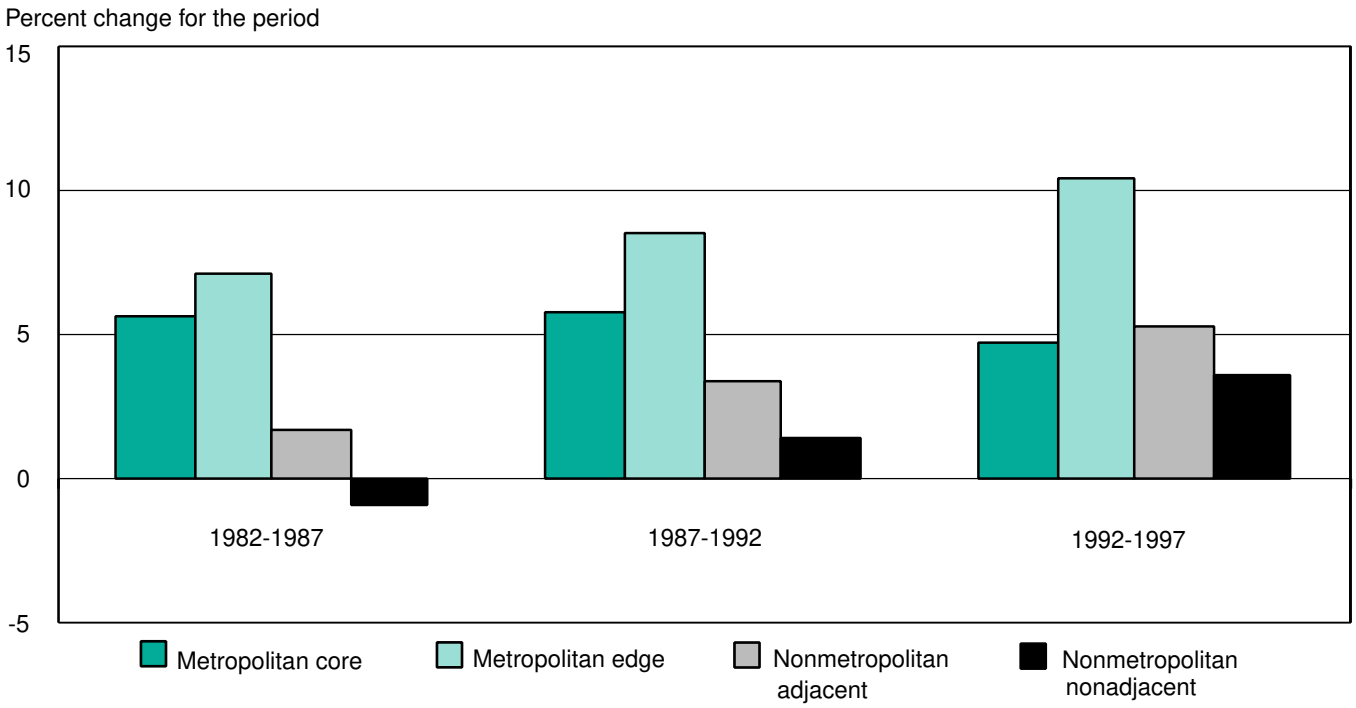
Dynamics of land-use Change

Urbanization of rural land is a dynamic process that, despite its chaotic appearance at any particular moment, occurs in regular spatial and temporal patterns that are clearly distinguishable to anyone who has watched a city grow over time. Starting at the historical origin of any metropolitan area (New York's battery, Chicago's lakefront, or Denver's original pueblo), growth expands outward at the urban periphery. The dense, inner city neighborhoods of today were the market gardens and farms of the former city, and the inner suburbs of any metropolitan city were rural lands developed in the decades after the city's initial growth began.

The German land economist Von Thunen recognized that rural areas surrounding cities arranged themselves in concentric rings of decreasing development intensity because of declining bid rent surfaces reflecting the value to agriculture of proximity to urban markets (Sinclair, 1967; Brooks, 1987). Transportation and communication improvements in the 20th century transferred this same sorting to developed uses. The value of land declined with distance from the city center as people sought their own place on the continuum between rural amenity and urban access that plays out on every radius leading from downtown (Sinclair, 1967; Alonso, 1968; Brooks, 1987). The natural distortions of mountains, bays, and rivers, and those imposed by transportation arteries, result in the zones of decreasing development surrounding every metropolitan center (Fales and Moses, 1972).

What may be less obvious in any snapshot of the city is the dynamic element implied by this spatial pattern. As a city grows in population and spreads out seeking less dense and more amenable living arrangements, these zones also shift outward, creating Hart's "perimetropolitan bow wave" (Hart, 1976, 1991). Hart's case study of the New York metropolitan area (1991) showed that these outward shifts of population and development roll through the agricultural economy, affecting land rents, the amount of land in agricultural production, and the character of agricultural production. In the words of the U.S. Office of Technology Assessment (OTA, p. 99), "the historic dominance of the central city is giving way to a much more dispersed pattern of growth as

Figure 9
U.S. population change, 1982-97



Source: U.S. Census Bureau.

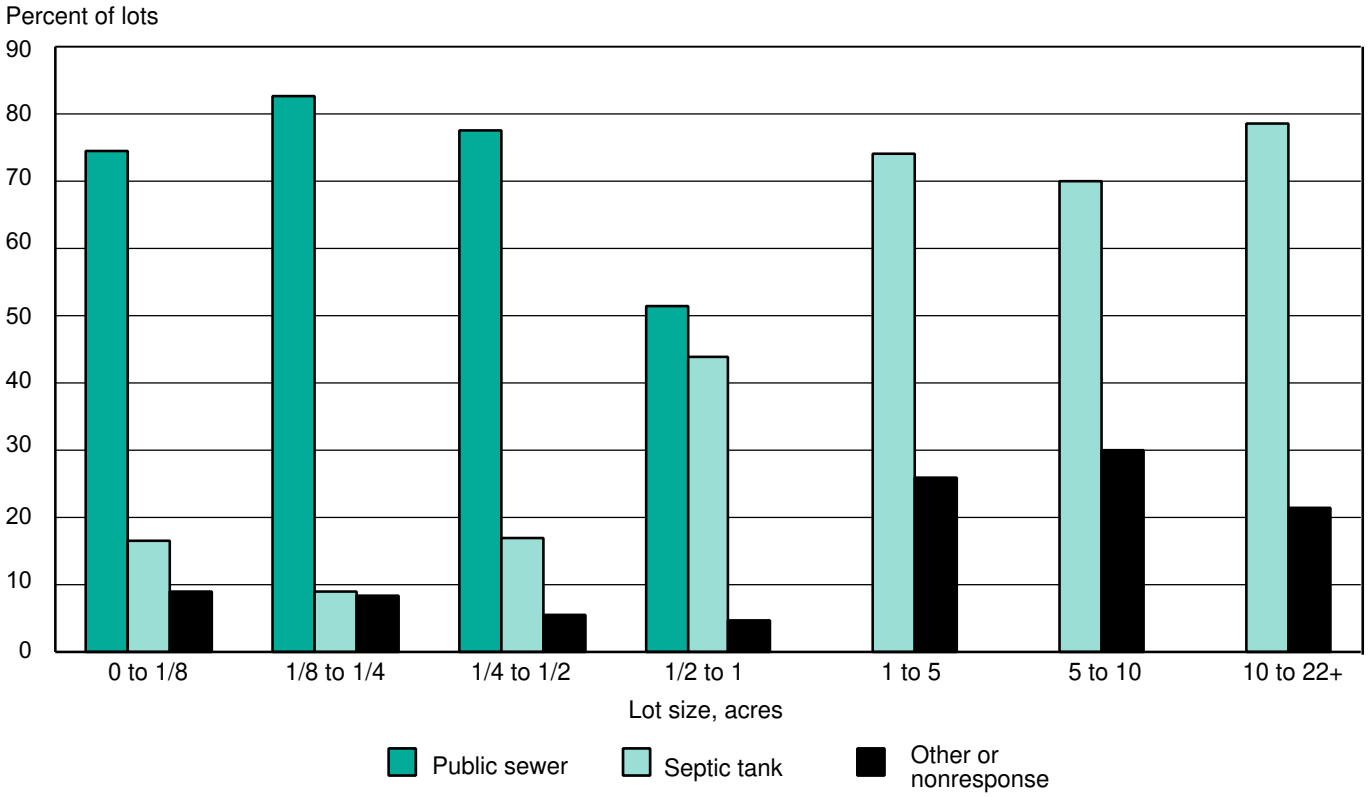
economic activity spreads unevenly throughout the metropolitan areas in other nodes and centers."

Economic theory suggests a partial explanation for the increasingly diffuse settlement pattern that develops from technological innovation. New technology lowers the cost of communication and transportation, driving higher land prices farther out into rural areas, and increasing the size of the urbanizing area. Advanced telecommunications capabilities, such as the Internet and cable, are already available in many areas of the country, but there are currently significant gaps in its availability in some States and rural areas. However, these gaps are expected to diminish over time. Eventually, when access to the urban center through communication and transportation technology is nearly effortless, the development value of land completely overshadows the value for agricultural purposes. People will then choose where to live based entirely on the amenities offered by the various locales. This is not especially unrealistic: consider airline pilots (who fly free on employing airlines) who may live in Seattle, but "commute" weekly to Dallas or other distant cities. Writers and others whose production process does not require urban contact for long periods of time are free to seek living space rich in amenities. Knowledge-based companies in the new economy bring this freedom to more and more employees.

Infrastructure

Investments in infrastructure, such as roads, sewers, and water supplies, can be one of the most important drivers of urbanization, since infrastructure provides the essential framework for development. There is, however, a dynamic to infrastructure investment that affects land-use change. At the very edges of urban development in metropolitan areas, construction of new homes depends on private wells and septic systems. Under these conditions, house lots may be required to be sufficiently large to ensure that wells are not contaminated and that adequate area is allowed for septic drainage fields, thus consuming larger-than-average amounts of land per household. New single-family house data from 1997 show that half the lots between half an acre and 1 acre were not sewered, and nearly all lots greater than 1 acre were not sewered (figure 10). The percentage of lots on public water supplies

Figure 10
Sewage disposal by lot size, 1994-97



Source: American Housing Survey data in Peterson and Branagan, 2000.

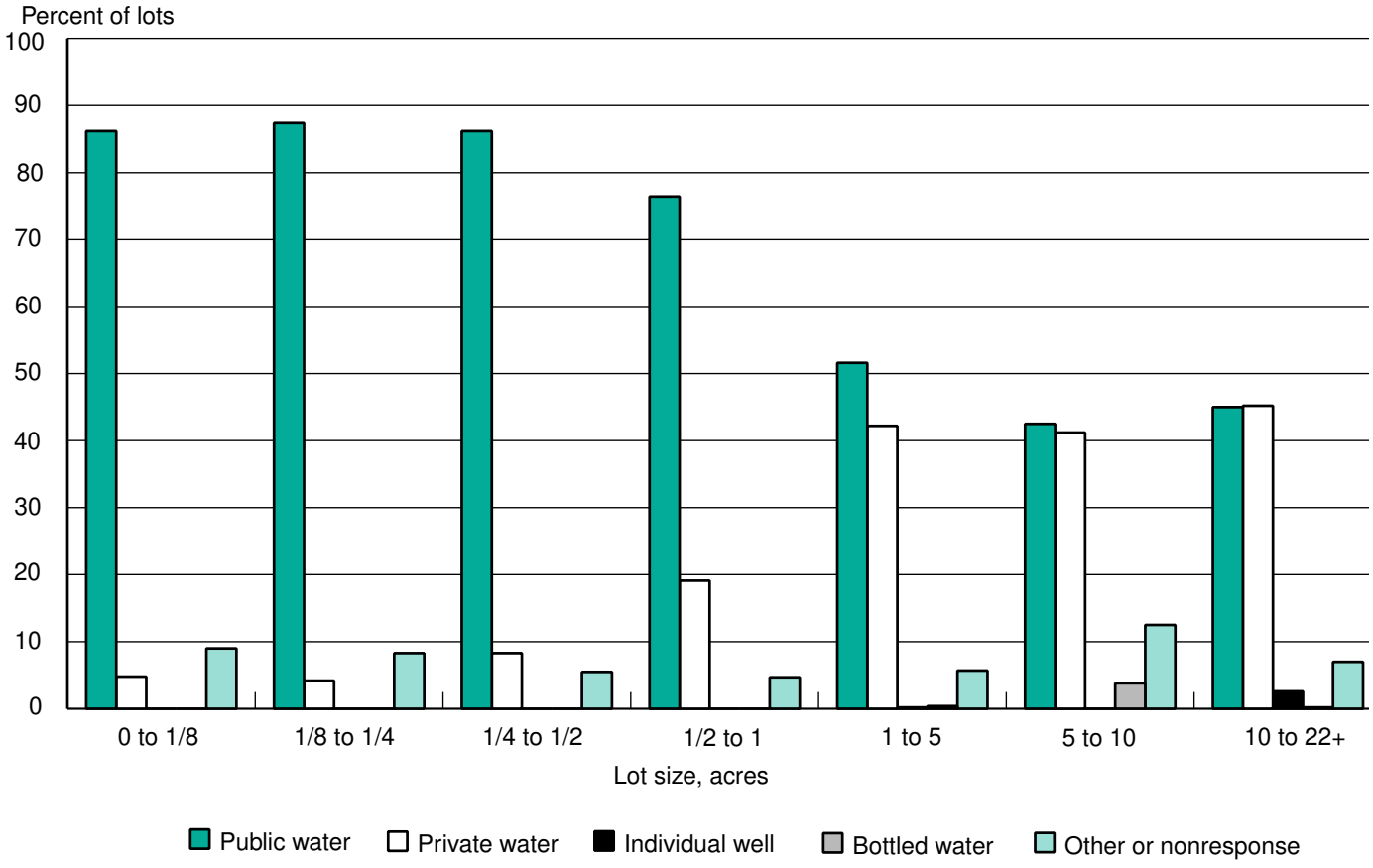
dropped below half for lots greater than 1 acre (figure 11).

As sufficient development occurs, one of the first demands of new rural citizens is for road improvements, which often fuel even more development. At another critical mass of development, public health pressures motivate replacement of private wells with public water supplies. Sewer service, and especially trunk sewer lines, are the last infrastructure investments to occur. These facilitate full-blown developments, often at density levels comparable to inner suburbs as infill development occurs.

A study in Maryland showed that highway construction was a key factor in growth, with new roads preceding migration outward from the cities (Heavner, 2000). Extension and upgrading of automobile transportation networks is both demanded as the negative impacts of growth become manifest in congested highways, and contributes to the further growth that will spawn the next generation of complaints. Road building is, at the interstate and primary highway levels, a joint effort of local, State, and Federal transportation authorities. Interstate highways, in and of themselves, offer little incentive for development. However, where there are numerous interchanges and a widening network of feeder and tributary road construction, and growth is not controlled, development is inevitable.

Once again, there is a dynamic to this infrastructure investment. In the most remote corners of the metropolitan area, existing, narrow, two-lane roads are the first channels for new development at low densities. At some point, a critical mass of citizenry is in place to demand upgraded and improved road systems, which soon generate additional development pressure. The pressure for new and improved interstate and primary highways can often propagate in reverse as focal points of development generate sufficient traffic to justify changes to these top-level systems.

Figure 11
Water supply by lot size, 1994-97



Source: American Housing Survey data in Peterson and Branagan, 2000.

Thus, while provision of infrastructure investment is almost always a clear inducement to urban development, its absence is usually not enough to curtail development. "Adequate facilities laws," which explicitly stage infrastructure investments and simultaneously restrict unserviced development, may be the best way to use the leverage of infrastructure to control growth.

Employment, Economic Development, and Technology

Face-to-face contact has been the main factor behind the attraction of the city center for employment (Sinclair, 1967; Alonso, 1968). Developments in information and communication technology have been a major driver in the recent U.S. economic expansion. The United States, like other industrial economies, is in the midst of a technological revolution. In recent years, society has embraced cellular (wireless) phones, video phones, pagers, e-mail, call-forwarding systems, voice messaging, facsimile machines, the Internet, local and wide-area networks, optical scanners, barcode readers, fiber optics, data transfer protocols, digital switching, satellites, and portable computers. Based on advances in microelectronics, these innovations are directly altering telecommunications, information, and transportation technologies, and indirectly reshaping America's cities. An array of even more sophisticated microelectronic technologies, including high-definition images, high-speed, high-capacity Internet connections, and wireless computing and data transfer, already on the consumer horizon, conceptually have the potential to further reduce the importance of center cities.

Clearly, the Internet has not been widely available long enough to change development patterns to any noticeable degree . . . yet. Internet access and cable are not currently uniformly available. This may change if wireless Internet access is widely deployed, because high-speed fiber optic wiring is currently a limiting factor in many areas. Rapid adoption of these innovations can be compared with earlier innovations including electric power, automobiles, and television (Levitt, 2000). The new technologies may not only increase productivity, but may transform how firms do business, the way they compete, and the nature of work (*Economic Report of the President;* Horan et al., 1996). New technologies have changed the economics of locational decisions, both for consumers and businesses, and are facilitating the existing trend toward a more dispersed economy. Because these technologies reduce the frictions of space and time, businesses and people are freer to choose where they locate, no longer as tightly tethered, economically and functionally, to the major metropolitan core. Just how "footloose" these businesses and employees become depends on how many and which business functions are transformed into electronic flows, how much activity still requires face-to-face interaction among suppliers, customers, and competitors, and the path of future technological change.

Although the new technologies will technically enable firms and residents to disperse to rural areas, they are more likely to relocate both to lower cost metropolitan areas and to suburban and exurban locations within metros. The Office of Technology Assessment (OTA), in its comprehensive review of the impact of communication and information technologies on human settlement patterns, concludes that "a limited number of high-amenity rural areas and rural areas at the periphery of metropolitan areas may experience significant growth...", but "at least in the foreseeable future, most of the economy will be locating in metropolitan areas, perhaps not the largest, highest-cost metros, but the next tier of mid-sized metros" (U.S. OTA, p. 6).

The concept of telework has obvious appeal, suggesting that large numbers of workers may be able to avoid the negative aspects of urban congestion, while at the same time enjoying lower real estate costs, lower property taxes, and more rural residential settings. Widespread adoption of telework would accelerate the trend toward dispersed land-use patterns (U.S. OTA, 1995, p. 171; Kunar, 1990; Horan et al, 1996). But OTA concludes that "those who think of telecomuters living in idyllic, remote locations are generally thinking of fulltime telecommuters. Most experts expect that fulltime telework is unlikely to result in a widespread shift of households to rural locations" (U.S. OTA, 1995, p. 172).

The trend in job growth on the urban fringe for much of the last 50 years was strengthened by the preponderance of high-tech job growth in the suburbs engendered by the so-called "New Economy," or high-technology, companies (figure 12). A recent HUD report finds that larger metro areas in all parts of the country lead the Nation in high-tech jobs. High-tech jobs, including the occupational classifications of telecommunications, science, and research and technology, accounted for 9.3 percent of job growth in the suburbs, and increased at twice the rate of 1992-97 overall job growth in the suburbs. In 1997, 57 percent of metropolitan area jobs were located in the suburbs, a 17.8-percent increase since 1992 (HUD, 2000). With access to more skilled,

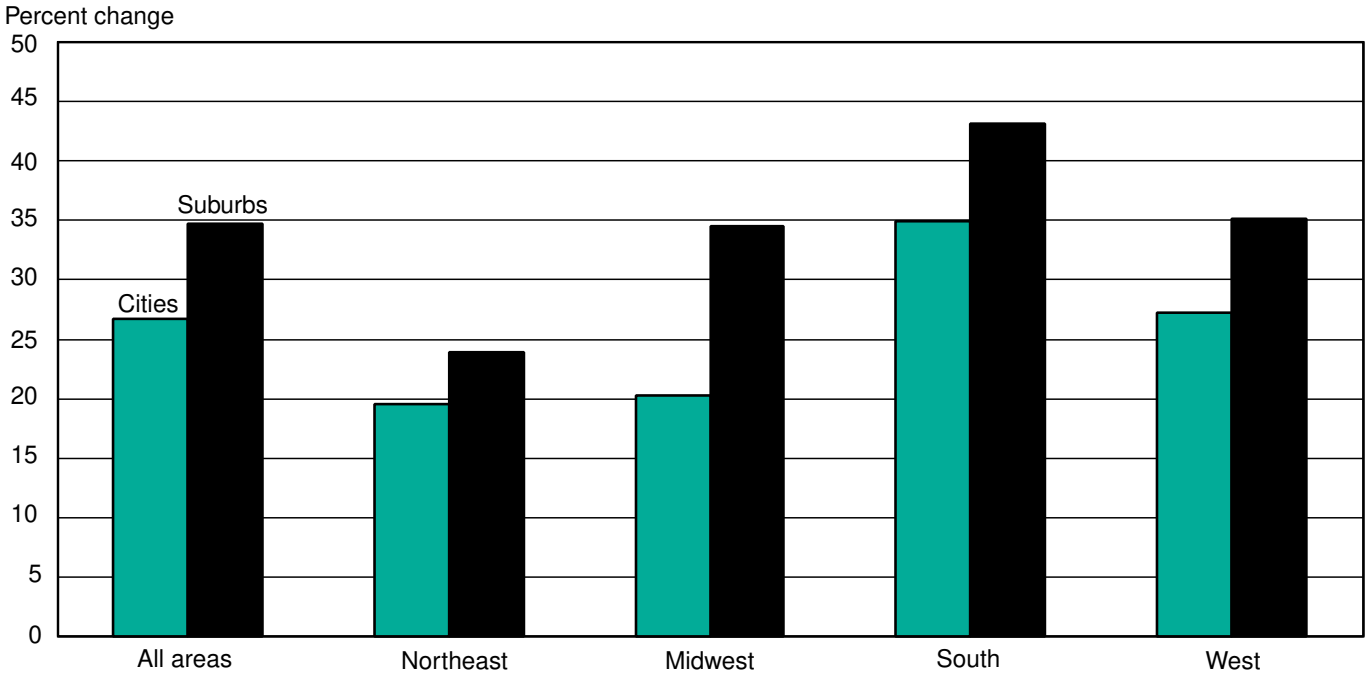
college-educated residents, especially women ready to return to work, suburban firms can fill positions faster at lower wages. As technology plays an increasingly larger role, labor quality becomes more important for firms, and firms are more likely to meet their skill needs in the suburbs. New technology enables greater economies of scale by reducing the constraints of distance on business operations, letting them serve more customers and a wider area from fewer locations. Business service facilities have consolidated into fewer, larger service centers. Taken together, the decreasing need for physical proximity and the consolidation of activity into larger operations both favor suburban locations on the edge of fast-growing metro areas.

Confirming evidence of suburban job growth comes from the U.S. Conference of Mayors 2000 survey showing high-tech jobs growing 20 percent faster in Northwest suburbs than in cities, 60 percent faster in suburbs in the Midwest than cities, and 25 percent faster in suburbs in the South than in the cities. According to Hirshhorn (2000, p. 7), suburbs are now home to 60 percent of office space nationwide. That is an increase of 25 percent since 1970. The rise of high-tech corridors outside cities, such as Silicon Valley, Route 128 in Boston, and the Dulles Corridor near Washington, DC, illustrates the phenomenon of new high-tech growth (Conference of Mayors, 2000). These high-tech corridors have begun to spawn outlying employment growth centers even farther out in the rural hinterland, such as Loudoun County, Virginia, California's Central Valley, and southeastern New Hampshire.

In addition, many of the New Economy companies, no longer economically and functionally tethered to major metropolitan areas, are locating in suburban areas of small cities in less populated States. Long-distance and 800-number services are examples, like Citigroup's back office credit card functions in Sioux Falls, SD.

The search for quality-of-life characteristics is of particular significance to the location decisions of knowledge-based, New Economy companies. The relatively small pool of highly skilled New Economy employees can perform their jobs nearly anywhere, providing unprecedented choice about where to live and work. More traditional criteria, such as salary and cost of housing now appear to be less important than quality of the environment (Hirshhorn, 2000, p. 23). To attract these highly skilled employees, companies must locate where many intangible amenities contribute to quality of life. Fortunately, the knowledge-based nature of their products also allows New Economy companies to locate nearly anywhere they wish. These companies are

Figure 12
High-tech jobs grow more slowly in cities than in suburbs, 1992-1997



Source: U.S. Department of Housing and Urban Development, State of the Cities, 2000.

among the most footloose, and are increasingly locating in rural suburban or exurban locations.

Suburban job growth, while slower than suburban population growth, is compounding the pressure on land far out in the countryside. The number of suburban jobs has grown to satisfy employers' needs to, first, exploit the labor force that now lives in suburban locations, and, second, to provide services to the new suburban populations. The old central city/suburb commuting patterns have been replaced with a web of commuting between satellite city employment nodes and residential suburbs, and between outlying areas and these nodes.

Residential development reaches out earlier and farther than office and commercial development. In a 10-year study of development in Columbus, Ohio, and surrounding Delaware County, Hite et al. showed that residential development was largely completed before commercial and industrial development commenced. Almost all parcels that eventually were converted to commercial and industrial uses "survived" in rural uses for nearly the entire period before being developed, while more than 70 percent of the parcels converted to residential use were converted before nonresidential development began.

IV. The Costs of Growth

Local, State, and Federal governments and the public they represent incur costs from development, some of which are borne directly by the land uses replaced. However, many of the costs of growth are apparent only after the development is in place. The consequences of growth for the communities and the benefits of retaining rural lands also need to be accounted for in judging the need for measures to control growth.

Poorly planned, extensive low-density, fragmented patterns of settlement impose a variety of direct and indirect costs on individuals and society. These costs can be approached in two ways. First, it is important to enumerate the costs imposed by new development in previously rural areas—real impacts and their monetary and nonmarket costs that accompany the replacement of rural landscapes with more developed ones. Second, urbanization has hidden costs because it causes us to forgo the benefits previously enjoyed from rural landscapes. Because low-density development is so common, we also examine possible benefits of low-density settlement patterns that may act as incentives or motives for that kind of growth.

Costs Imposed by Growth

There is a general consensus in the planning literature that low-density development costs more than compact development. For example, compared with more compact forms of development, low-density "sprawl" can result in (Burchell et al., 1998):

- Greater capital costs associated with building new infrastructure;
- Greater vehicle miles traveled and, consequently, higher levels of automobile emissions;
- More adverse fiscal impacts when annual tax revenues from residential uses are inadequate to cover the annual costs of providing public services;
- Higher rates of conversion of prime agricultural lands and lands with fragile environments.

The following reviews key findings synthesized by Axelrad (1998) from three major research investigations on this topic completed by Frank (1989); Duncan (Florida Community Case Studies, 1989); and Burchell (NJ, Michigan, City of Lexington, Delaware Estuary, South Carolina Studies 1992-1997). For counter-arguments, however, see Gordon and Richardson (Winter 1997, Spring 1997) and Peiser (1989).

Infrastructure Costs

The capital cost per dwelling unit of providing public services and infrastructure for new residential development varies by density, lot size, type of dwelling unit (single-family versus multifamily, detached versus attached), proximity to service areas, population characteristics, and utility capacity utilization. In a landmark study based on the characteristics observed in numerous developments using different patterns, Real Estate Research Corporation constructed hypothetical communities of 10,000 housing units in patterns ranging from low-density "sprawl" to high-density planned developments (RERC, 1974). They found that "sprawl" created 74 percent greater capital costs than high-density planned development, primarily due to higher land, residential construction, road, and utility costs. Public capital costs for streets and utilities were 120 percent greater for "sprawl" than for high-density planned development. Operating and maintenance costs were 13 percent higher with "sprawl."

Windsor (1979) recalculated these impacts for standardized 1,200-square-foot units in different housing types (figure 13). The RERC study has been criticized in part because assumptions relating to population and the sizes of dwelling units across community types influenced the results. In a comprehensive review of major studies conducted to determine the costs imposed by "sprawl" in various parts of the country, Burchell et al. (1998) found that infrastructure costs for "sprawl" development were 5 to about 25 percent higher than for compact development. (An exception is a study by Peiser (1984), which found that road infrastructure costs were lower with unplanned versus planned development.) Burchell et al. also found that school and municipal operating costs may be 2-5 percent less annually under compact development.

These calculations capture the inevitable economies of scale lost with low-density development: a fire hydrant serving a block with 20 families is more cost efficient than one serving a block with 5 families (U.S. House, 1980, p. 6). A more subtle cost not included above is the opportunity cost of leaving existing urban capital underutilized and losing support for maintaining exist-

ing urban institutions like schools, public facilities, and churches.

In five studies of managed growth in New Jersey, Michigan, South Carolina, Lexington, KY, and the Delaware Estuary Region, low-density development generally resulted in greater public capital and operating costs for infrastructure (Axelrad, 1998; figure 14). Costs of providing local roads were about 25 percent higher, new schools were about 5 percent higher, and utilities were about 20 percent higher than for planned development. Overall, capital and operating costs for public infrastructure are from 5 to 63 percent lower with planned development than with "sprawl" (figure 14). The annual costs required to provide services and infrastructure to a new dwelling unit are 20-30 percent of total annual costs (annual capital plus annual operating and maintenance costs).

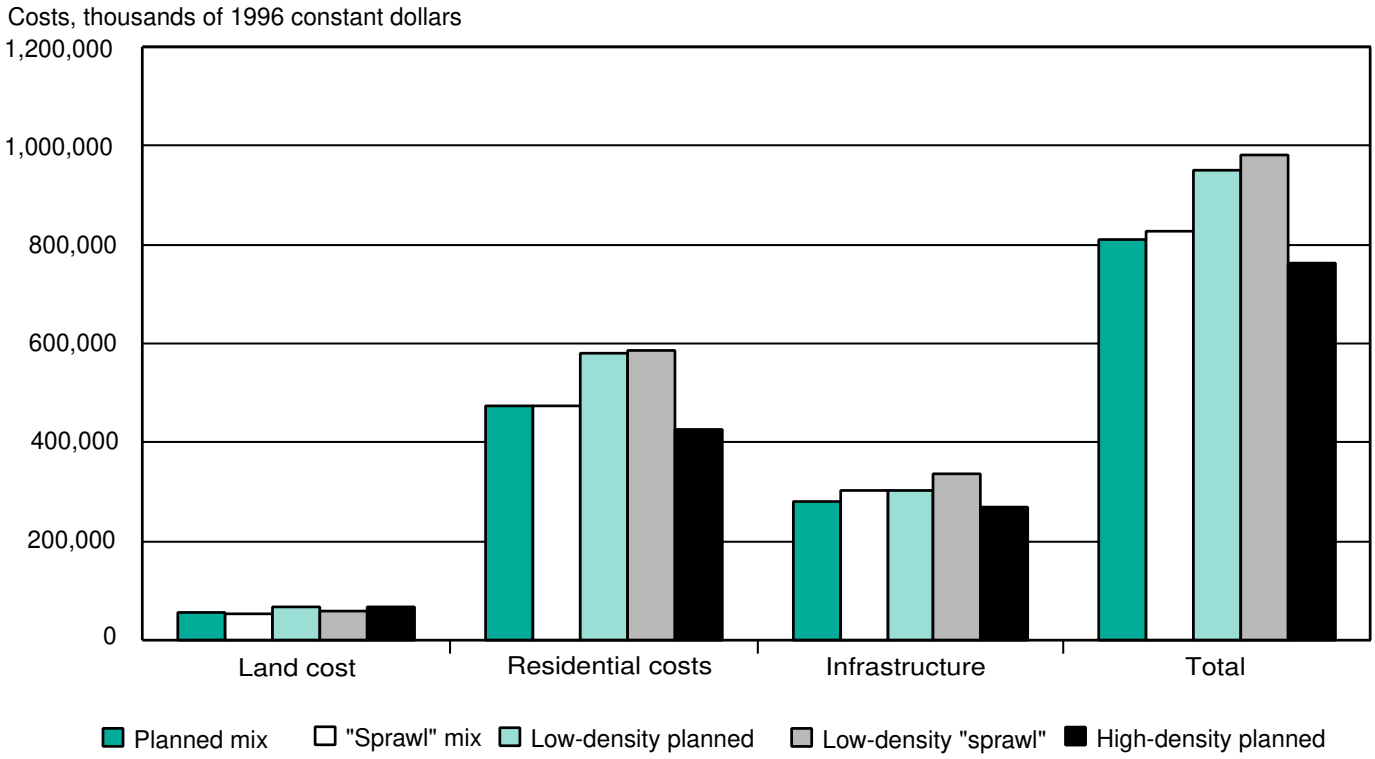
Low-density development incurs private capital costs, both because it increases the cost of building housing, and because demand for higher-density housing is reduced. Burchell found that private housing savings with more compact development ranged from 2.5 to 8.4 percent of costs under "sprawl" development.

That low-density development results in higher capital costs is not necessarily a public policy concern, unless these costs are borne by all the citizenry, instead of just the new residents of these developments. In a study of the incidence of costs from a 200-acre development near Lexington, KY, less than 1 percent of more than $100,000 in increased costs was paid by the new residents (Archer, 1973). Local governments are increasingly using development exactions to force developers, and their eventual customers, to internalize infrastructure costs of roads, sewers, water supply, and other investments, rather than pass them on to existing residents (Fischel, 2000, p. 412; Altshuler et al., 1993; Babcock, 1987). However, such exactions have been imposed only on relatively large developments that are subject to considerable planning and site review.

Transportation

Quantitative data show a strong relationship between low-density development and increased transportation and travel costs. Less compact development generates more vehicle miles traveled (VMT) than more compact forms of development. HUD reports VMT nationwide increased sixfold between 1950 and 1998 and by 25

Figure 13
Private and public capital costs by community type



Source: Windsor, 1979.

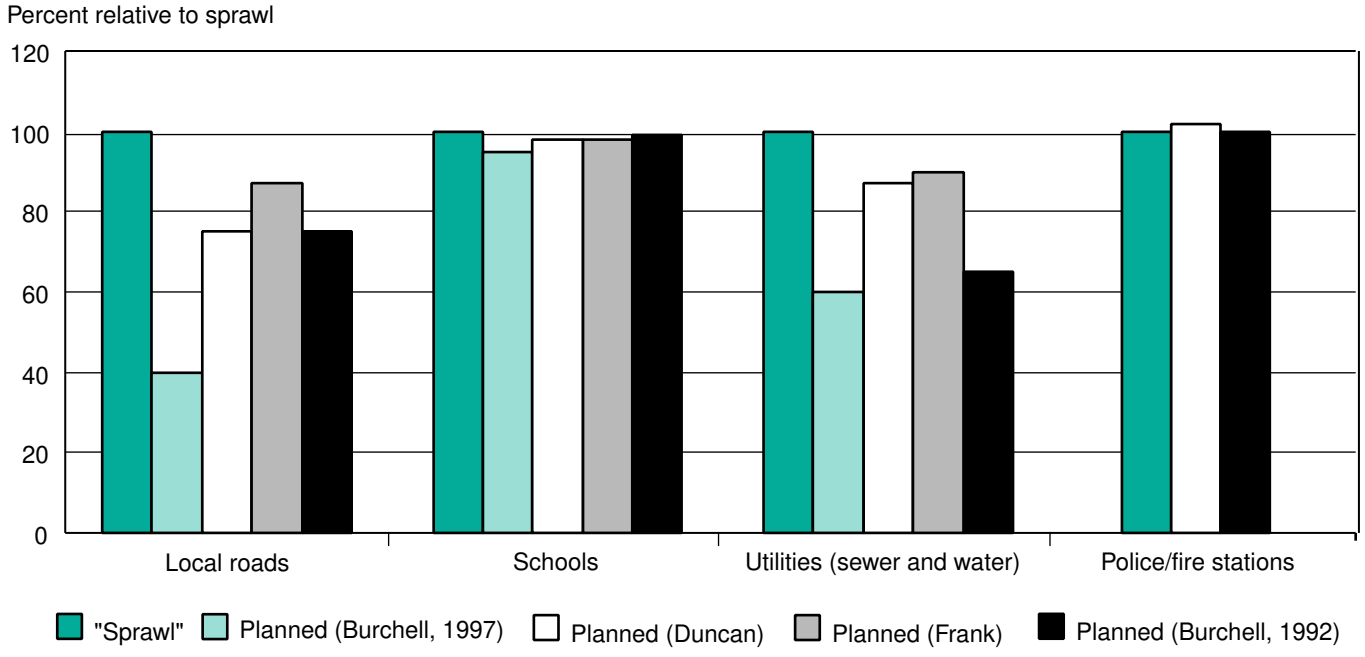
percent in the last 10 years (HUD, 2000). Daily trips per household were up 35.2 percent between 1977 and 1995 and vehicle miles were up by 38.1 percent. Low-density development creates longer distances traveled and increases dependence on the automobile—two of the three primary factors behind the trend to increased VMT nationally (the third is changing demographics). The expansion of commuter distances and traffic volumes further taxes rural roads and leads to highway expansion. Some argue that new roads lead to "induced travel demand" and that a better solution to congestions is to shift travel behavior, travel mode, route, and time of day (U.S. HUD, 2000). In addition, low-density development leads to a less cost-efficient and effective public transit. These findings are repeated across the country:

- Household transportation expenditures ranged from 17 to 22 percent of household spending in the 10 most "sprawling" cities, according to a study by the Surface Transportation Policy Project. Households in 7 of the 28 cities studied that had the greatest "sprawl" spent at least 20 percent more on transportation than households in the 7 cities with the least "sprawl" (Surface Transportation Policy Project/Center for Neighborhood Technology, 2000).
- Based on a 1994 study of 28 California communities (controlling for levels of transit service and vehicle ownership), a doubling of residential density was associated with a 16-percent decline in vehicle miles of travel (Holtzclaw, 1994).
- A simulation comparing future growth patterns in Portland, Oregon, found that a "growing out" pattern (with new development continuing at current types and densities) resulted in an estimated 15 percent higher average daily VMT than in a "growing up" pattern that kept all growth within the existing urban growth boundary by reducing lot sizes and introducing more multi-family housing (Portland Metro, 1994).
- Between 1970 and 1994, under the prevailing low-density trends in development, the Chesapeake Bay area population grew by 26 percent while VMT increased by 105 percent (Chesapeake Bay Commission, 1996, cited in Axelrad, 1998).
- An econometric study using 1995 data from the Nationwide Personal Transportation Survey showed a statistically significant 24- to 60-percent increase in household vehicle mileage in metropolitan areas compared with the central city (Kahn, 2000).

Impacts on Taxpayers

Concern about development includes its relationship to taxes and the costs of providing services. New development is a "shock," whose effects ripple through the economic, fiscal, environmental, and social fabric of a community, influencing employment, income, govern-

Figure 14
Relative capital costs of public infrastructure



ment tax revenues, quantity and quality of public services, and nonmarketed "public" goods related to the quality of life and the environment. Increasingly sophisticated and expensive methods can be used to estimate more or less of the fiscal and economic effects of urban development. These methods include Cost of Community Service studies (COCS), fiscal impact analysis, and cost/benefit analysis (see box, "Methods for Estimating Growth's Economic Impact").

Costs of Community Services

In recent years, COCS has been widely applied, in part because of its relatively low-cost, straightforward methodology, and the intuitive appeal and ease in understanding the results. The American Farmland Trust developed this approach in the early 1980's and conducted a large number of studies (AFT, 1986 a and b, 1991, 1992, 2000; Hartman and Meyer, 1997).

The more than 80 cost-of-community-services (COCS) studies conducted across the country found that residential development provides less tax revenue than it consumes in public service expenditures. According to these studies, farm and open space lands contribute more to tax revenues than they use in public service expenditures, but contribute much smaller proportions of total community tax revenues than does residential development (6.4 percent vs. 66 percent).

The ratio of service expenditures per dollar of revenue generated by residential land is greater than 1 (figure 15). The studies conclude that farmland and open space lands consistently make a positive net contribution to community budgets, even though agricultural lands generate relatively little tax revenue. A large proportion of the disparity in service costs between residential and farmland uses is attributable to the costs of educating children. Public schools account for 60-70 percent of spending in typical communities, constituting the single largest expenditure category (Prindle and Blaine, 1998).

COCS studies do not provide a full picture of the costs and benefits of urban growth, and consequently are subject to criticism (see box, "Methods for Estimating Growth's Economic Impact"). New residents do not just pay taxes and demand services; they contribute to the economic base of the community. Population changes affect the local labor force, which in turn changes employment, income, income taxes, business activity, and property and sales taxes. This economic multiplier effect, not captured in COCS studies, can generate significant revenues in the form of additional sales and services.

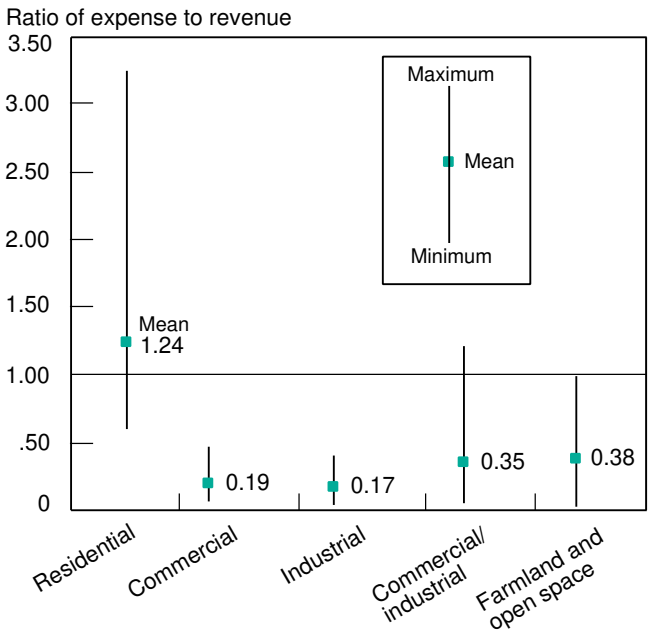
Further, COCS studies take a "cost theory" of taxation, which does not consider how growth increases individual wealth through increases in property values. Given that the supply of land is fixed, increased demand for land due to growth increases land values, and thus the total property tax revenue. If growth brings increased public expenditures that increase services and the quality of life, then the benefits of this higher quality of life will also be capitalized in land values. Of course, negative effects of growth (e.g., loss of landscape amenities and sense of community, increased congestion, and reduced air and water quality) also change land values.

Fiscal Impacts

Fiscal impact analysis focuses on the net cash flow to the public sector from new development, including those indirect or secondary effects discussed above (see box, "Methods for Estimating Growth's Economic Impact"). Fiscal impact analysis requires projections of changes in the local economy, tax revenues, and the cost of public services, which COCS studies do not make.

Studies find that for relatively low annual growth rates, local per capita government spending does not increase rapidly (Kelsey, 1993; Kelsey, 2000, Lincoln Institute, 1993; Esseks et al., 1998). For higher growth rates, however, per capita spending begins to increase dramatically. Whether increases in per capita spending reflect

Figure 15
Ratio of community service costs to tax revenues (n=85)



Source: American Farmland Trust, 2000.

Methods for Estimating Growth's Economic Impact

Cost of Community Services—COCS studies allocate a community's current budget to the category of land use that generated the tax revenues and consumed the public services. Revenues include taxes and nontax fees; costs include the local share of expenditures for education, social programs, public health and safety, highway maintenance, other public works such as sewer and water, and local government. The local government's income and expenses are allocated to various land use categories, usually residential, commercial/industrial, and farmland and open space, for a recent year. To trace the flow of tax revenues and public service expenditures to their associated land uses, the analyst must reorganize local financial (budget) records at a point in time. Conclusions drawn from COCS studies implicitly assume current infrastructure and services, thus the results are community-wide averages. Deller maintains that though the results are consistent, the implications drawn from the results may be wrong. Results can be affected by allocation of costs between States (or other regional authorities or the Federal Government) and the local jurisdiction being studied. The size of the government being studied and whether it includes commercial and industrial enterprises that support the residential development also affect the results. Timing of major capital purchases is also important. Further, the ratios reflect average community revenues and expenditures at a point in time, not marginal costs and revenues, which are particularly affected by capacity and congestion considerations. Deller cites the following methodological and theoretical flaws associated with COCS studies:

- Aggregation across land use types—The residential group makes no distinction between important residential categories including mobile homes, single-family dwellings, apartments, or retirement homes.

- Intensity of manufacturing—There is no distinction between low-intensity manufacturing and large-scale industrial uses.

- Basis measure bias—COCS uses a gross dollar basis to make comparisons, and thus predetermines the outcome of the study. If the basis of ratio comparison was "per acre" rather than "per dollar," commercial and industrial uses would advance in importance.

- Capacity to add development is ignored—Whether existing public utilities have excess capacity is crucial to determining the impact of any development.

- Economies of scale ignored—The high fixed cost of many public services means that spreading that cost over more residents will lower the per resident costs.

- Nature of public goods ignored—COCS treats public goods (those with nonrival, nonexcludable characteristics) as if they were private goods.

Fiscal Impact Analysis—Fiscal impact studies take the perspective that residential developments create economic changes that are not reflected in existing community budgets. New residents contribute to a community's economic base in ways that are not captured by COCS studies. In essence, fiscal impact studies attempt to incorporate the multiplier effect that is associated with any new economic activity generated by the new residential development. In general, fiscal impact studies are of two forms: one that is project specific, such as a new housing development or new industry, and one that takes an area-wide perspective. In either case, fiscal impact studies project public costs and revenues under alternative land development scenarios, but remain focused on the local government budget, not the full social cost of the new economic activity.

Costs and Benefits—Fiscal impact analysis does not account for an array of nonmarket costs and benefits that change when farmland is converted to urban development. These nonmarket effects are not reflected in changes in government expenditures and revenues, nor in land values or other market price signals. Many of the costs are related to externalities including environmental degradation, traffic congestion, and loss of open space. Other intangible costs include noise, crime, and changes in community character. If additional development changes the quantity or quality of these nonmarket characteristics of the rural environment, then consumers' willingness to pay to preserve positive characteristics and avoid negative ones should be accounted for in a complete analysis. Such complete cost/benefit analyses depend on estimating nonmarket impacts so the cost of such studies is often prohibitive. Studies of this kind must rely upon expensive nonmarket valuation techniques, such as hedonic price analysis, travel cost models, or stated preference surveys. Sometimes results from a limited study are "transferred" to other or broader applications using what are called "benefits transfer" procedures.

purchases of higher quality services is not clear. Ladd (1994, p. 661) concludes that they do not:

> "Higher growth-related per capita spending primarily reflects the combined effects of greater density and increased local spending shares. In sum, established residents in fast-growing areas may experience declines in service quality, as well as rising local tax burdens."

As described above, low-density development results in greater public capital and operating costs for local roads, schools, and utility infrastructure (Windsor 1979, RERC 1974). At typical urban-suburban densities, per capita infrastructure costs fall as densities rise. At very low densities, the use of septic systems, open drainage, and unpaved rural streets without curbs and sidewalks may result in low costs, but the equally low quality of such services becomes evident as development increases and these services prove inadequate.

Impacts on Landscape, Open Space, and Sense of Community

Growth involves more than traffic congestion, infrastructure costs, and altered public finances. It alters the landscape, the natural environment, and other factors important to quality of life. For example, low-density development consumes open space in the surrounding countryside, so residents who once had pleasant views of nature now have views of other suburban houses and shopping centers. In some cases, growth can destroy the very scenic amenities that once attracted people. This section draws, in part, on the comments of local government and business representatives from eight nonmetropolitan counties experiencing growth over the last two decades (Reeder et al., 2000).

Community Spaces—The loss of open space can stymie local recreation and cultural activities. For example, a publicly used lake or beach may become fenced off private property. A place known for hunting or fishing may be closed off to public access. Many communities use undeveloped lands for public activities, such as county fairs and other local festivals. Other such open spaces may be the sites of historic events, such as civil war battlegrounds. The pressure of development can consume these sites and, in the process, obliterate local historical landmarks.

Retail Relocation—The relocation of key retail businesses and services (such as the post office) to open space on the periphery can drain the vitality of the town's center, or create center-less communities. Retail restructuring has negative effects on some downtown businesses, while creating congestion problems in the fringe. For example, Tim Sheldon, of the Economic Development Council of Mason County, Washington (near Seattle), noted that "Wal-Mart and other national chains had moved into the fringe area of new development, emptying the county's downtown area, where small businesses were hurting" (Reeder et al., 2000). However, over time many town centers in growing communities eventually redevelop with tourist and specialty shops. Brenda Johnson, with the Gilmer County Chamber of Commerce (north of Atlanta, Georgia) said "Gilmer's new Wal-Mart in a strip mall on the fringe was causing incredible congestion at the existing intersection; and the new retail on the fringe of town had killed a few downtown stores, but the county's downtown area had become a thriving tourist and specialty shop area with smalltown charm."

Sense of Community—In extreme cases, development can make it difficult to tell where one town ends and another begins. When town boundaries are obscured, the sense of community, which is important in generating civic pride, volunteerism, and support for local public services and community activities, may be diminished. The sense of community may also be impaired when developments are not open to the public. Gated communities are often developed at low densities, and may be well-planned and provide some of their own infrastructure and services. However, these communities often differ in demographic characteristics from the outside community, typically wall out their neighbors, and often think and act as if they are a community in themselves. This can create a significant divide with the surrounding town on public policy issues such as schools and economic development.

Environmental Changes

Growth poses numerous environmental challenges. Because the environment is linked to other aspects of society, such as public health and the economy, environmental implications from growth can have various adverse impacts on local communities and require many and diverse policies to prevent or mitigate these impacts (table 2).

Land Use and Soil Quality—Studies of land consumption associated with low-density growth show that greater land consumption stems from three characteristics:

Table 2—Growth-related issues, impacts, and possible solutions

Growth issue	Environmental issue	Impacts	Possible solutions
Haphazard expansion of suburban communities	Water runoff	Increased pollution of streams, rivers, and marine environments Increased flooding Loss of biodiversity in streams Soil erosion Decreased recharge of aquifers Lower drinking-water quality	Coordinated land use planning More compact communities Greenspace buffers and preservation Watershed protection
Poor land use planning	Consumption of open spaces	Loss of contiguous greenspaces Loss of natural habitats for native species Stressing of endangered species Loss of wetlands Fragmentation and loss of forestland Increased flooding Increased mountain mudslides and slope collapses Increased prevalence of non-native, invasive species Health impacts from proximity to wild animals and confined-animal feeding operations Loss of open space Less access to recreation areas Higher temperatures or “heat islands” in metropolitan areas Reduced plant photosynthesis	Land preservation Priority development areas Growth boundaries Purchased development rights Urban revitalization and infill development Higher impact fees for developers Expand open spaces in urban and suburban areas Strengthened zoning Consistency in zoning based on comprehensive plan Public education
Traffic congestion	Air pollution	Increased smog and other pollutants Increased health impacts, such as asthma Noncompliance with Federal standards and limits on new road construction	Improved transportation, land use planning Mixed-use development Urban revitalization Mass transit Telework
	Public safety	Increased response times for fires and medical emergencies Road rage	Traffic congestion relief efforts Public education
	Energy use	Wasted petroleum	Improved transportation planning Flexible work hours and telework
Urban depopulation	Contaminated land and buildings	Increased human exposure to toxic substances	Brownfields development projects
	Public infrastructure	Decreased maintenance and greater service interruptions for water, sewer, road repair, and waste disposal	Urban revitalization and increased growth Revenue sharing with suburbs Stronger regional planning

After Hirschorn, 2000, p. 12

• low density of settlement;

• unlimited outward extension of growth;

• "leapfrog" or fragmented development pattern (Axelrad, 1998).

Low-density development results in a greater loss of agricultural lands than more compact development. However, studies have shown that, nationwide, the amount of prime and class I-IV cropland lost in urbanizing areas was proportional to the amount of those soils found in the area (Heimlich and Bills, 1997; Heimlich and Krupa, 1994; Vesterby and Krupa, 1993; Vesterby et al., 1994). Low-density patterns of development result in a greater loss of sensitive environmental lands, including wetlands, flood plains, critical habitat, aquifer recharge areas, stream corridors, and steep slopes.

Better planned, more compact settlement patterns can often avoid converting such lands, incorporating them into open space and environmental protection zones. Studies by Burchell (1992-97) and Landis (1995), summarized in Axelrad (1998), estimated such land consumption savings (figure 16).

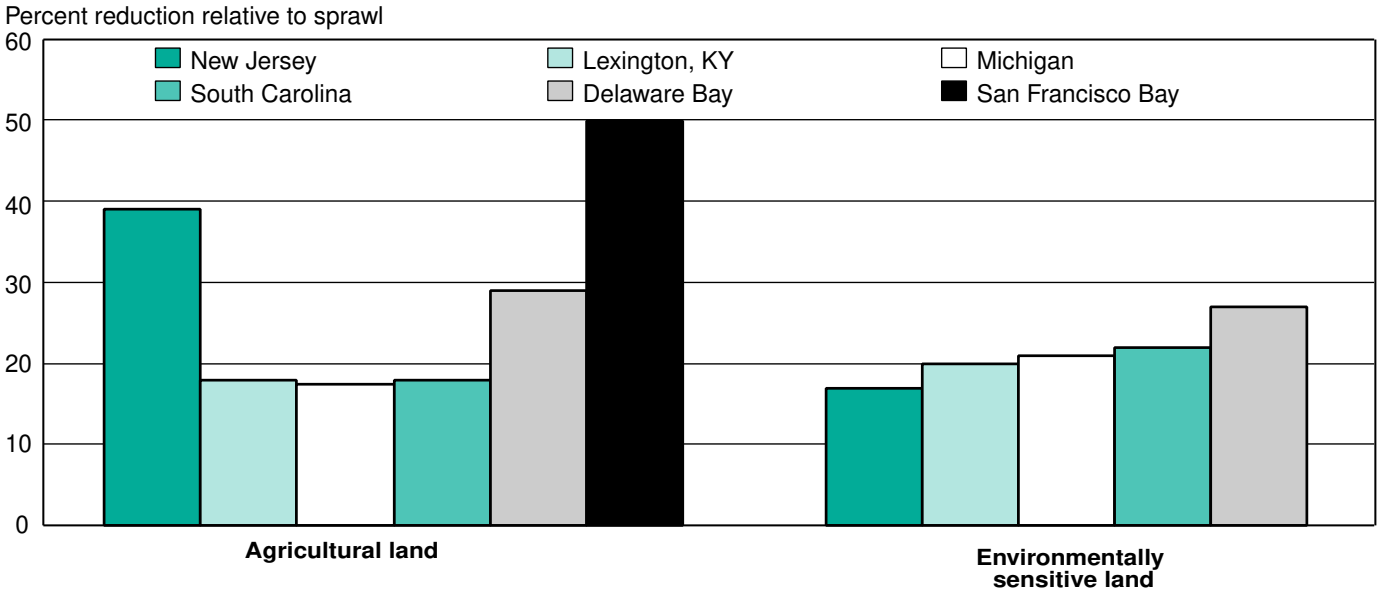
Wildlife Habitat—Development disturbs, pollutes, and destroys the natural habitats for various native species when it consumes wetlands, forests, alpine, and desert terrain. Insecticides and fertilizers used on lawns can have significant negative effects on wildlife. In some cases, Federal or State governments will cause communities to restrict development and related activities to protect wildlife. For example, Bob Fink, of Mason County's planning office, noted that "because of a new series of endangered species announcements covering several species of fish, his county may change its development regulations." However, not all wildlife effects are bad. For example, some types of developments provide protected green space or parkland that creates mini-ecosystems where habitat-generalist species and those that can fly between fragments can flourish (Lovejoy et al., 1984, Whitcomb et al., 1981).

Growth seriously fragments wildlife habitats. Habitat fragmentation is often singled out as a principal threat to the preservation of biodiversity (Harris and Gallagher 1989; Wilcox and Murphy 1985; Noss and Cooperrider 1994). The negative effects of fragmentation on biodiversity are numerous, and can be grouped into four major categories:

• Reduction in total habitat area. Habitat remnants support fewer species and smaller populations of the same species than larger swaths;

• Loss of wide-ranging, low-density, and habitat-specialist species. Mountain lions, which have ranges that can exceed 1,000 square kilometers (Hemker et al. 1984) are now extinct in a recently isolated habitat

Figure 16
Savings of agricultural and environmentally sensitive lands, compact growth versus "sprawl"



Sources: Studies reported in Axelrad, 1998.

fragment in Orange County, California. Habitat interior dwellers, such as some forest birds, may be locally extinct from fragments of 1 square kilometer as studies in eastern North American deciduous forests have shown (Whitcomb, 1977; Wilcove et al., 1986);

- Increased "edge effects," or the microclimatic changes that occur along power line corridors, roads and urban development which favor exotic species often at the expense of native and interior species (Newmark, 1987); and

- Increased extinction risk from demographic, environmental, and genetic variances (Menges, 1992).

Urban development is one of the principal causes of wetland loss. In 1985, 85 percent of Maine's wetlands were visible from a road or within 2,000 feet of a road, and thus of limited habitat value. Of Maine's 2,700 lakes, 200 have been harmed by development, and 300 are at risk (Maine State Planning Office, 1997). Between 1982 and 1992, the National Resources Inventory showed that 89,000 acres of wetlands were lost to urban uses per year, 57 percent of total gross wetland loss (Heimlich et al., 1998).

Development of roads in formerly rural areas creates increased opportunities for collisions between wildlife and new urban residents. The Humane Society and the Urban Wildlife Research Center estimate that more than 1 million large animals are killed annually on U.S. highways. Roadkills usually increase with traffic speeds and volumes. Studies in the state of Florida indicate that road kills are the primary cause of death for most large mammals, including several threatened species. Some animals have an aversion to roads, which may affect their behavior and movement patterns. For example, black bears cannot cross highways with guardrails. Other species become accustomed to roads, and are therefore more vulnerable to harmful interactions with humans. By forming a barrier to species movement, roads and development fragment and isolate wildlife populations, preventing interaction and cross breeding between population groups of the same species. This reduces population health and genetic viability. Development and road construction and use introduce a variety of noise, air, and water pollutants. Loss of habitat, invasion of exotic species, alteration of watershed hydrology through changes in water quality and water quantity, stream channels, and groundwater all accompany development, as does increased access by hunters, poachers, and irresponsible visitors (Litman, 1999).

Water—Many of development's health-related issues involve water. For example, much of the development in the countryside involves homes with on-site septic systems, which often cause greater water pollution problems than municipal sewage systems. While many of the bigger developments are hooked up to municipal or county water and sewer systems, these systems can sometimes overflow, particularly during heavy storms, causing significant pollution problems. Some developers build their own wastewater treatment plants, and these systems sometimes prove to be inadequate. "These private developer-built systems sometimes prove to be unacceptable in quality. This happened recently in Lyon County (Nevada), and the county ended up having to pay for upgrades and repairs to these systems to meet public standards," according to Mark Clarkson, manager of Lyon County's Utilities Division.

The type of land use, and particularly its density and the amount of impervious surface, affects the amount of pollutants in storm water runoff. More intense uses engender more pollutants, and large impervious surfaces lead to greater volumes of runoff and more pollution. The original "Costs of Sprawl" report (RERC, 1974) estimated that low-density "sprawl" generated the most sediment, biological and chemical oxygen demand, nitrogen and phosphorus runoff, and suspended solids and fecal coliform bacteria of any development pattern.

A New Jersey study of different urban development patterns found that compact development would generate significantly less pollution than low-density development for all categories of pollutants (Burchell, 1992). The reduction ranged from over 40 percent for phosphorus and nitrogen to 10 percent for lead (figure 17). The study noted that, in some places where development is particularly dense, water quality will deteriorate, but in general water quality will be better with planned growth than with unplanned development.

Another problem, particularly in the West, involves limited or declining water supplies. Many new homes in the countryside use on-site wells for water, and in some cases underground water supplies are declining. This problem is exacerbated by less natural replenishing of underground water due to increased water runoff caused by increased area of impervious surfaces, such

as roofs, roads and parking lots, and the building of sewers.

Floods and fires can become more significant concerns as more people move to the countryside (Esseks et al., 1998). For example, Rob Nesbitt, of the Lamoille County Planning Commission (near Burlington, Vermont) reported that "Lamoille County has had a history of floods. None of our water bodies have flood control dams on them." Development not only raises the stakes of life and property loss, it may also help cause or aggravate floods and fires. For example, construction often causes erosion which fills ups streams and increases the likelihood of floods, and the increased area of impervious surface increases flood peaks. Development may add to heat retention, eliminate wetlands, and result in reduced forestland management, resulting in increased fuel and adding to the threat of fires.

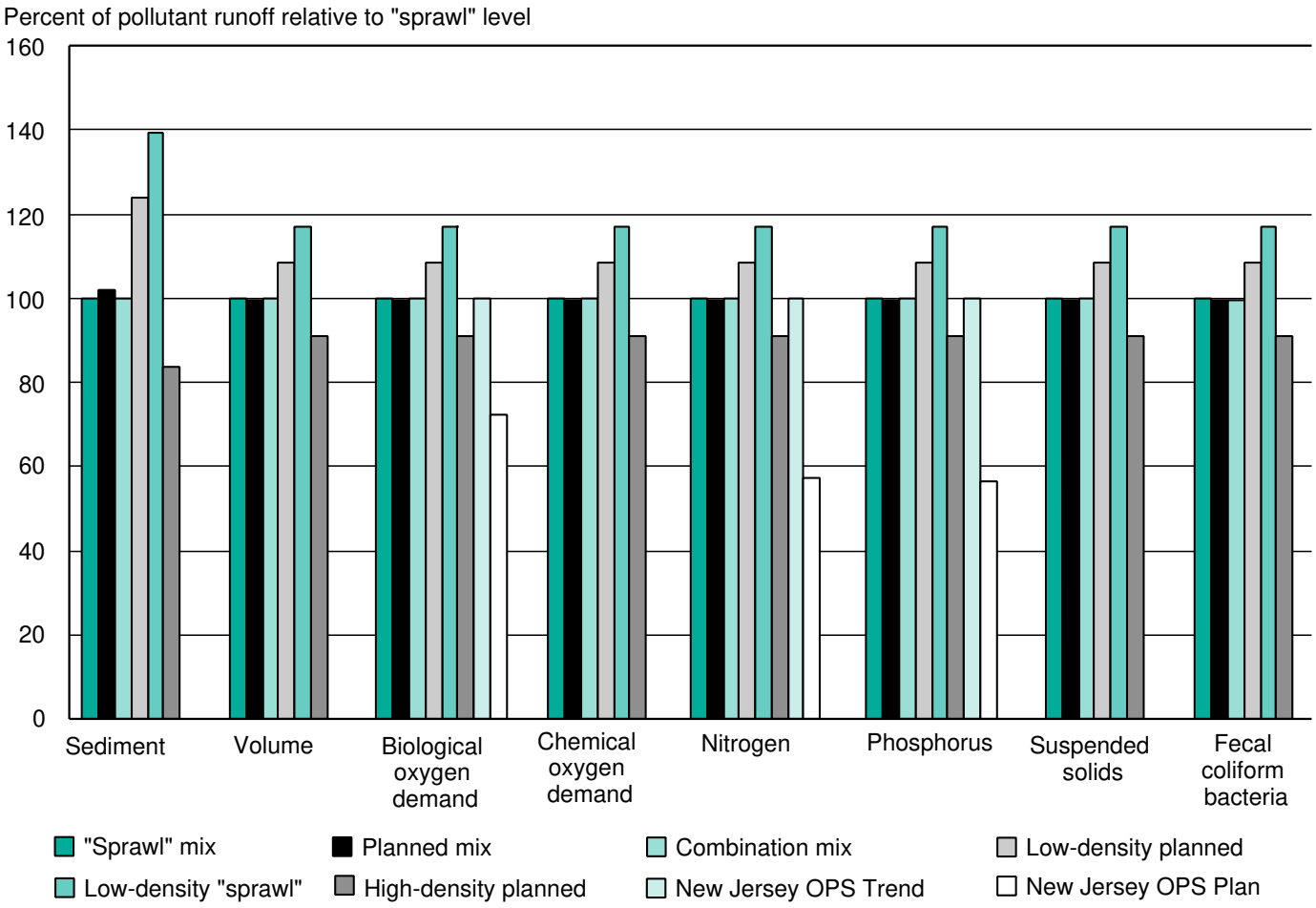
Air Quality—Air pollution is sometimes an important environmental issue in areas with high rates of commuting, where ground level ozone (smog) emitted from autos creates significant health concerns. When the level of air pollution exceeds EPA standards, Federal law requires that planning be aimed at reducing air pollution levels, or the State may be penalized by reductions in Federal highway aid.

Other Quality of Life Issues

Aside from traffic congestion, other quality of life issues affected by growth are the quality of education and the affordability of housing.

Education—Many are drawn to these rapidly growing areas by the perception that schools are of better quality than those in the central cities. However, newcomers

Figure 17
Water quality impacts by community type



Sources: RERC, 1974; Burchell, 1992
New Jersey Office of State Planning Trend was for existing mix of development; Plan was for greater density.

often demand improvements after they arrive. In addition, the influx of new students is so rapid and unplanned that schools can quickly become overcrowded. Even in places that plan well ahead for the incoming school populations, some problems remain for schools in growing areas. For example, according to Pete Kelly, school superintendent for Citrus County, Florida, "Many schools are already built in the developing areas, however there are too many developing areas to build high schools in every one. With the population spread far and wide, long bus trips are required to transport students to the high schools."

While demands for schools and other services are increasing, many growing communities experience slower growth in tax base and expendable revenue, due to the tendency of commercial and industrial development to lag behind residential growth. Without concurrent growth in the commercial and industrial tax base, schools often must make cuts in current spending per pupil. In addition, because most of these places find that their new student population is above the poverty level, State and Federal aid does not grow proportionally with student populations. As a result, many school systems in growing communities are constantly playing catch-up in school construction, and are hard pressed to come up with sufficient tax revenues to maintain education quality.

Affordable Housing—Affordable housing is another issue of concern. Though single-family housing may be cheaper on the fringe than in central cities or the inner suburbs, not much housing is available at prices that low-income individuals or families can afford. In some cases, local zoning provisions exacerbate this situation by requiring more expensive large-lot development. For example, Comissioner John Metli of Elbert County, Colorado (near Denver), said "Elbert County's average home costs $225,000—up from $150,000 just 5 years ago, and this lack of affordable housing is self-inflicted, because regulations are more stringent on the 5-acre lots, making it more economical to buy and build on a 60-acre lot than on a 5-acre lot in a high-priced development."

Although the lack of affordable housing may not be perceived as a problem by most local residents, it becomes a problem for low-wage industries, including retail and services. It is also a problem for the children of long-term residents who may lack the incomes to be able to afford new housing in the area. Consequently, local governments often must require that developers build some affordable housing.

Despite these negative aspects, it would be wrong to conclude that the quality of life declines in all respects for places experiencing low-density development. For example, the retail and commercial growth that follows residential growth provides local residents with a greater diversity of goods and services to purchase, as well as a growing supply of jobs. While it is true that many of these jobs are low paying compared with some traditional rural jobs (such as mining and manufacturing), many provide part-time or seasonal employment that is critical for supplementing family income. For example, farmers have come to rely on this form of off-farm employment to maintain their standard of living in the face of weak agricultural markets.

An Economic Interpretation of the Demand for Low-Density Development

The worst consequences of unplanned, low-density development are not the result of some vast conspiracy by ruthless capitalists known as "developers." Walt Kelly's famous cartoon character Pogo correctly observed that, "We have met the enemy, and he is US" (Walt Kelly). Millions of individual choices by consumers and businesses which are aimed at creating a better way of life designed to garner the benefits of low-density development outlined above instead result in patterns of development that often have negative consequences for new and old residents alike in loss of rural amenity, traffic congestion, and environmental degradation. How can consumers, businesses, and communities so consistently fail to anticipate the results of their actions with regard to development?

Economists usually attribute such unanticipated results to market failure. While the markets for housing and commercial real estate work efficiently, the market for "lifestyles," including landscape or rural amenities either fails to exist or fails to deliver the anticipated benefits. This market failure can be understood as arising from interactions among the following factors:

- Markets for positive externalities from agricultural production, such as open space and rural amenities, do not exist. Therefore, these attributes in the landscape are neither permanent nor even necessarily long-lived when development begins to occur. Housing construction does not impose negative spillover effects (externalities) in this regard, it removes positive spillovers that were in place from the previous economic activity, farming.

- Negative spillovers from housing consumption, such as traffic congestion, destruction of visual amenities, and crowding, are not priced in the cost of the housing or other development. If the cost of the landscape amenities were accurately included, "housing" costs would be much higher and demand lower. For example, fully planned communities with carefully controlled land uses and landscape amenities such as open space, lakes, and recreational facilities included are more expensive than nearby developments without these amenities.

- Imperfect information creates a market failure because consumers do not anticipate future development patterns and do not weigh them perfectly in current housing purchase decisions.

- Absence or failure of planning and zoning in local communities contributes to this failure because there is no information about the institutional framework within which future development can take place. When future development is dealt with on a piecemeal or ad hoc basis, neither consumers nor developers can adequately anticipate what development will occur on surrounding parcels.

- Developers, who generally have a good grasp of future development potential, have no incentive to inform housing consumers who value open space and other rural amenities that they are likely to be developed.

Other sources of failure in the "lifestyle" market derive from the nature of development and land-use change. Development results from the cumulative impacts of many small decisions, with the rare exception of a large, planned, "new town," such as Columbia, Maryland, Reston, Virginia, or Irvine Ranch, California. Markets proceed on the basis of many small decisions, which when taken without an overall context, produce results that can be neither envisioned by nor anticipated by consumers and developers (Kahn, 1966). There is no problem when consumers of corn or soap fail to anticipate the resultant changes in supply and demand that result from their atomistic consumption decisions because corn and soap producers respond quickly and seamlessly to small variations in supply and demand in very short order. However, the cumulative effects of similar decisions in land use can result in significant disamenity over time (CEQ, 1997; Spaling and Smit, 1993). Specifically:

- Individual developers' decisions, which produce negative spillovers for existing land users, are generally small in scale relative to the entire landscape, occurring subdivision by subdivision, or even house by house (Fischel, 1999, p. 411).

- Consumers' decisions on housing consumption, which produce negative spillovers for each other from consumption, are made one house at a time.

- Both developers' and consumers' decisions are irreversible over time scales of a lifetime, providing little scope for adjustment except to move to a "clean canvas" in another rural setting (Tiebout, 1956; Hamilton, 1975).

- Efficiency in the real estate market increases property values as development proceeds in desirable new neighborhoods, creating greater incentives to develop (Lafferty and Frech, 1978; Burnell, 1985; Speyer, 1989).

- Negative spillovers from development do not create a drag on property values in the real estate market until disamenities are quite high.

In summary, there are substantial costs imposed by allowing low-density development, both at the fringe of existing urban area and farther out in the rural countryside. People recognize substantial benefits from maintaining and conserving rural land uses in farming, grazing, and forestry. While some communities actively address growth control issues, private market forces often operate with minimal intervention from fragmented land-use control authorities at the State and local levels and cannot recognize and avoid these costs, nor capitalize on the benefits. land-use issues are primarily local in nature, and, under our constitutional system, authority over them rests with State and local government. But the consequences of development are being felt all across the Nation, in almost a third of the country.

V. Consequences for Farming

Through the entire process of development, farming coexists with development and adapts, however uneasily, in the shadow of the city. Settlement patterns that create low-density development and fragmentation across rural landscapes have both negative and positive consequences for agriculture. Increasing population and employment provide some opportunities for farms, but also create problems.

Agriculture: Farming in the City's Shadow

Large and growing areas of U.S. agriculture are influenced by proximity to urbanization and concentrations of population brought about by growth. Metropolitan Statistical Areas (MSAs), defined by the Bureau of the Census, contain 20 percent of U.S. land area and 80 percent of the U.S. population (Bureau of the Census, GARMS, 2000). Nationally, farms in metropolitan areas are an increasingly important component of U.S. agriculture. In 1997, they made up a third of all farms and controlled 39 percent of farm assets (table 3). Eighteen percent of farmland operated was located in metro areas in 1997, roughly proportional to the total land in metro areas (Barnard and Heimlich, 1993; Heimlich and Barnard, 1992, 1997; Hoppe and Korb, 2000). The count of farms excludes service firms, such as horse boarders and landscape services that are not directly involved in agricultural production, but that contribute to open space and economic activity.

As urbanization proceeds, landowners may seek enterprises and markets that offer returns to land more commensurate with those from development, in part to offset the higher property taxes that are incurred as land prices rise to reflect the potential for future nonagricul-

Table 3—Metro and nonmetro farm characteristics, United States, 1991 and 1997

Characteristic	Metro				Nonmetro	Total
	Recreational	Adaptive	Traditional	Subtotal		
			Number			
Number of farms, 1991	372,689	97,024	226,704	696,416	1,390,607	2,087,023
Number of farms, 1997	283,776	74,522	199,569	557,867	1,181,349	1,739,216
			Thousand acres			
Acres owned, 1991	23,107	12,613	55,996	91,927	417,182	509,109
Acres operated, 1991	33,542	24,741	142,370	200,568	1,090,236	1,290,804
Acres operated, 1997	22,675	13,894	123,323	159,892	733,031	892,923
			Million dollars			
Sales of agr. products, 1991	910	18,877	17,647	36,900	69,975	106,875
Net cash farm income, 1991	-1,813	4,190	2,752	4,993	13,866	18,858
Total off-farm income, 1991	16,708	4,564	2,102	27,883	38,301	66,185
Assets, 1991	92,026	90,537	129,420	311,982	489,434	801,416
Net worth, 1991	85,251	79,328	116,207	280,786	424,312	705,098
Sales of agr. products, 1997	996	27,652	38,055	66,703	130,162	196,865
Sales per acre operated, 1991	27	763	124	184	64	83
Sales per acre operated, 1997	44	1,990	309	417	178	220
			Percent of all farms			
Number of farms, 1991	18	5	11	33	67	100
Number of farms, 1997	16	4	11	32	68	100
Acres owned, 1991	5	2	11	18	82	100
Acres operated, 1991	3	2	11	16	84	100
Acres operated, 1997	3	2	14	18	82	100
Sales of agr. products, 1991	1	18	17	35	65	100
Sales of agr. products, 1997	1	14	19	34	66	100
Net cash farm income, 1991	-10	22	15	26	74	100
Total off-farm income, 1991	25	7	3	42	58	100
Assets, 1991	11	11	16	39	61	100
Net worth, 1991	12	11	16	40	60	100

Sources: 1991 data from Heimlich and Barnard, 1996; 1997 data from Hoppe and Korb, 2000

tural development. Initially, this may involve innovative marketing techniques, such as U-pick, community agriculture, contracts with restaurants, or farmers' markets. At some point, successfully adapting farmers may become more general rural entrepreneurs, not limiting themselves to farm activities at all. Landowners may also sell off less productive woodlots and pastureland, concentrating on more intensive production on remaining cropland. Other farmers attempt to maintain traditional crops and practices, some merely waiting for the perceived inevitable sale for development. Some farms simply go out of business and the land remains idle, or the land is divided and sold to hobby farmers, recreational farmers, or part-time farmers whose primary use of the land is as a residence.

Many of the economic changes faced by farmers on the urban fringe have a dual-edged impact on agriculture, bringing pressures to adapt, while simultaneously offering opportunities and rewards for doing so. On the down side, proximity to urban areas can present obstacles to profitable farming operations.

Positive Impacts on Farming from Urbanization

- Proximity to urban centers may provide a larger pool of seasonal or part-time labor that is especially important to harvest high-value crops. One reason metro farms can adopt high-value crops is because local sources of labor are available at peak periods (Jordon, 1989).

- Greater off-farm employment opportunities for the farmer or his/her family may help support the farming operation (Stallman and Alwang, 1991). Off-farm employment can also provide a transition to part-time farming, particularly if enterprise changes are undertaken that reduce full-time labor needs on the farm. Opportunities from urban employment run in both directions. People in urbanizing areas may work part-time on the farm or start recreational farms that eventually develop into full-time, part-time, or retirement businesses.

- Nationally, 90 percent of average farm household income was from off-farm sources in 1999, including part-time employment, spousal income, and other business income. The percentage in recent years has varied from 83 to 90 percent. Government payments are part of gross cash income, and cannot be compared to net farm income or household income. Only 36 percent of farms receive government payments, and the percentage is lower in metro areas (Sommer et al., 1998, table 31).

- Expanding populations provide opportunities for farmers to grow new crops and to market them in new ways, such as through farmers' markets (figure 18; Price and Harris, 2000). High-value crops, such as fresh fruits and vegetables, can be sold through restaurants and gourmet grocery outlets or directly to consumers in roadside stands or U-pick operations (see box, "Urbanization and Vegetable Production"). U-pick farms may combine produce sales with value-added products like dried herbs or flowers, jams and jellies, homemade breads or pastries, or other farm-related products. Recreational aspects of U-pick operations, such as hayrides, picnics, farm-pond fishing, and special holiday features, such as old-fashioned Halloween or Christmas activities, may also add value to urban customers' purchases. Horse boarding, breeding, and training facilities, cattle-breeding operations or other specialty livestock operations may replace more extensive dairy farms and cow-calf operations.

Negative Impacts on Farming from Urbanization

- Suburban neighbors' complaints about farm odors and chemical spraying may force farmers to turn to enterprises that produce fewer negative side effects. Some of the alternatives will be more profitable and some will be less (Reynnells, 1987; Van Driesche et al., 1987).

- Conflicts can arise between growers and new suburban neighbors over early morning noise, and increased traffic can hinder farmers' ability to move their equipment along overcrowded rural roads being used as commuter routes.

- Markets for traditional dairy products or field crops may be reduced, as milk-collection routes are curtailed and grain elevators go out of business. In some areas, farm input suppliers, machinery dealers, and other forms of agricultural support may decline.

- Real estate taxes may rise as land prices rise to reflect the potential for nonfarm development.

- Growers may face increased pressure from water- and land-use restrictions.

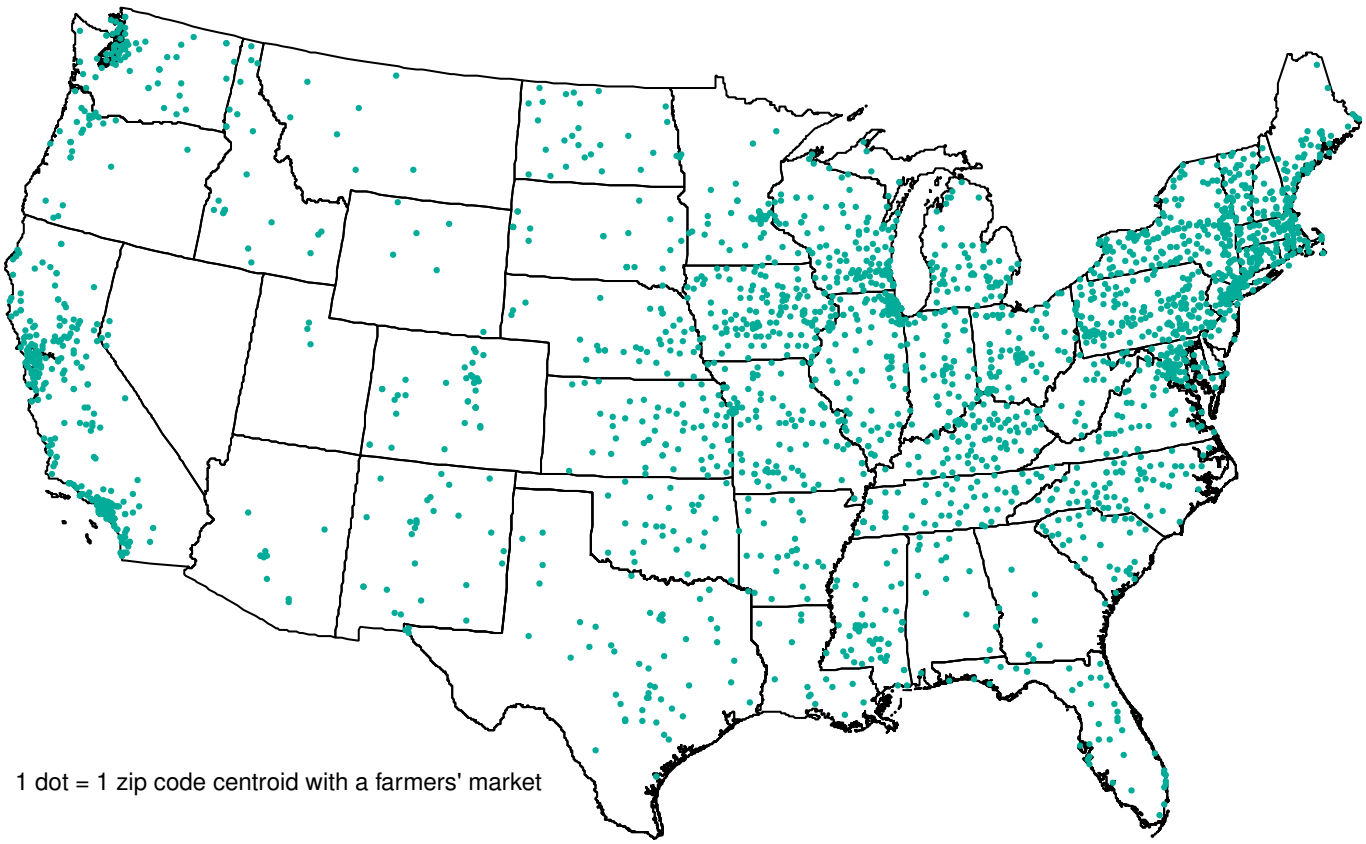
- Farms may face deteriorating crop yields from urban smog, theft, and vandalism.

The dynamic forces of urbanization create an urban fringe in which a variety of farm types coexist, reflecting different paths that farms have taken in adapting to urban influence (figure 19; see box "Categorizing Metro Farms" for methods). These changes occur primarily through changes in the product and input markets in which farmers buy and sell, and through the actions of local government institutions, which by law and tradition exercise control over property taxes and land use (Heimlich and Brooks, 1989). Farms in metro areas are generally smaller, produce more per acre, have more diverse enterprises, and are more focused on high-value production than nonmetro farms (Barnard and Heimlich, 1993; Heimlich and Brooks, 1989; Heimlich 1988; Heimlich and Barnard, 1992, 1997; Hoppe and Korb, 2000). Metro agriculture is characterized by a relatively large group of recreational farmers who are availing themselves of opportunities in both farm and nonfarm pursuits, a smaller group of more adaptive farmers who have accommodated their farming operation to an urban environment, and a residual group of more traditional farmers who are trying to survive in the face of urbanization (see box, "Categorizing Metro Farms").

Recreational farms in metro areas accounted for 16-18 percent of U.S. farms, but contributed only 1 percent to aggregate U.S. sales of agricultural products. Within metro areas, recreational farms accounted for 51-54 percent of farms and controlled 29-30 percent of farm sector assets and equity and 14-17 percent of the land operated. These recreational farms have little viability as economic enterprises and are essentially a consumption activity that will become increasingly expensive for their owners as urban development continues. Traditional farms made up a third of metro farms, operated 71-77 percent of metro farm acreage, and controlled more than 40 percent of assets, sales, and net cash farm income. When a farm hobby is no longer fun, or the farming tradition finally yields too little profit to continue, development may soon follow.

Adaptive farms accounted for 13-14 percent of metro farms and 9-12 percent of metro farm acreage operated,

Figure 18
Distribution of farmers' markets



Source: Price and Harris, 2000.

but they controlled more than proportional shares of metro farm sales, assets, and net cash farm income. These are the farms that have a better chance of continuing in an urbanizing setting.

Survival of Farm Types in Metropolitan Areas

Longitudinal data from the 1997 Census of Agriculture were used to follow farms existing in 1978 through time (Hoppe and Korb, 2000; see box "The 1997 Census of Agriculture Longitudinal File"). A farm was defined to be "out of business" in a given year if it had no sales that year, either because it had ceased operation or had been sold to another farm. As shown in figures 20 and 21, the share of farms that went out of business be-tween 1978 and 1997 varied widely among the farm categories.

Virtually all the farms classified as recreational in 1978 were out of business by 1997, regardless of geographic location. Data from the 1995 Farm Costs and Returns Survey (FCRS) indicate that small farm operators who

Urbanization and Vegetable Production

As the United States continues to urbanize, conflicts between agricultural and nonagricultural uses of land will intensify. These changes are particularly important for the vegetable industry. The agronomic characteristics of land that are key for vegetable production (warm temperatures, especially in the winter; an adequate supply of water; and level, well-drained soils) are also characteristics that are highly valued for urban development. Many of the major national production centers for vegetables and melons are located in areas subject to intense pressure from urban development. A significant percentage of U.S. vegetable acreage (61 percent) is located in metropolitan areas.

Vegetable and melon production tends to be geographically concentrated in California, Florida, Texas, and Arizona. This regionalization of production is even more acute during the winter months, with domestic production largely confined to a relatively few counties within these four States. But, these States also rank high in population and projected population growth. The Bureau of the Census projects 45- to 55-percent increases in population in these States between 1995 and 2025. Seven of the top 10 vegetable-producing counties are in California. California's Monterey County is the Nation's top vegetable area, with 6 percent of the harvested area. The fertile Salinas Valley, which has been called the world's salad bowl because of the concentrated production of green vegetables, is located in Monterey County. Does impending population growth pose a risk to domestic vegetable and melon production?

The interface between vegetable production and development in urban fringe counties sets up competition for the use of farmland that has both negative and positive impacts on vegetable acreage. Urban uses generate higher returns per acre than do agricultural uses, with the consequence that urban uses outbid agricultural uses and farmland is directly converted to developed uses. But, as urbanization proceeds, changes in the local economic environment for agriculture act in a countervailing manner to increase the suitability of urban-influenced farmland for vegetable production. First, population growth in nearby urban areas creates increased demand for locally grown fresh vegetables. This effect implies that there is an economic advantage for production located close to concentrations of consumers. Second, relative to other agricultural products, many vegetables produce high returns per acre, creating a comparative advantage for vegetable production in urbanizing areas. Substitution of vegetable production for other less intensive enterprises may cause vegetable production to increase, at least temporarily, in many urbanizing areas. The counterintuitive result is that as urbanization proceeds, acres devoted to vegetable production may actually increase. This finding is consistent with research reported elsewhere (see Barnard and Lucier; Lopez, Adelaja, and Andrews, 1988; Heimlich and Barnard; Hart; Vesterby and Krupa, 1993).

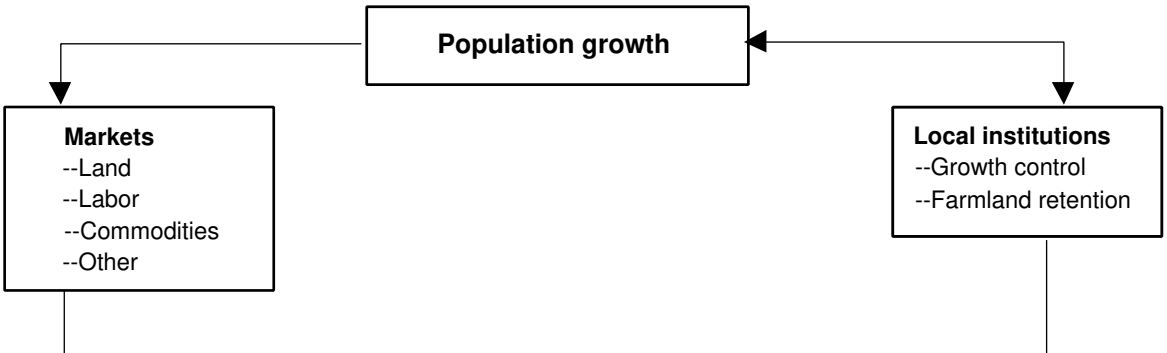
Urbanization often has negative impacts upon agricultural production, including vegetable production. In urban/agricultural fringes, conflicts between growers and new suburban neighbors occur with respect to issues such as farm odors, early morning noise, pesticide applications, and hindrance of farmers' ability to move farm equipment along overcrowded rural roads being used as commuter routes. Growers also face increased pressure from water- and land-use restriction. Some farms on the urban fringe face crop-yield deterioration from urban smog, theft, and vandalism.

Land used for other crops dwarfs that needed for vegetables and melons—all vegetable production in the United States occurs on less than 1 percent of total cropland. In 1992, the United States harvested 3.8 million acres of vegetables—about 0.9 percent of total cropland. There is wide geographic dispersion of the top vegetable counties, indicating that many areas of the United States can produce vegetables on a commercial scale—although only a select few can do so year round. The top 100 vegetable counties, which are dispersed across 20 States, account for only 62 percent of vegetable acres. In addition, since 1959, more than 40 counties have moved ***into*** the top-100 list. The countervailing pressures of urbanization mean that vegetable production is the last to go, and its high value means that when urban pressures prevail, vegetable production moves beyond the urban fringe, to wait for the next burst of development, if it can.

do not report farming as their occupation gave "a rural lifestyle" as their highest-ranking goal from farming (Hoppe, 2000). In contrast, farmers depending on farming for substantial portions of their income reported survival of the farm as their most important goal. However, more than three-fourths of the 1978 traditional farms had also left business by 1997. Again, there was little variation by geographic location.

Adaptive farms were much more likely than either recreational or traditional farms to survive the full two decades. In the case of adaptive farms, the percentage leaving business varied substantially by geographic area, with the percentage declining with distance from the metro core. Adaptive farms may have a survival advantage over recreational or traditional farms in urban or metro areas, but they survive better where there is less development.

Figure 19
Conceptual model of agricultural adaptation to urbanization



Metropolitan farm types

	Recreational	Adaptive	Traditional
Farm size	Very small	Small	Large
Intensity			
Land	Very low	High	Low
Labor	High	High	Low
Capital	High	High	High
Inputs	Very low	Very high	High
Enterprises	Either	High-value	Conventional
Occupation	Nonfarmer	Either	Farmer

Source: Heimlich and Brooks, 1989.

Categorizing Metro Farms

Each farm was grouped into one of three categories in each census year, using the recreational, adaptive, and traditional groups from Heimlich and Barnard (1992). The definitions developed in the earlier study could not be exactly duplicated because the longitudinal Census data used here are much less detailed than the data used earlier. The farm categories are:

Recreational—Includes any farm with sales less than $10,000, defined in 1997 constant dollars. Farms with sales this low are very small and have little ability to generate income for the farm family. Income from off-farm sources is common across farms today, but it makes up a large portion of total income for these farm households. Dollar values for earlier years are adjusted with the implicit GDP deflator.

Adaptive—Includes farms that produce relatively high-value products, with sales of $10,000 or more and having sales of more than $500 per acre of land. Specializing in high-value products allows these farms to adjust to increasing land prices, population density, and continuing conversion of local agricultural land to nonfarm uses.

An alternative criterion is that the farm specializes in high-value commodities, with those commodities accounting for more than 50 percent of the farm's sales.

Traditional—All other farms fall in the traditional group. However, farms with sales greater than $500 per acre were classified as traditional if they did not have high-value specializations. Traditional farms are most likely to remain in nonmetro counties, where there is less competition for land and labor and fewer off-farm job opportunities.

Other classifications of farms have been devised (see for example, Hoppe et al., 1999). However, the classification presented here focuses on farmers' reactions to development.

Although the 20-year survival rates were fairly low for all farm categories in the metro counties, survival rates for farms were similar to those for businesses in general (Hoppe and Korb). Furthermore, the fact that individual farms may go out of business does not mean that farms and their land disappear into subdivisions. Metro areas experience substantial entry of new farm businesses (figure 21).

The different types of farms and the turnover in farms have implications for metro areas' attempts to preserve open space held by farms. Adaptive farms are the most likely to survive as farms. Programs to preserve farmland through commercial farming may have minimal impact on traditional and recreational farms, because these farms have difficulties generating enough revenues to resist development. The turnover in farms of all types suggests that land-use planners concerned with maintaining viable farm businesses will need to monitor sales of land among farmers as well as sales between farmers and developers.

The 1997 Census of Agriculture Longitudinal File

This data set contains information on individual farms from the 1978, 1982, 1987, 1992, and 1997 Censuses of Agriculture. Data from each census were merged for individual farms. Thus, individual farms can be followed for a 20-year period. Variables measured in dollar terms are defined in 1997 dollars. Values for earlier years are adjusted with the implicit GDP deflator.

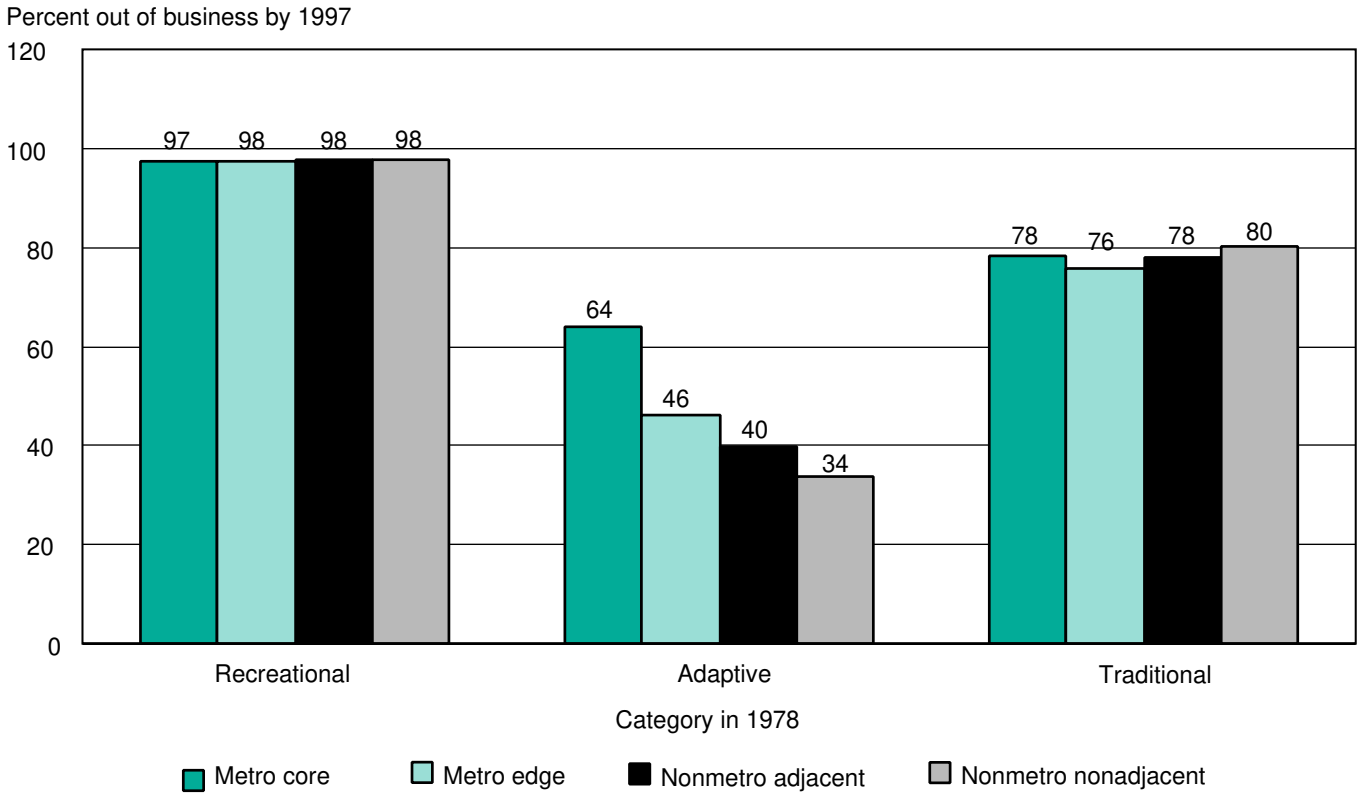
A farm is defined to be "out of business" in a given year if it had no sales that year. Farms are defined in terms of the operator, not the parcel of land. Consider a farmer who sells his farm to a new operator just beginning to farm. The file shows one farm going out of business (the farm operated by the exiting farmer) and one farm beginning business (the farm of the new operator). If the exiting farmer sold his farm to an established farmer, the file would show one farm going out of business and one farm continuing in business.

Working Landscapes and Rural Amenities

At the extreme, urbanization brings about the local extinction of farming as an economic activity and as a working landscape. However, the transition from rural to urban is not entirely negative, since some farming activities benefit from greater proximity to urban population. Growth makes this transition more difficult than it might otherwise be because the future pattern is more haphazard and less certain than development guided through planned growth.

Farming activities adapted to urbanizing areas can provide rural amenities that are profitable for the landowners and operators, and desirable for the surrounding population. Inevitably, these activities differ from those that went before, and they may not be embraced by the farm's prior owners or operators. Different kinds of

Figure 20
Farms in 1978 out of business by 1997, by farm category



Source: Hoppe and Korb, 2000 from USDA, ERS and NASS, 1997 Census of Agriculture Longitudinal File.

products and services are produced, in different ways, for different markets that are better suited to an urbanizing environment. How permanent these adaptations can be in the face of development, and how much and in what ways public support for these amenities should be provided are questions that cannot yet be answered.

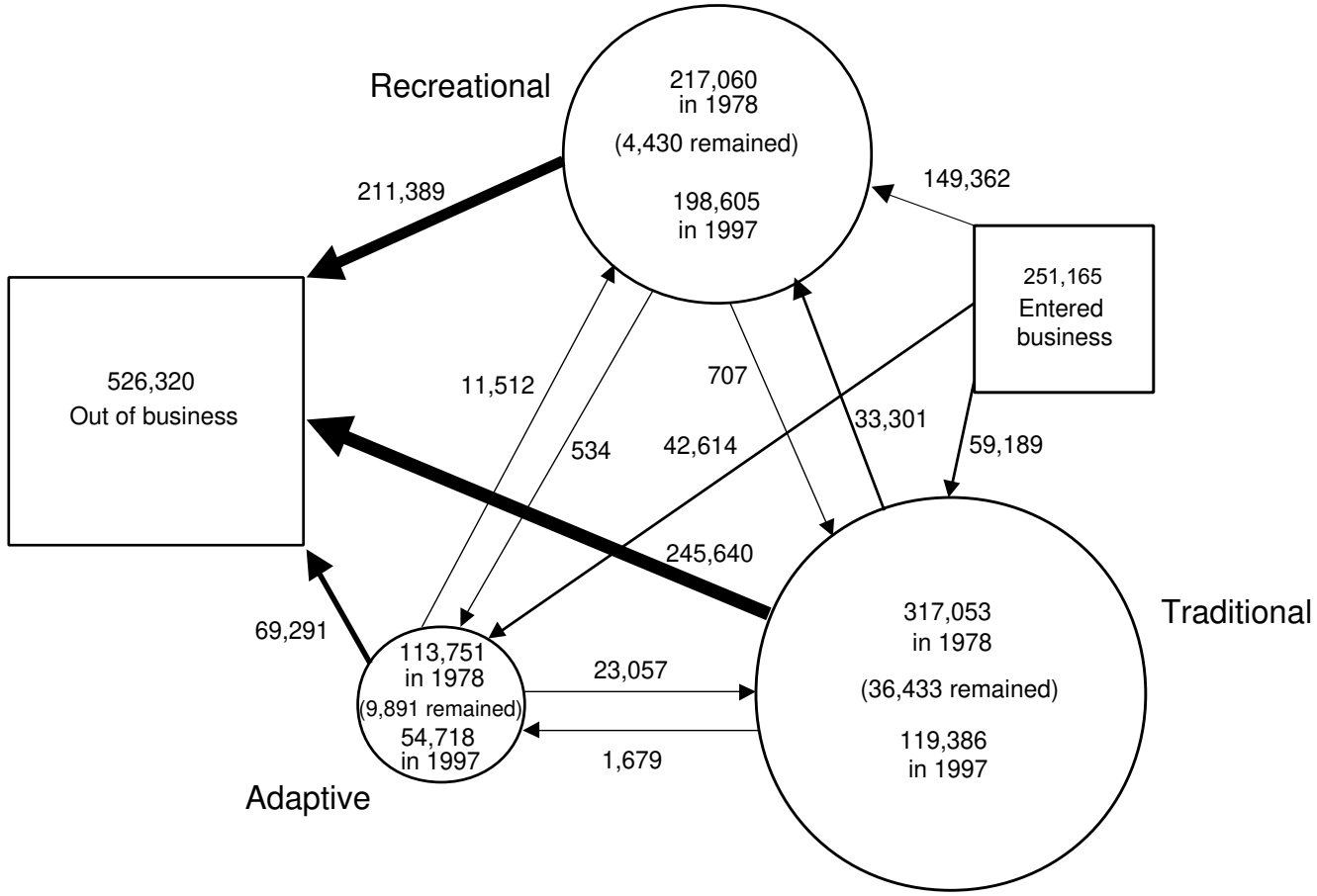
Farmland encompasses cropland, pasture, range, and farm woodlots, all of which serve some function in a working farm and also provide rural amenities. Even if active farming as an economic activity is no longer profitable, conserving rural land uses may continue to provide rural amenities that justify protection programs. Other rural landscapes that may never have been in farms (forestland, wetlands, barrens, etc.) or to which abandoned farmland may revert may also provide rural amenities worth preserving.

Benefits of Farmland and Open Space

A question for thoughtful consumers and public policy officials is: Do those who move to new suburban or exurban developments actually get what they paid for? That is, does moving into the "country" ultimately destroy the good things that prompt that move? In the words of the National Governor's Association, "In the context of traditional growth patterns, the desire to live the 'American Dream' and purchase a single-family home on a large lot in a formerly open space can produce a negative outcome for society as a whole." (Hirschhorn, 2000, p. 55). Can the potential benefits of lower density development, which accrue from a better relationship between home place and work place, actually come about without planning communities? What benefits of rural landscapes do we destroy by growing out into previously undeveloped rural areas?

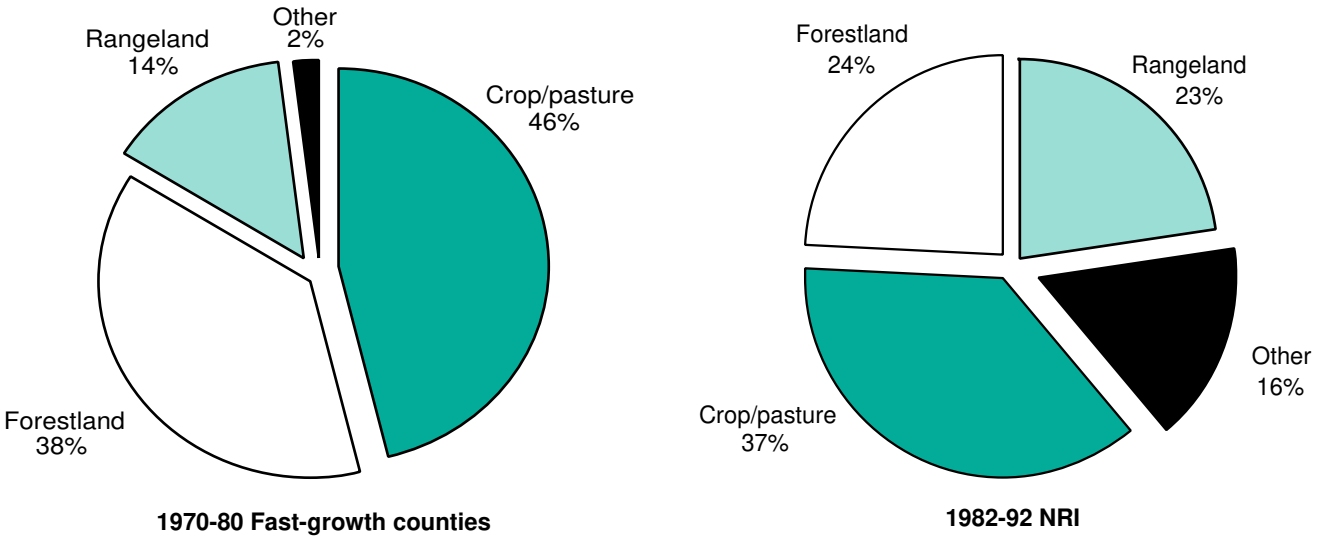
It is important to consider what is sacrificed for development. Rural land is more than "vacant" building lots waiting for development. It is a working landscape of functioning farms and forests that serve both economic and environmental purposes. In a study of rapidly growing counties during the 1970's, cropland and pasture provided about a third of the area for urban expansion, and rangeland and forestland each provided about a fourth (Vesterby, Heimlich and Krupa, 1994; figure 22). About a sixth of urbanized land came from other

Figure 21
Transitions between farm types, metro farms, 1978-97



Sizes of circles, boxes, and arrows proportional to farm numbers.
Source: ERS analysis of 1978 to 1997 Census of Agriculture microdata, Hoppe and Korb, 2000.

Figure 22
Composition of land use change in urbanizing areas, 1970's and 1980's



Sources: Vesterby et al.,1994; National Resources Inventory.

land uses, including vacant land whose previous use could not be determined. Based on the NRI data for urban and built-up land for the 1980's, 46 percent of land converted to urban uses came from cropland and pasture, 38 percent from forestland, and 14 percent from range land.

Aside from the direct economic use of these lands in farming and timber production, they provide amenities that cannot be measured in the marketplace. Individuals may derive pleasure from the use of these lands for recreational purposes, they may enjoy viewing these lands from a distance, or they may derive pleasure from knowing that these lands are being protected from development. Rural land provides nearby residents an absence of congestion and scenic views for which they are willing to pay. In other words, rural land may be valued most for what it is not, namely, developed land. For example, focus groups conducted by the American Farmland Trust of residents in Kane, McHenry, and DeKalb Counties in Illinois found that the most important aspect of open space for these residents is its role in slowing growth and reducing development (Krieger, 1999). This result is borne out by contingent valuation studies used to estimate the amount people would be willing to pay to preserve land in agriculture. Halstead (1984) and Beasley, Workman, and Williams (1986) found that households were willing to pay about $150 each to preserve an acre of average-quality farmland when the replacement for agriculture was hypothesized to be high-density development, but only about $50 if the alternative was low-density development.

Nonmarket Values Associated With Preserving Open Space

Previously published estimates give benchmarks for estimating the total economic value of preserving open space. All of the six studies listed in table 4 directly asked individuals to state their willingness to pay for a change in farmland or asked them to vote yes or no to a set amount of money to preserve various amounts of farmland. For purposes of comparison, the average value of preserving 1,000 acres of farmland (converted to year 2000 constant dollars) appears in the last column of table 4.

The values reported in the six studies vary and are likely affected by study location. Beasely et al. (1986) and Halstead (1984) studied areas with scarce farmland, which is reflected by relatively high value estimates. Ready et al. (1997) focused on preserving horse farms, which tend to be a more specialized type of land than generalized agricultural land, and may thus have a higher value than other farmland. The Bergstrom et al. (1985), Bowker and Didychuk (1994), and Krieger (1999) studies were conducted in predominantly agricultural areas, which is reflected in their lower estimates of willingness to pay.

We used the Bergstrom et al. (1985) and Krieger (1999) studies to estimate benefits as an illustration of the potential nonmarket value for undeveloped farmland and open space in the United States, based on conservative estimates that reflect the preferences of U.S. residents. To estimate an aggregate value for land subject to development, we first estimated how many acres were threatened by development. Using the 1992 NRI and a variable measuring urban influence, acres by use class were identified in low, medium, and high urban influence categories. Of 3,077 U.S. counties, 1,062 have some land in at least one of these urban influence categories (figure 23). Comparing the areas of urban influence with areas that changed to developed land uses between 1982 and 1992 shows that the urban influence boundaries capture most of the area experiencing development (figure 24).

Table 4—Estimates of the average amenity value of farmland[1]

Study	Geographic area	Good valued	Annual value per 1,000 acres per household (2000 constant dollars)
Bergstrom et al., 1985	South Carolina	Prevent development of agricultural land	$0.21-$0.54
Beasley et al., 1986	Alaska	Prevent development of agricultural land	$17.56
Krieger, 1999	Illinois	Prevent development of agricultural land	$2.93
Halstead, 1984	Massachusetts	Prevent development of agricultural land	$17.82-$49.80
Ready et al., 1997	Kentucky	Prevent development of horse farm	$4.34-$4.94
Bowker and Didychuk, 1994	New Brunswick, Canada	Prevent development of agricultural land	$1.08-$2.45

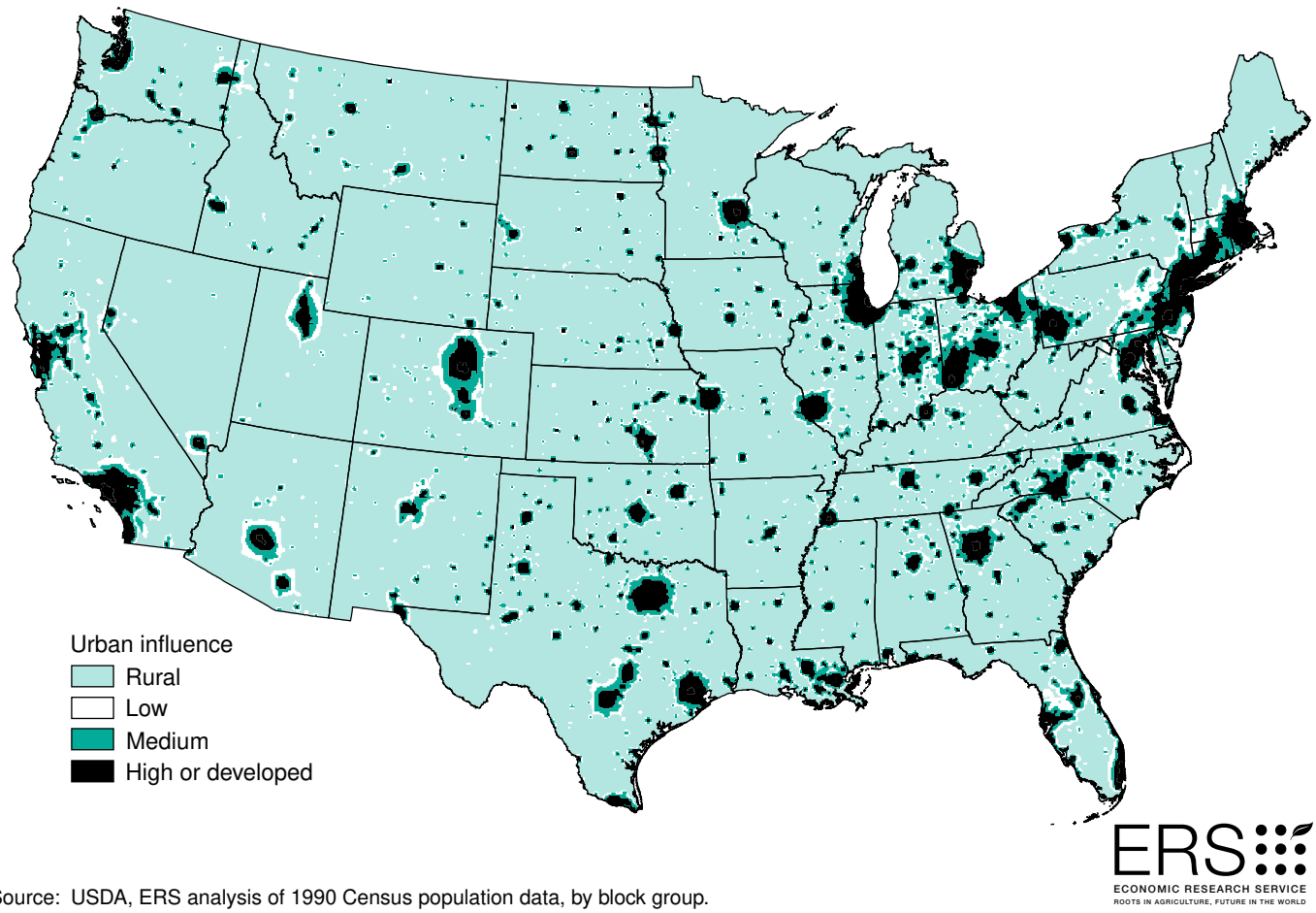
[1]All estimates are determined using the contingent valuation method with exception of the lower Ready et al. value, which used the hedonic property value approach. Values are average per household values inflated to year 2000 dollars using the April 2000 CPI.

We examined two potential development scenarios. In the "low-density" scenario, we assumed that 10 percent of the acres will be developed in the lowest urban influence class over the next few decades, 20 percent in the medium class, and 60 percent in the highest class, an estimate of the potential development in these areas is 50 million acres (table 5). In the "high-density" scenario, we assumed that development is more weighted to the high urban influence areas, with 90 percent of land there developed, 10 percent of the acres are developed in the medium urban influence area, and only 5 percent in the low urban influence area.

Most of the studies, including the two selected, asked respondents to place a value on preventing development near their residence. To generalize the results of the two selected studies to the Nation, we assumed that the public is willing to pay to preserve threatened open space only in their county of residence. We used the lowest of Bergstrom's willingness-to-pay estimates ($0.21 per 1,000 acres) because Bergstrom concentrated on farmland only. Accounting for all types of land, residents of counties expected to face development over the next few decades across the Nation were estimated to be willing to pay from $1.4 to $26.6 billion per year, depending on which willingness-to-pay estimate and development scenario was considered.

These estimates are subject to a great deal of qualification. Because the amount and location of open space varies so much from site to site, better estimates would have to focus on the actual and potential settlement patterns in particular areas to account for local supply and demand conditions, particularly the availability of alternatives to existing farmland. Most valuation studies of this type are valid for only marginal changes. Because we are estimating many years of development, the values now held by residents would likely change as development proceeds. The likely direction of these qualifications is not easy to determine. Thus, the estimates presented here serve more to illustrate the potentially large value the public may place on preserving

Figure 23
Degree of Urban Influence, 1990

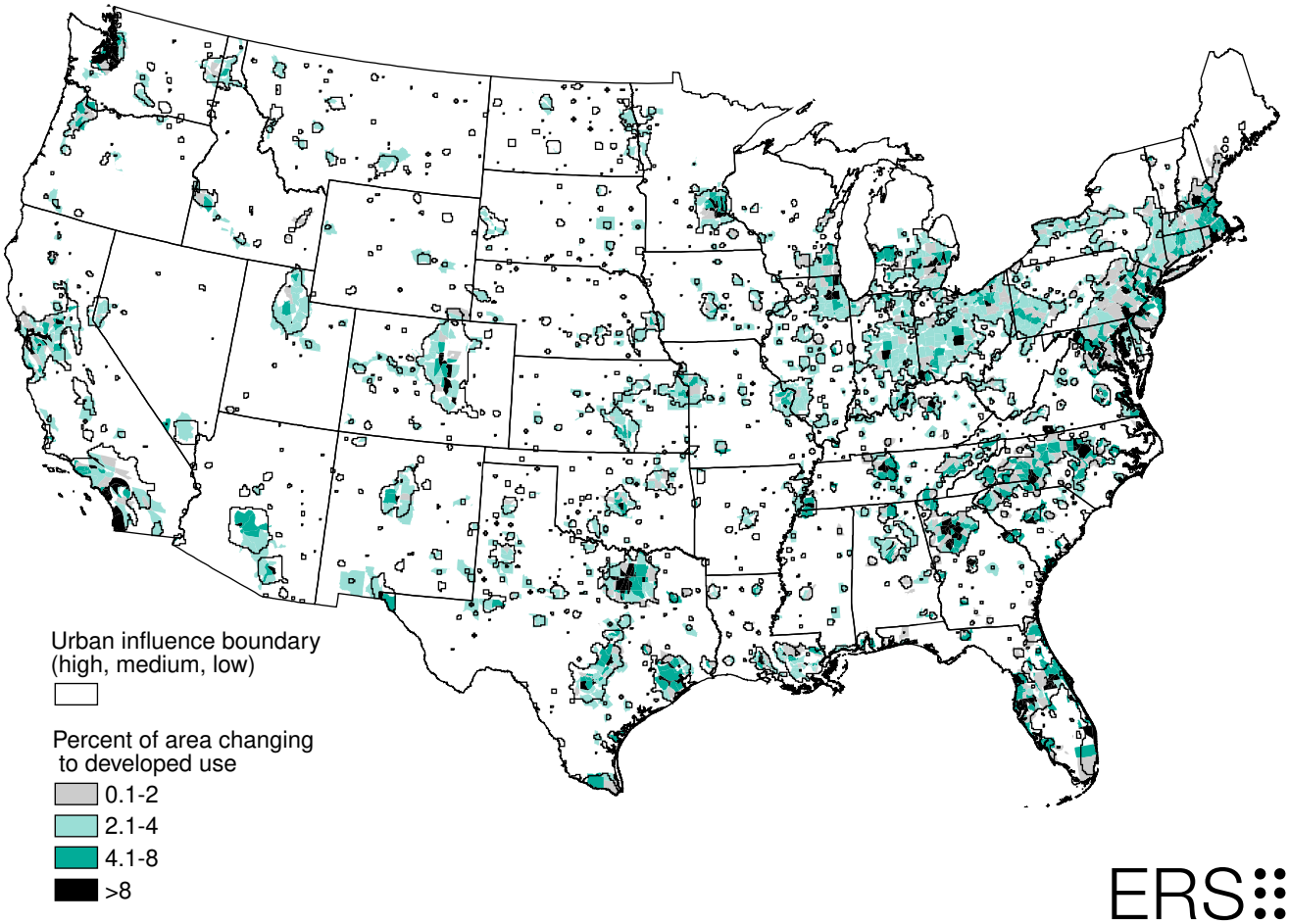


Source: USDA, ERS analysis of 1990 Census population data, by block group.

Estimating Erosion Damages from Growth

To estimate erosion damages, we used a model developed by Feather and Hellerstein (1997) that estimates changes in use values for water-based recreation associated with changes in ambient erosion, using the revealed preference method. To estimate the loss in use values, we estimated average changes in soil erosion that are caused by development at the NRI polygon level. The three urban influence categories from the analysis above (low, medium, and high) were identified, with the same 10 percent, 20 percent, and 60 percent conversion factors. Since each NRI polygon falls into only one urban influence category, a percentage of farmland in each polygon was randomly selected based on the proportion of total land expected to be developed. The Universal Soil Loss Equation (USLE) for each selected NRI sample point (representing a parcel of farmland being developed) was manipulated to predict erosion that would occur during development. NRI data do not contain USLE erosion information on types of lands other than farmland. For this reason, only farmland could be considered in this portion of the analysis. This is done by changing the USLE equation C and P factors to 1.0 (as suggested in USDA, 1978). Average erosion for the entire polygon is then re-computed. This is the average erosion that would occur in the polygon during development. Best management practices (BMPs), which are mandated by many States during construction, lessen erosion to some degree. The use of these practices is approximated by reducing the C factor to 0.7 from 1.0.

Figure 24
Comparison of estimated urban growth boundaries and percent of area changing to developed uses, 1982-92



Source: USDA, ERS analysis of Census of Population 1990 and 1992 National Resources Inventory data.

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Table 5—Estimated nonmarket value of land under urban influence estimated to be developed in succeeding decades

	Degree of urban influence[1]			
	Low	Medium	High	Total
Developable land		*Thousand acres*		
Cropland	30,179	30,690	33,840	94,709
Pasture/range land	28,424	25,077	21,299	74,800
Total developable land	58,603	55,767	55,139	169,509
Land assumed developed				
Low-density scenario[3]	5,860	11,153	33,083	50,096
High-density scenario[4]	2,930	5,577	49,625	58,132
	Estimated annual value of conserving rural land[2]			
		Billion dollars		
Low-density scenario[3]				
Proportion assumed developed	10%	20%	60%	
Low-benefit estimate	0.1	0.1	1.2	1.4
High-benefit estimate	.8	1.6	16.9	19.3
High-density scenario[4]				
Proportion assumed developed	5%	10%	90%	
Low-benefit estimate	>0.1	0.1	1.8	1.9
High-benefit estimate	0.4	.8	25.4	26.6

[1]See box "Methods for Estimating Cropland and Farmland Purchase of Development Rights Cost" (p. 62) for a description of how urban influence is determined.

[2]Total willingness to pay (in year 2000 dollars) for preserving all land indicated in the row weighting scheme based on $0.21 per 1,000 acres for the low-benefit estimate, $2.93 per 1,000 acres for the high-benefit estimate.

[3]Assuming development is distributed more broadly, 50.1 million acres are developed.

[4]Assuming development is more concentrated in the areas of highest urban influence, 58.1 million acres are developed.

Source: ERS analysis of 1992 National Resources Inventory and NASS June Ag Survey land value data.

open space under three hypothetical development schedules than any prediction of development or how residents value conservation.

The total benefit estimated also depends on the pattern and level of development expected to occur, which cannot be predicted with very much accuracy. In the "low-density" scenario in table 5, arbitrary percentages of the land in each urban influence zone are assumed to be developed, totaling 50 million acres, resulting in annual losses of nonmarket value of between $1.4 and $19.3 billion. However, if more development occurred and if it were more focused on the area of most heavy urban influence, as in the "high-density" scenario, 58.1 million acres would be developed with annual benefit losses ranging from $1.9 to $26.6 billion. This results partly because of the increase in development level, and partly because there are more households in the high urban influence zone than in the other two, resulting in higher values.

These willingness-to-pay estimates do not include off-site damages that result from construction, such as the reduction in surface water quality caused by erosion from construction sites. Clearing land for construction causes significant erosion, beyond that experienced in agricultural production. This increased runoff diminishes the quality of nearby lakes and streams that are used for recreation. Although these damages occur in a short period (1-2 years), they are potentially significant and were estimated (see box "Estimating Erosion Damages from Growth"). The estimated annual losses due to erosion are $0.93-$1.06 billion without construction best management practices (BMPs) and $0.67-$0.79 billion with construction BMPs, depending on settlement patterns (table 6).

Table 6—Annual recreational water quality damages due to urbanization of farmland[1]

Scenario (percent of high, medium, and low urban influence assumed developed)	Erosion damages	
	No BMP	With BMP
	Billion 2000 constant dollars	
Low density (60, 20,10)	0.93	0.67
High density (90, 10, 5)	1.06	0.79

[1]Annual losses due to changes in erosion resulting from conversion of farmland to urban uses. Losses are reductions in the enjoyment (use value) of water-based recreation resulting from diminished water quality. Estimates are inflated to year 2000 dollars using the April 2000 CPI.

VI. Local Responses to Growth

In all States, local governments have been delegated authority for control of land use and growth. Since early in the last century, planning and zoning have been the principal tools for controlling growth and directing land-use change in local communities. Increasingly, State governments are taking a more active role in attempting to strategically change incentives and disincentives for development, without exerting direct control over growth, a process known as "smart growth." Because of strong interest in maintaining individual landowners' property rights, direct financial incentives to keep rural land in agricultural uses have become important tools. These include preferential or use-value property taxation and direct purchase of development rights.

Most rural communities experiencing growth have their hands full simply trying to catch up with the growth in demand for public services, such as education, water and sewer, and police and fire. Some respond with actions aimed at limiting growth and mitigating its consequences. There is a fine line between rural counties at the metropolitan fringe that are still trying to attract development, and those that have been all too successful at attracting growth and are now trying to control development.

Playing Catch-Up

The need to play catch-up seems to be the most common response of local governments. A recent General Accounting Office (GAO) survey of almost 2,000 governments in cities over 25,000 population (949 responded) and all metropolitan counties (609 responded) found that 53 percent of the counties and 35 percent of the cities claimed "sprawl" was a high or very high concern. GAO identified these respondents as "communities concerned about sprawl" (44 percent of rural counties were concerned about "sprawl," compared with 56 percent of nonrural counties). As a whole, GAO found that the priorities of the sprawl-concerned communities were fairly similar to the priorities of all communities. The most frequently cited priorities in planning for the future involved increasing the local tax base to support better schools and roads, attracting businesses, and enhancing transportation systems (U.S. GAO, 2000). But more sprawl-concerned communities (66 percent) were experiencing fast growth than non-sprawl communities (46 percent), which may explain why sprawl-concerned communities were more likely than other communities to place a high priority on enhancing their transportation systems.

Planning priorities differed between more urban and more rural places. Metropolitan counties that identified themselves as "rural" (27 percent of the metro counties responding to the survey) placed a much higher priority than "nonrural" counties on increasing job opportunities and attracting new development to areas with infrastructure; "nonrural counties" were relatively more interested in enhancing their transportation systems to deal with growth. Cities put a greater priority on revitalizing downtowns, which are also affected by growth, than did counties.

How Local Governments Address Growth Problems

This section provides examples of some of the ways local communities deal with problems caused by growth. The examples are based on information and statements from local officials when ERS conducted its study of eight counties experiencing growth in the 1980's and 1990's (Reeder et al., 2000). Growth-related problems are often hard to address because they compound each other. For example, growth control advocates favor concentrating development in town centers. However, towns such as Shelton in Mason County, Washington, cannot grow due to limits on infrastructure, which is constrained by an inadequate tax base. Growth and development could increase the tax base, but is constrained by lack of infrastructure in the town, and so on.

Some places have gotten around this conundrum by raising special sales taxes, imposing impact fees on developers, or creating special districts where taxes are raised to pay for infrastructure and public services needed for development. However, these efforts are not always successful since local voter approval may be required. In some cases, State regulations constrain local efforts to raise more revenues, such as in Monroe County, in the Pocono Mountains of Pennsylvania, where State rules make it difficult to use impact fees.

Aggressive business recruiting is another approach to add more to the tax base than to public spending on infrastructure and services. Monroe County, Pennsylvania, is using tax incentives together with industrial and business parks, to entice new businesses into the area.

However, such an approach is not without risk. According to John Woodling, of the Monroe County Planning Commission, "Some of the local schools had a concern that the tax incentive program might give away too much tax revenue for the number of jobs it created. More important was the concern that new firms would hire too many nonresidents who subsequently would move into the county, bringing their children with them, and that this could ultimately burden the school system. However, Monroe County statistics suggest these concerns are not justified, because most of the new employees of these firms are county residents at the time they are hired" (Reeder et al., 2000).

Many localities take advantage of Federal programs to address their growth-related infrastructure, business-attraction, and affordable-housing needs. For example, some communities attempt to combat growth-induced transportation problems through public transportation, a federally subsidized activity. Public transportation has the added advantage of strengthening central locations that are more readily served by public transit systems. But funding is limited for these activities. The elderly and homebound in Wise County, Texas, use a State-funded Para-Transit system. But according to County Commissioner James Hubbard, "expansion and maintenance needs far exceed current funding levels."

This is not an unusual problem for growing communities. A GAO survey of local growth challenges found that 40 percent of responding local governments supported more Federal assistance with "smart growth" programs (U.S. GAO, 2000). The U.S. Department of Transportation's Transportation and Community and System Preservation Pilot program is so popular that the demand for funding exceeded the program's appropriations in fiscal year 2000. DOT funded 84 projects from 292 applications received. The program funds projects that integrate transportation initiatives with the goals of community development, environmental protection, access to jobs and markets, and efficient land development patterns. GAO's survey showed that "sprawl" communities were more likely than "non-sprawl" communities to complain about inadequate Federal funding for public transportation.

Planning Efforts To Control Growth

Rather than simply reacting to growth by addressing the problems it creates, communities are increasingly using planning to help prevent or reduce growth's consequences. GAO found that 34 percent of the counties expected to increase their involvement in planning and growth management activities over the next 5 years (GAO, 2000). A common first step is to establish or update the county's comprehensive plan. Such plans may envision ways to prevent or limit ill effects from growth by employing land-use and zoning techniques that result in more concentrated development, such as encouraging mixed-use development within a designated centrally located area, or encouraging cluster or large-lot development on the fringe, or increased use of conservation easements to preserve open space. Infrastructure and public services, such as public transportation, may be planned and implemented to discourage "sprawl." Plans may also provide for ways to address growth-related problems, such as through encouraging the construction of local industrial or commercial parks with incentives to attract businesses that can augment the tax base and reduce commuter-related transportation problems, or by identifying areas and incentives for developing affordable housing.

In some cases, States require or encourage their localities to pursue comprehensive planning and growth management. For example, Florida's growth management legislation in the early 1980's required localities to prepare comprehensive plans that assured that adequate infrastructure, and a funding plan to finance it, was present. Gary Kuhl, former Administrator of Citrus County, Florida (now the Water Resource Team Administrator for Hillsborough County), said "Citrus County experienced a lot of sprawl issues during the rapid growth of the 1980's, but with help from the comprehensive plan, growth was well-managed in the 1990's. Citrus uses a variety of zoning and land-use provisions that have the effect of limiting sprawl by targeting development in a central portion of the county that is well-drained and served by the county water and sewer system and by discouraging development in more sensitive wetland and coastal areas. Citrus also has been helped by Federal and State agencies, the water management district, and by private trusts, which have acquired and protected some environmentally valuable land in the county" (Reeder et al., 2000).

Although all States require at least some local planning, many communities are not required to conform to their plans, and even when conformance is required, it is often not enforced. A common problem is that county plans capable of restricting growth are disregarded by municipalities, which actually control most of the development. Due to this fragmentation of government responsibility, efforts to control growth are often ineffective or, at best, piecemeal.

Michele Boomhower, Director of the Lamoille County Planning Commission, explained that "The State of Vermont did not require growth management. A significant portion of zoning controls are at the municipal level, and every town is upgrading growth management in some way." But according to State Senator Susan Bartlett, "Sprawl is overrunning the county as loose local zoning laws allow strip-style development to dominate the local landscape. Uneven development is the rule, as all of the desirable development is going to towns with good local planning, while unwanted development goes to poorly regulated towns" (Reeder et al., 2000).

Despite its fragmentation problems, Lamoille has accomplished a great deal in farm and forestland protection. According to Boomhower, "Farm and forestland are most threatened by sprawl, so protection of these lands is of great importance." Using zoning to protect some working lands, limited use of large-lot-size requirements, conservation easements, and purchase of development rights (PDR's), Lamoille County now has the largest percentage of publicly and privately protected land in the State.

In other places, land conservation efforts are just beginning. According to John Woodling of the Monroe County Planning Commission, "Pennsylvania's Agricultural Preservation Program encourages the purchase of farmland conservation easements. And in Monroe County, a bond issue was passed recently which will provide money for the acquisition of open space and recreation areas. In addition, the county's new comprehensive plan encourages the transfer of development rights (TDR). Recently, the Commonwealth allowed the transfer of development rights from one municipality to another, which should enhance the use of TDR's" (Reeder et al., 2000). Mason County, Washington, also authorizes the use of these conservation devices, and the State provides some money for purchase of development rights (PDR's), but as yet it is unclear whether the voters will support local PDR bonds.

Efforts to control growth sometimes run into significant constitutional and political obstacles. For example, many rural areas have been traditionally opposed to zoning, and such traditions can be hard to overcome. The big problem in Wise County, Texas, according to city administrator Brett Shanon, is that the county constitution prohibits zoning in unincorporated areas, resulting in uncontrolled growth outside town limits. Wise County commissioner James Hubbard adds that "Some progress was made in the State Assembly in enhancing county legal authority during the last session, and the Assembly may add additional county authority this year." Local political barriers can be just as formidable as legal or constitutional ones. A good example comes from Georgia. According to Brenda Johnson at the Chamber of Commerce in Gilmer County, Georgia, "The last county commissioner who tried to establish zoning in the rural portion of the county was recalled from office" (Reeder et al., 2000).

Growth control efforts can also run into problems in the courts. Mason County established a new comprehensive county plan in 1996 in conformance with the new State growth management requirements for rapidly growing rural areas. According to Bob Fink of the County Planning Office, "This included many 'good planning' requirements, including protecting environmentally critical areas, preserving the rural character of the land, and encouraging urban and cluster development. This would have made for a great change from before, when growth was uncontrolled. But the plan has been challenged in court, nearly stopping all nonresidential development in the rural portion of the county, including some desirable forms of development such as agricultural buildings and fire stations, until the legal issue is decided" (Reeder et al., 2000). Similar legal challenges have resulted in a significant weakening of Florida's growth management law in recent years. In many newly developing areas, local capacity to develop and implement such growth-directing plans in the face of sophisticated challenges to their validity is limited. Either assistance from State and Federal governments to develop the capacity to effectively plan for growth is not authorized or funding has been inadequate.

Some municipalities attempt to control development on their fringe by annexing land adjacent to city limits. Such annexation can be used as a way to control or limit growth. However, annexation can also be used to encourage even more growth on a city's edge. Annexation is limited by State law, which varies from State to State. This often requires the approval of the jurisdiction that would lose the land. Nevertheless, the affected rural residents outside city limits often feel powerless to oppose these annexation efforts.

Capacity for Response in Relation to Urbanization Pressure

A local government's capacity to respond to growth pressures generally increases with the degree of urbanization. Urbanization usually results in higher income,

wealth, and tax base, which translates into more public and private financial resources that can be devoted to hiring more planners, offering incentives for mixed-use development, paying for public transportation services, or purchasing open space. Strong rural traditions of property rights cause people to oppose planning and zoning in some regions. Economies of scale in the provision of many types of government services, including planning functions, means that planning is more economical and efficient in larger, more urbanized communities that require more such work. Consequently, most rural areas begin with relatively little capacity to respond to urbanization pressures, and it may take years of development before the community is able to develop capacity to control growth.

Communities Affected by Growth Are Already Planning, but Capacity is Limited

Better planning and zoning are central to the ability to respond to growth. GAO found that 75 percent of the communities that were concerned with "sprawl" were highly involved in planning for and managing growth, which indicates a relatively high level of planning activity, compared with 72 percent for cities and 59 percent for metropolitan counties in general (U.S. GAO, 2000, p. 99). Moreover, about a third of these counties expected to increase their planning involvement over the next 5 years.

GAO also found that the majority of "sprawl-concerned" counties were already using several key growth-management tools, including land-use planning, zoning, mixed-use zoning, working with adjacent communities, and targeting State infrastructure funding to areas where development is desirable (U.S. GAO, 2000, figure 19, p. 101). In addition, 78 percent of these sprawl-affected communities use regional planning approaches—some focusing on specific functions, such as affordable housing in Seattle and traffic congestion and pollution in Atlanta.

Many cities and counties, however, are falling short of what is needed to control and manage growth effectively. A recent Alabama survey of mayors in 458 municipalities and 358 county commissioners in 67 counties found a general consensus in support of growth management or smart growth approaches (Seroka and Veal, 2000). Despite their overall good intentions, only a minority of the responding officials (18 percent of the mayors and 19 percent of the commissioners) believed they currently had the necessary staff and resources to plan and manage growth effectively. Another 24 percent of the mayors and 17 percent of the commissioners thought they could do the job effectively with modest increases in funding and staff resources. High-growth communities were only somewhat more likely to have the capacity to manage growth than were other communities.

Seroka and Veal found that more than 80 percent of the Alabama officials surveyed said that their local government needed more powers to manage growth. They also found that counties were more likely than cities to face significant opposition to growth management from rural residents, other constitutional officers, the elderly, and long-term residents of the county. Most local officials looked to the State to provide leadership in this area. Although these findings pertain only to Alabama, they point to some of the potential obstacles that rural growth management efforts face in other States as well.

Rural areas often have very limited planning capacity. Most of the smaller rural towns cannot afford a full-time planner. To meet their planning needs, these communities may be served by a circuit riding planner; another alternative is that several towns and a county may combine their efforts to set up one planning office to serve their joint needs (Lapping, Daniels, and Keller, 1989, p. 56). Shared service arrangements can suffer from conflicts between communities. Even at the county level, rural planners often must spend part of their time doing other duties. In addition, rural planners may lack important technical tools (such as GIS, computer, and legal services) needed to do their job.

One result of this limited capacity for planning is that rural counties tend to rely more on nongovernmental institutions—such as regional development organizations—for planning. Planning for key functions driving development, such as transportation investment, is carried out by separate special-purpose planning offices, such as the highway department, that may ignore broader concerns affecting growth management.

Planning for major roads and institutions in the more rural, nonmetropolitan counties is often done at the State rather than the local level, bypassing local government. Rural places often are forced to compete with neighboring communities to obtain Federal and State transportation funding, leading to conflicts between jurisdictions. In urban areas, transportation planning is done by multicounty Metropolitan Planning Organizations (MPO's) which are capable of superior planning and coordination through regional collaboration, but may be too narrowly focused on transportation issues. However, the more fragmented rural planning process

adds to the difficulty of doing good comprehensive planning needed to control growth.

Federal Assistance for Planning

The Federal Government has supported programs to improve the planning capabilities of State and local governments in the past, but support was cut for both ideological and practical reasons. The most well known of these efforts was the HUD 701 planning grant program, established as part of the Housing and Community Development Act of 1954 (40 USC 461). As late as 1975, the HUD 701 program spent $100 million per year, paying as much as two-thirds of the costs of an "ongoing comprehensive planning process" required of all grant recipients. However, the budget was cut to $75 million in 1976 and was proposed for elimination in 1977 (NRDC, 1977, p. 334). Comprehensive planning, as defined in the 1954 law, included:

- Preparation of guides for governmental policies and actions on the pattern and intensity of land use, the provision of public facilities, including transportation, and development of human and natural resources;
- Identification and evaluation of area housing, employment, education, and health needs, and plans to meet those needs;
- Historical and architectural structure surveys;
- Long-range physical and fiscal plans;
- Programming of capital improvements and infrastructure needs;
- Coordination of all related plans and activities of the State and local governments concerned; and
- Preparation of regulatory and administrative measures needed to support the above plans.

Stringent review of Section 701 followed amendments in the Housing and Community Development Act of 1974. HUD also required that each comprehensive plan have housing and land-use elements, and that National Environmental Policy Act (NEPA) environmental assessments, public participation, and nondiscrimination guidelines be followed in all plans prepared with this funding.

One early estimate of the impact of the Section 701 program suggested that the business of planning consultation had multiplied tenfold (ASPO, 1968). Criticisms were that administrative requirements unnecessarily raised planning costs, and that plans were stereotypical, filled with boilerplate text, and overly elegant for the situation (National Academy of Public Administration, 1998). Questions were raised as to how much the plans were in fact used and what effect they were having on land-use regulation. Reform, rather than elimination, was suggested as a cure.

The HUD Section 701 program and OMB Circular A-95 provided impetus for regional or areawide planning and coordination, among other things. By 1976, there were 669 regional councils. In the 1980's, the Federal Government largely abandoned these efforts, and similar regional planning efforts with regard to water resources and transportation, with the exception of metropolitan planning organizations linking transportation with air quality (National Academy of Public Administration, 1998).

Within USDA, the Rural Development Act of 1972 authorized Section A-111 Rural Development Planning Grants (U.S. Senate, 1973). Grants under the program could not exceed $10 million annually. Outlays for A-111 in FY1980 were $6 million. However, the incoming Reagan Administration budget for FY1981 severely reduced, then eliminated Section A-111 assistance (Stansberry, 2000). In 1981, the National Agricultural Lands Study, begun in the Carter Administration, recommended that USDA "…assess the feasibility of providing small matching grants for 'capacity building' to state departments of agriculture (or other appropriate state agencies) that seek to manage agricultural land issues" (NALS, 1981). No legislation was ever proposed or enacted.

Authority for Section A-111 continued, without funding, until the 1990 farm bill, which replaced it with authority for some technical assistance and planning grants. These were also not funded, and regulations were not even prepared to implement the grants. The 1996 FAIR Act replaced this program with new authority for the Rural Business Opportunity Grant program (RBOG), first funded in 1999 with $3.5 million in FY2000 appropriations. RBOG provides money to nonprofits, public bodies, Indian tribes, and cooperatives for planning and technical assistance to assist economic development in rural areas, so it could potentially create more growth than it combats (see Web site at http://www.rurdev.usda.gov/rbs/busp/rbog.htm for details). USDA's FY2001 appropriations increased RBOG funding to $8 million.

Other Federal agencies and programs provide some support for planning in rural areas, particularly regional planning through the Department of Commerce Economic Development Administration's support for local planning organizations. The Appalachian Regional Commission, Tennessee Valley Authority, USDA's Rural Conservation and Development (RC&D) program, and HUD's Rural Housing and Economic Development and Community Builder programs all provide limited, fragmentary planning or planning assistance. However, this piecemeal approach tends to focus on more narrow, limited objectives particular to the program. They do not provide much increase in capacity for general-purpose land-use planning efforts needed to understand and control growth.

One can imagine how difficult it is for local governments to become aware of this fragmented basket of programs, muster the effort needed to make application to them, and overcome the variety of rules for different programs to effectively use the funds to develop plans for growth control. The ambiguity between rural development objectives, which seek to foster growth and development, and planning for growth control in rural areas, may also pose problems for both the local communities and the agencies seeking to provide assistance. In many situations, it is a fine line between needs for economic development and needs for growth control.

Slow Growth, No Growth, and Smart Growth

Land-use planning and zoning authority has been delegated to local governments by all 50 States (Meck, 1999). Historically, local governments have relied upon zoning regulations and subdivision requirements based on the landmark Euclid case to manage the character and density of new development (Village of Euclid v. Ambler Realty Co., 272 U.S. 365, 47 S. CT. 114, 71 L. ED. 303 (1926) in Haar, 1976, p. 194.). By the 1970's, local and State governments in rapidly urbanizing areas were learning that these techniques were inadequate to influence the character of growth (Platt, 1996). Across the country, concerns about the impact of growth are fueling a growing recognition that local land-use planning efforts are in desperate need of updating. In some localities, land-use plans have not been updated since they were developed based on statutes enacted in the 1920's; in others, such plans are nonexistent (Salkin, 1999a). As HUD recognized in its scrutiny of Section 701 planning assistance, simply having a land-use plan and a zoning map to guide parcel-by-parcel decisions is insufficient to control the cumulative impacts of growth, and applying inappropriate development standards across the landscape may actually exacerbate "sprawl" (Chen, 2000). The American Planning Association recognizes six States as having substantially modernized planning legislation to address growth management issues (Maryland, New Jersey, Oregon, Rhode Island, Tennessee, Washington), as well as 10 States that have not updated their land-use statutes or proposed significant legislation or studies to address reforms (Alaska, Louisiana, Michigan, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, West Virginia, Wyoming).

Obtaining political support for updating land-use policies to address growth issues can be difficult, particularly in light of U.S. constitutional protections for property rights and the freedom to move. When the California town of Petaluma responded to a surge of new construction in the early 1970's by imposing a moratorium on extensions of public sewer and water services, and thus constraining the number of building permits issued annually, the plan was challenged in court by a building trade association (Platt, 1996). The city of Livermore, California, was similarly challenged when it imposed a moratorium on residential development until public services (water and sewer provision, and schools) were updated (Platt, 1996). Although eventually upheld, these policies are not permanent solutions, but rather act to delay rapid growth and the problems it causes.

In efforts to tame growth, local governments subsequently turned to policies such as "adequate public facilities" ordinances, impact fees, zoning changes to allow mixed-use developments, and working with neighboring communities to develop compatible growth management plans. However, obtaining political support for even these milder policies can be challenging. In Virginia, bills that would allow local governments to enact adequate public facilities ordinances died in House and Senate committees as a result of claims by building industry lobbyists, and real estate and business representatives that the bills would diminish property rights (Smart Growth Network, 2000). Some of these policies, in fact, may have done little to control growth and may even have exacerbated growth's consequences. For example, if public water and sewer services were at capacity, the bills proposed that developers could meet housing demands by building even more low-density development with septic systems in surrounding rural areas.

Georgia's Growth Strategies Reassessment Task Force recently concluded that comprehensive planning by nearly all of its 700 local governments has done little to direct development, and cited a need for a broader "vision" to guide local planning efforts (Hirschhorn, 2000). While local governments are increasingly challenged to consider the impacts of their local land-use policies beyond their own borders, they individually lack the authority to enact changes outside their jurisdictions. This is not a new phenomenon: Regional planning has attempted to provide coordination within areas of a State and across several States since at least the 1950's, and 29 States had passed regional planning-enabling acts by 1957 (Bossleman and Callies, 1971; Linowes and Allensworth, 1975; Healy, 1976; Pooley, 1961). To deal with these problems today, several States have adopted a substate regional or metropolitan approach to address problems where the geographic extent of growth-induced impacts spreads over multiple jurisdictions. For example, Georgia's Regional Transportation Authority covers the 13 counties in the Atlanta metropolitan area. Regional planning commissions also exist in Florida, Vermont, and Maine. Virginia's Regional Competitiveness Act, passed in 1996, provides for incentive payments to encourage regional planning and cooperation. Regional commissions work to identify resources of regional importance, develop regional plans, review local plans for consistency, and provide technical assistance to local governments. However, these commissions typically act as planning coordinators and do not have statutory authority (DeGrove and Metzger 1993). Implementation remains the responsibility of local governments (U.S. GAO, 2000; National Academy of Public Administration, 1998).

State Responses to Growth

The last two decades have witnessed a growing but gradual shift from reliance on local and regional planning to statewide strategies to counter the negative impacts of growth. In the 1980's, States began using a coordinated planning approach to manage growth and its associated costs. Typically, States do not enact sweeping changes all at once. In a recent comprehensive study of planning statutes and legislative activity, the American Planning Association found that States have tended first to enact legislation that authorizes changes in land-use planning, then progress to legislation that requires it (Meck, 1999).

The term "smart growth" is a catch-all phrase used to describe a number of policies that influence the pattern and density of new development (Chen, 2000). In general, smart growth strategies represent a movement away from State-imposed requirements for local compliance with State planning goals. Because smart growth strategies tend to use financial incentives to encourage voluntary adoption, they are generally supported by a broad spectrum of interest groups. These strategies also garner support because they direct, rather than inhibit, growth and development. There is no "one size fits all": the specific smart growth strategies that have been adopted vary by location but often share common elements. Smart growth principles favor investing resources in center cities and older suburbs, supporting mass transit and pedestrian-friendly development, and encouraging mixed-use development while conserving open space, rural amenities, and environmentally sensitive resources (Hirschhorn, 2000). These strategies also typically remove financial incentives provided by State funding to develop outside designated growth areas. In essence, smart growth encourages development in designated areas, without prohibiting development outside them, while not threatening individual property rights.

The following land-use planning techniques implemented by various States highlight the objectives of smart growth:

- **Urban growth boundaries—**Oregon pioneered this strategy in the 1970's to discourage urban sprawl. Oregon's statewide plan mandated the designation of urban growth boundaries, within which urban development would take place. Although this policy has not entirely curtailed development outside the boundaries, Oregon is recognized as being the most successful State in separating rural and urban uses (DeGrove and Metzger, 1993). In 1998, Tennessee adopted legislation that requires counties to establish urban growth boundaries for municipalities and planned-growth areas.
- **Designation of priority funding areas—**With this strategy, local governments take the lead in designating growth areas to concentrate development and direct State funding. In Washington, cities and counties exceeding a certain size or experiencing rapid population increases are required to designate urban growth areas (Johnson, 1999b). This can apply to private financing, such as the Location Efficient Mortgage (LEM) pioneered by banks in Seattle, Chicago, and California and underwritten by Fannie Mae (Chen, 2000). LEM's let homebuyers increase the mortgages for which they can qualify by the amount

of savings expected in compact versus low-density neighborhoods.

- **Farmland/environmental resource preservation—** The goal of these strategies is to proactively preserve farmland and other environmental resources of local importance, rather than trust their preservation to development controls. Maryland is one of several States with a well-established State-level farmland preservation program. In addition to its existing farmland preservation program (administered by the Maryland Agricultural Land Preservation Foundation), the smart growth initiatives implemented in 1997 included the Rural Legacy Program. In this program, the State partners with local governments, land trusts, and citizens, aiming to protect an additional 200,000 acres of farms and forestland by 2011 (Office of the Governor, 1998). Washington's Growth Management Act requires localities to adopt land-use policies that protect commercially significant agricultural lands (WSCTED, 1997).

- **Brownfields redevelopment—**Brownfields (urban redevelopment sites in older developed areas) programs limit the liability of redevelopers of old industrial sites. In 1998, New Jersey enacted the Brownfield and Contaminated Site Remediation Act, which, in addition to limiting liability for redevelopers, provides financial incentives for remediation and redevelopment of brownfields. It also includes brownfields re-use as part of its urban redevelopment programs (Finucan, 1999a). Another example at the local level is the "Homerama" demonstration project, which builds affordable new homes on redevelopment sites in distressed neighborhoods of Detroit, begun by a dozen local developers in 1987 (Chen, 2000).

- **Neighborhood business development—**Through these programs, small businesses can obtain financial assistance in designated revitalization areas. Since 1993, the Illinois Main Street Program has provided State support in the form of technical assistance to communities that are defining and implementing plans to improve development and redevelopment. The goals are to foster public and private support for the initiatives, enhance downtown areas through historic preservation, develop strategies to encourage downtown activity, and maintain the vitality of downtown areas. More than 50 communities are participating in the program (Hirshhorn, 2000). Consistent with State planning goals, a task force in South Providence, Rhode Island, adopted a program that provides State-funded assistance to new small businesses locating in one of its 10 State-designated enterprise zones (Davis, 1999, in Finucan, 1999b).

- **Multi-jurisdictional planning—**This strategy involves State incentives for coordination of local planning efforts. Wisconsin gives State funding priority to its local governments that address the needs of adjacent communities in their own development plans, rather than follow a "beggar-thy-neighbor" strategy (Smart Growth Network, 2000).

- **Coordinating transportation systems and development—**This strategy seeks to increase transportation efficiency by linking development and transportation investments by locating transportation infrastructure within designated urban growth areas. In 1998, Tennessee passed a law directing that funding under the Federal Transportation Equity Act for the 21st Century (TEA-21) be reserved exclusively for localities that have growth plans with identified urban growth boundaries for cities, planned growth areas, and rural areas (Finucan, 1999c).

- **Public/private partnerships—**This strategy involves representatives from multiple levels of government, non-governmental organizations, special interest groups, and other stakeholders in the planning process. Utah's Envision Utah partnership is working to create a growth strategy based on informing citizens about the causes of and implications of unplanned growth, rather than government-imposed requirements. The goal is to achieve reform and to shape future development based on citizens' demands for such changes. The partnership includes State and local government officials, business people, developers, environmentalists, and citizens (Hirschhorn, 2000).

Table 7 identifies some of the State actions implementing smart growth strategies. Many other States have legislation that allows, but does not require, adoption of smart growth strategies. Smart growth strategies take a synoptic view of growth and attempt to marshall the resources of the State to address growth. A larger view of the monetary resources deployed to control growth and estimates of the magnitude of the problem are made in the next section.

Monetary Incentives for Conserving Farm and Forest Land

Despite the benefits farmland provides to residents beyond the urban fringe, and to society in general, and despite adaptations farm operators can make to accommodate an urbanizing environment, few landowners can

Table 7—State implementation of smart growth strategies

State	Commission/task force to study smart growth in 1999	Enacted State-level smart growth legislation
Arizona	Growing Smarter Commission (1998-99)	Growing Smarter Act (1998) in part requires that municipalities' and counties' plans identify growth areas. The Growing Smarter Plus bill (Senate Bill 1001, 2000) authorizes municipalities to designate boundaries beyond which public water, sewer and street service will not be provided.
Colorado	Interim Legislative Committee on Development and Growth (1998)	Governor's Smart Growth Award Program awards matching grants for measures that balance growth with community needs.
Delaware		Shaping Delaware's Future Act (1995).
Florida		House Bill 17 (1999) offers financial incentives to local governments to adopt plans for and to develop in urban infill and redevelopment areas, by granting authority to issue bonds or to engage in tax increment financing and by providing grants for local public projects in these areas.
Iowa	Commission on Urban Planning, Growth Management of Cities, and Protection of Farmland (1998-99)	
Kentucky	Legislative Subcommittee on Planning and Land Use (1999)	
Maine		Passed legislation (2000) to direct State capital investment projects to designated growth areas and areas served by public sewer systems. State grants for capital investments are awarded first to municipalities that have comprehensive plans consistent with State smart growth objectives. Requires adoption of rules that encourage siting of State office buildings and schools in growth areas.
Maryland	Smart Growth and Neighborhood Conservation Sub-Cabinet to coordinate State agency actions (1998)	The Neighborhood Conservation and Smart Growth initiatives (1997) rely on incentives to encourage local governments to voluntarily adopt smart growth strategies. They direct State funding for capital investments to designated "priority funding areas," preserve farmland and natural resources through the Rural Legacy Program, encourage redevelopment of old industrial sites, and provide financial incentives for businesses to locate in priority funding areas. Also provides homebuyers with financial assistance with purchasing a home in an older neighborhood near their jobs.
Massachusetts		Sustainable Development Act (proposed in 1999). Executive Order 385 "Planning for Growth" (1996) in part requires coordination of State agencies, and provides incentives for local governments to engage in planning.
New Hampshire	Land Use Management and Farmland Preservation Study (1998); Cost of Sprawl Study (1999)	House Bill 1259 (2000) requires State agencies to make decisions consistent with smart growth principles when funding and siting infrastructure and public facilities.
New Jersey	State Planning Commission (1985)	The Commission adopted (1999) a revised State development and redevelopment plan that includes financial incentives for communities to engage in multijurisdictional planning through a Smart Growth grant program.
New Mexico	Legislative subcommittee on enabling statutes (1999-2000)	

Continued—

Table 7—State implementation of smart growth strategies (continued)

State	Commission/task force to study smart growth in 1999	Enacted State-level smart growth legislation
New York	Smart Growth Economic Competitiveness Task Force (1999); Quality Communities Task Force (2000)	The Smart Growth Economic Competitiveness Act and several other bills were introduced in 1999. The proposed Smart Growth for the New Century Act would favor local governments with smart growth plans when allocating State funding; State financial assistance for public projects is limited to locally designated "smart growth" or redevelopment areas. The proposed New York State Smart Growth Compact Act would authorize creation of smart growth compact areas and governing councils, and gives funding priority for drinking water and wastewater infrastructure projects to localities with certified smart growth plans. AB 9080 and SB 5893 (1999, in committee) would create the Smart Growth Planning Council, which would provide incentive grants to local governments that meet smart growth goals.
North Carolina	Smart Growth Study Commission (1999)	
Oregon		The land-use plan enacted in 1973 (and subsequent amendments) contains mandatory provisions for cities to designate urban growth boundaries, for local plans to be consistent with State planning goals, local governments to coordinate planning efforts, and that counties use protective zoning to help preserve farms and forestland. In the recent "Smart Development" initiative, local governments are encouraged to locate development near existing urban services. S.B. 1128 (1999) promotes "sustainable development" and helps economically distressed communities by providing State assistance.
Pennsylvania	21st Century Environment Commission (1997)	
Rhode Island		The Comprehensive Planning and Land Use Regulation Act (1988) requires cities and towns to adopt comprehensive plans that comply with State plans, and that these local plans address natural resources, farmland, open space, and economic development. The Act contains incentives for "smart development."
Tennessee		Pub. Chap. 1101 (1998) requires counties to adopt and adhere to growth plans that include urban growth boundaries for each municipality, planned growth areas, and rural areas. Funding provided by the State for economic development and infrastructure projects is to be limited to counties with approved growth plans after July 1, 2001.
Utah	Quality Growth Commission (1999) formed to identify growth areas and administer conservation fund to purchase easements on agricultural and open space land.	Quality Growth Act (1999) established the Quality Growth Commission.
Virginia	Joint Legislative Smart Growth Subcommittee (1998) to identify smart growth areas where State infrastructure funds are to be directed.	
Washington		The Growth Management Act (1990) in part requires cities and counties (a) exceeding a certain population or population increase to designate urban growth areas and to adopt consistent comprehensive plans, (b) to protect environmentally sensitive resources, and (c) to identify and design policies to protect commercially important farmland.
Wisconsin		The Smart Growth Law (1999) gives funding priority to local governments that address the needs of adjacent communities and identify planned growth areas for development or redevelopment. The Smart Growth Dividend Aid Program was established to award funds to local governments that have increased the amount of compact development and moderately priced housing.

Sources: Finucan (1999a-c); Johnson (1999a,b); Hirschhorn (2000); NCSL (2000); Salkin (1999a,b) and references therein.

continue to farm in the face of high competing returns from development. Real resources are needed to provide incentives for landowners to conserve land in agriculture. The most widely enacted provision to provide incentives for farmland preservation, use-value or preferential assessment, has been scrutinized very little, while the most effective, purchase of development rights, is under-funded relative to the amount of land that could be enrolled.

Cost of Preferential Assessment

Preferential or differential property tax assessment is the most popular farmland preservation technique and is authorized in all States (Aiken, 1989; AFT, 1997). Preferential assessment removes a disincentive for conserving farmland in the face of development pressure by assessing the property at its value in agricultural use, rather than the higher developed land values found near cities, often in exchange for an agreement not to develop for some period. Penalties (called rollback provisions) can be imposed if the land is developed within the agreed term. While not widely recognized by the public, tax reductions like this are a form of expenditure in disguise, called "tax expenditures." We estimated the implicit subsidy that farm operations receive through tax expenditures in preferential assessment programs by applying each State's tax rate per $100 of full market value against the difference between current land values and land values in rural areas without development pressure (appendix table 1). Nationally, the estimated tax subsidy is $1.1 billion annually. This annual flow of tax expenditures has a present value (from discounting the stream of annual tax expenditures at 4 percent) totaling nearly $27 billion.

Evaluations of preferential assessment generally recognize that, while it is a popular subsidy for farmland owners, it has not provided a strong incentive for conserving farmland (Tremblay et al., 1987; MacKenzie, 1989; Lincoln Institute, 1993). With relatively minor agricultural activity, developers as well as other landowners can reap reductions in property taxes that reduce the cost of holding land prior to development. The rollback penalties are generally too small, relative to the potential rewards from development, to deter landowners from selling out for development if the opportunity arises. At best, preferential assessment may slow the transition from rural to developed uses, but it is not a permanent solution. Other tools, such as purchase or transfer of development rights, are more effective in permanently preventing development.

Buying Development Rights

All States now have laws enabling conservation easements on agricultural land through voluntary donations from landowners, and about 19 States have programs for purchase of development rights (PDR), purchase of agricultural conservation easements (PACE), or transfer of development rights (TDR) (Buist et al., 1995; Wiebe et al., 1996). With PDR's and related programs, public funds purchase permanent or specified-term restrictions on the deeds of individual parcels, effectively prohibiting future development or use of the parcel for nonfarm uses. These programs are intended to retain parcels with high potential for continued, active agricultural use, and usually focus on cropland. The distinction between "cropland" and "farmland" is important: cropland is a higher quality subset of all land operated in farms, which can contain pasture, range, woodland, and other kinds of land.

The restricted deed to the parcel, and all remaining property rights associated with ownership, are retained by the landowner, who can continue farming. Deed restrictions are binding not just on the current owner, but on all future owners. The implicit economic value of the easement is the difference between the unrestricted (market) value of the parcel and its restricted (agricultural) value, as determined by modern appraisal methods or by easement valuation "point" systems.

Nineteen States have State-level PDR programs, and at least 34 counties operate separate programs in 11 States (AFT, 1997; 2000). The growing popularity of these programs nationwide is due to:

- The nearly unique ability of this public policy tool to permanently preserve farmland;
- The voluntary nature of the programs, which avoids the takings issues that cloud the outcome of regulatory techniques such as zoning; and
- The ability of these programs to target funds toward parcels with the most important characteristics, an ability that is lacking in most other economic incentive-based farmland preservation techniques such as preferential assessment.

PDR's and related programs are a relatively new farmland preservation technique, although land trusts and other private conservation organizations have a long history of obtaining conservation easements on valuable or unique wetlands, wildlife or biotic habitat, riparian areas, and scenic landscapes (Wiebe et al.,

1996). Until fairly recently, these easements were most often obtained from landowners as a donation to a charitable organization compensated by a Federal income tax deduction under Section 170 (h) of the Internal Revenue Code (Ward et al., 1989). Conservation easements for agricultural land were first obtained in Suffolk County, New York, in the mid-1970's (AFT, 1998a, 1998b). Since that time, 21 States have based conservation easement-enabling legislation on the National Conference of Commissioners on Uniform State Laws Uniform Conservation Easement Act (1981). Another 23 States have enacted their own versions of enabling legislation.

AFT estimates that, nationwide, PDR programs have cumulatively protected 819,490 acres of farmland with an expenditure of $1.2 billion, slightly more in total than the *annual* tax expenditure on use-value assessment. The average easement cost $1,519 per acre. Public expenditures for PDR programs are reported from 20 States, with the most active programs existing in the Northeast (AFT, 2000). Maryland, Massachusetts, New Jersey, and Pennsylvania account for 68 percent of PDR expenditures to date (appendix table 2). Programs are usually funded through bond issues approved in public referenda. The Conservation Fund compiled results of 35 referenda on funding for easement programs in States, counties, and townships around the country in November 2000 (Conservation Foundation, 2000). Seven proposals for $403 million were rejected by voters. Another 28 for $1 billion were approved.

An important advantage of PDR's and related programs as farmland protection tools is their ability to target funds to the highest quality land parcels or to parcels with the highest degree of development pressure. Programs choose the parcels on which to spend their limited funds from those offered by eligible landowners on the basis of legislatively or administratively determined criteria, or on the basis of scoring systems that rank parcel and landowner characteristics. Some programs combine the two procedures, awarding ranking "points" only to parcels that meet a set of minimum criteria (e.g., outside water and sewer service boundaries, or in areas zoned for agricultural or rural uses). Most programs award progressively higher ranking points for parcels with higher quality soils, proximity to existing preserved parcels, or proximity to existing development, with the progression heavily weighted toward parcels consisting of "prime" cropland under imminent threat of development.

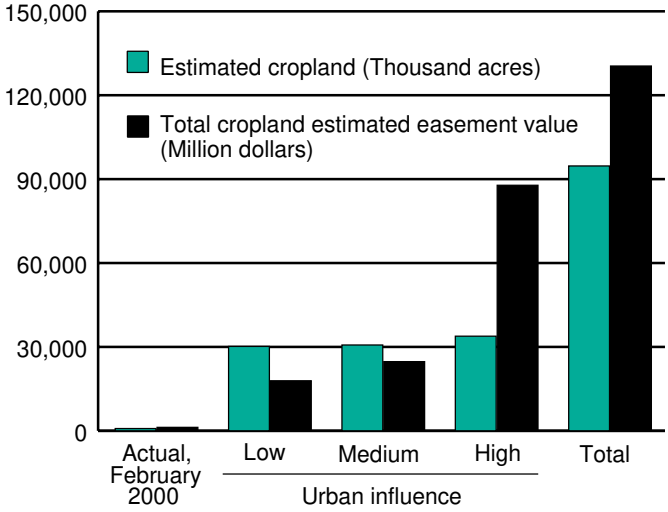
Both of these features increase the cost of PDR's and related programs. An increased likelihood of development, for example, from proximity to roads or existing development, increases the cost of the easement to the program by further increasing the difference between the parcel's market value and its agricultural value. Facing limited funds, programs must choose between preserving more farmland acres of poorer quality under less development pressure, and preserving fewer acres of higher quality under greater development pressure.

Potential Cost of Development Rights

State PDR's and related programs focus on protecting cropland as the highest quality farmland that holds the most potential for long-term viability in agricultural use. We estimated the cost for voluntary easements on all urban-influenced U.S. cropland (94.7 million acres) at $130 billion (figure 25; appendix table 2; see box, "Methods for Estimating Cropland and Farmland Purchase of Development Rights Cost"). The easement cost of 36 percent of the acres subject to the highest level of urban influence is $88 billion. Thus, expenditures nationwide for PDR's and related programs through February 2000 constitute just 1 percent of the estimated total easement cost to preserve all urban-influenced cropland. Cropland acres protected to date through PDR's constitute less than 1 percent of urban-influenced cropland acres nationwide.

Nationally, figure 25 indicates that it would cost $88 billion to purchase easements on the 34 million crop-

Figure 25
Actual and estimated easement value for cropland, by urban influence



Source: ERS analysis of National Resources Inventory land use and NASS land values data.

land acres most influenced by urbanization, at an average cost of $2,595 per acre. However, purchasing easements only on the 31 million acres of cropland subject to the medium level of urban influence preserves roughly the same number of acres for $25 billion, $806 per acre, or less than one-third the cost. Selecting cropland parcels only in the low urban influence category, for which urban conversion might not be expected for many years, would reduce current easement costs by an additional third, to $592 per acre, or $18 billion.

The chief obstacle to conserving more farm and forestland through PDR programs is the high cost of purchasing easements. However, States already incur a tax expenditure in use-value assessment programs for all farmland of $1.1 billion annually, which equals a present value of $27 billion when amortized at 4 percent (figure 26; appendix table 1). The tax subsidy on use-value assessment dwarfs the $1.2 billion in cumulative public expenditures on PDR programs since the mid-1970's. Since use-value assessment is generally acknowledged to provide far less certainty that farmland will actually be preserved from development than PDR's and related programs, more effective farmland conservation could perhaps be obtained by reallocating these expenditures.

We estimated that by applying the annual expenditure on use-value assessment to PDR's, State programs could cover 30 percent of the $88 billion easement cost needed to conserve cropland in the high-urban-influence category, or 63 percent of the cost of easements in the middle- *and* low-urban-influence categories. Because use-value assessment is generally provided to all qualifying farmland, redirecting expenditures on it to conserving cropland alone could cover a substantial portion of the total cost of cropland easements, particularly in States with less urban pressure, or with a lower ratio of cropland to all farmland (appendix table 2). In other words, converting use-value assessment tax subsidies to PDR expenditures could fund permanent easements on much of the cropland really at risk of development.

These estimates do not include costs associated with purchasing easements, which can be substantial. Direct costs—such as those incurred from settlement fees, title work and insurance, and conducting appraisals—

Methods for Estimating Cropland and Farmland Purchase of Development Rights Cost

USDA's National Agricultural Statistics Service annually collects information on farmland values via the national June Agricultural Surveys (JAS). Farmland values from the JAS, pooled for 1994-96, consist of more that 75,000 observations geo-referenced to the approximate parcel location (latitude and longitude). Each parcel was classified as urban-influenced or not based on an index of proximity to urban areas derived from Census tract population data using GIS-based statistical smoothing techniques. In geographers' terminology, the index is derived from a "gravity" model of urban development, which provides measures of accessibility to population concentrations. The index accounts for both population size and location of the parcel relative to that population (distance within a 50-mile radius). The index increases as population increases and/or as distance from the parcel to population decreases, hence, the "gravity" analogy. Census tracts were assigned to a "totally rural" category based on 1990 commuting data and Census Bureau geographic definitions. "Totally rural" means that the tract does not contain any part of a town of 2,500 or more residents and the primary commuting pattern was to sites within the tract. JAS parcels were classified as urban-influenced if the population accessibility index exceeded the 95th percentile of the index's distribution for the set of totally rural tracts in the region (LRR) containing the parcel. Within each LRR, the urban-influenced JAS sample points were sorted by their associated population accessibility index number and the distribution split into three categories, each containing equal numbers of JAS sample points.

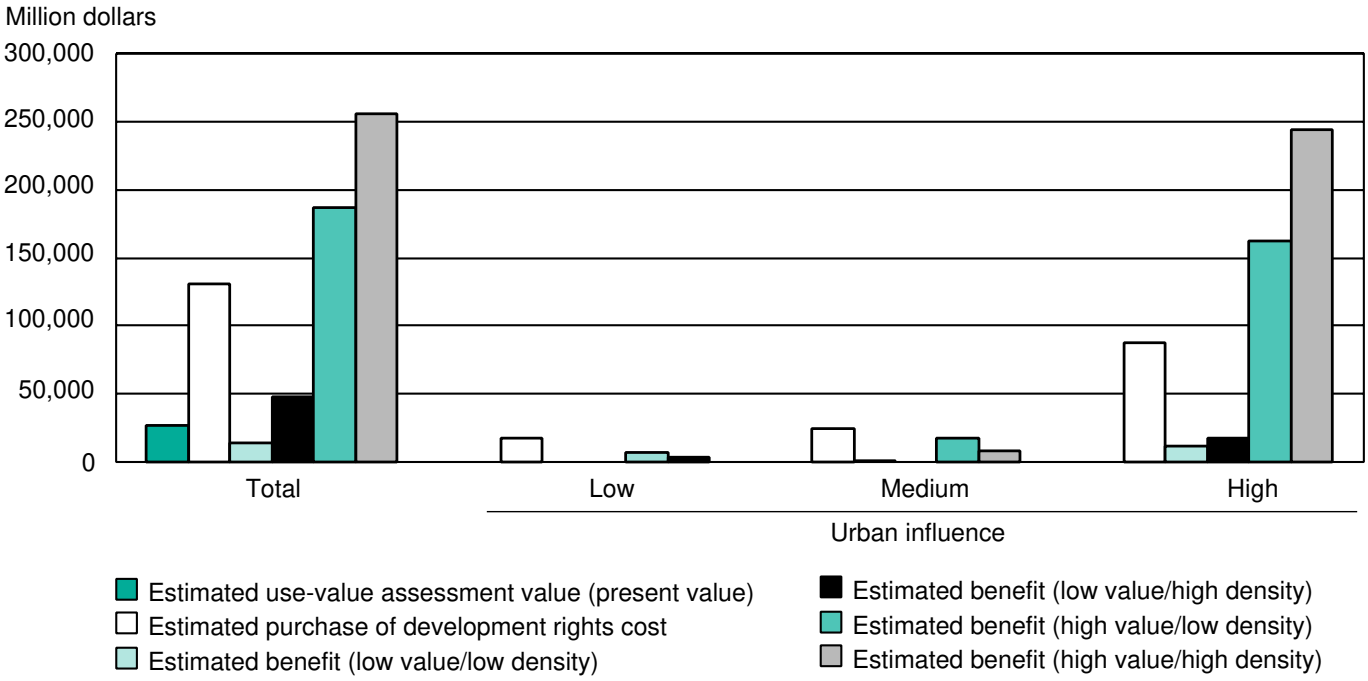
The statistical design properties of the JAS data can be used to estimate the number of acres and the average market value per acre in the totally rural category and in each of the three urban-influenced categories for each LRR. Because the average market value in the totally rural category is assumed to approximate the agricultural value in each of the three urban-influenced categories, the easement value per acre can be estimated as the difference between average market values in the totally rural category and in each of the urban-influenced categories. We assume that landowners would be willing to sell voluntary easements at this price. Multiplication by the respective crop or farmland acres in each category then determines the cost of purchasing all the crop or farmland development rights in each urban-influenced category. Results were summarized at the State and U.S. levels.

amount to several thousand dollars for each easement purchased. Appraisals, which may be needed to establish the market value of the property and hence the easement value, can cost $1,500 to $2,500 per property (MALPF, 2000; Daniels, 2000). In the Lancaster County, Pennsylvania, program in 1993, administrative costs averaged $83 per acre (4 percent) on easements averaging over $2,000 per acre (Wiebe, 1996, p. 13). Administering agencies also incur indirect costs in the form of salaries, administrative expenses, and legal fees. On the other hand, the cost of administering use-value assessment programs is also not included in the estimates of tax expenditures for use-value assessment. Assuming a cost of $2,000 per acre, and a $2,500 administrative cost, a 100-acre parcel would have additional costs of 1.27 percent, while a 10-acre parcel would have costs of 14.3 percent. A generous estimate of additional administrative costs for easements would be 5 percent of the easement cost, averaged across all transactions of different parcel sizes.

Redirecting use-value assessment tax expenditures to PDR's is not without risks. Essentially, this replaces a small monetary incentive applied to many farmland acres (the tax reduction) with a larger monetary incentive on fewer cropland acres (the easement purchase). Owners who no longer receive the tax reduction will be more inclined to sell land for development due to higher taxes. However, tax revenues from the land on which development rights are purchased will likely rise above agricultural use values, but will probably not rise to full market value levels. This is because a market for land with severed development rights has developed in States with extensive PDR programs (Nickerson and Lynch, 1999; Blakely, 1991). There are potential buyers of these parcels who are not primarily interested in agricultural production. Politically, many property owners will object to losing a property tax reduction, and fewer of them will benefit from PDR purchase. There may also be difficulty in getting voter agreement to convert the annual and largely disguised tax expenditure into a bond or other financing instrument for capital purchases of development rights.

Targeting cropland with the highest urban influence for protection may be a shifting target. Unless consumer preferences for single-family homes and low-density development patterns are altered, or growth control

Figure 26
Costs of purchase of development rights and use-value assessment relative to benefits for preserving cropland, by urban influence



See text for explanation of value/density scenarios.
Source: ERS analysis of National Resources Inventory land use and NASS land values data.

policies pursued more vigorously, purchasing development rights on land currently under the most intense development pressure would likely shift developers' attention to other land. The $27 billion that could be derived from current use-value assessment tax expenditures is more than the estimated $18 billion cost of easements for cropland with middle and low urban influence farther out from the urbanized areas, and would put "greenbelts" totaling more than 30 million acres around existing urban areas and surrounding areas of high urban influence.

Comparing Benefits and Costs

The costs of purchasing development rights easements on cropland estimated above can be compared with the benefits of conserving cropland (table 8). Because PDR easements are essentially an up-front capital investment, the annual stream of benefits estimated above in table 5 must first be converted to a present value (using a 4 percent discount rate consistent with that used to analyze use-value assessment above). An estimate of the benefits of conserving cropland, distinct from all farmland, is made by assuming that the benefits are proportional to the amount of cropland in the land base. After these adjustments, the costs and benefits can be compared (table 8). The benefits from not incurring additional soil erosion during construction in table 6 are not included in these estimates.

The most important conclusion from this exercise is that the relationship between costs and benefits depends heavily on the initial value per acre per household ($0.21 versus $2.93) assumed from the literature, and on the development scenario assumed. If the lower value estimate and a relatively low-density development scenario are correct, the benefits from cropland conservation probably will not justify the costs of a comprehensive PDR program. Not surprisingly, 87 percent of the benefits occur in the high-urban-influence area because more households are located there. Even in that area, however, estimated benefits are only about 13 percent of easement costs.

However, if the true per acre value is higher and development follows the high-density pattern with the land targeted for conservation in the more populated high urban influence area, then estimated benefits are much greater than expected costs. Estimated benefits exceed costs in total and for the high-urban-influence area whenever the high value per household per acre is assumed.

Estimated costs are relatively certain, and likely have a fairly narrow band of confidence, simply because we have market data on which to base these estimates. The results must be tempered by the fact that the benefit estimates cover only part of the benefits from farmland conservation that can be estimated quantitatively. The literature provides a wide range of values from which to choose, and the site-specific characteristics and preferences of areas across the country need to be factored in. However, the exercise is a useful one to judge the potential magnitudes and to provoke discussion and further analysis.

Table 8—Comparison of costs and benefits for protecting cropland, by degree of urban influence, 1995

	Degree of urban influence[1]			
	High	Medium	Low	Total
		Million dollars		
Cost of PDR easements[2]				
Cropland	87,803	24,741	17,894	130,438
Estimated benefits of conserving farmland[3]				
High-density scenario				
Percent developed	90%	10%	5%	
Low value/acre/household	17,500	500	250	18,250
High value/acre/household	243,500	8,500	3,750	255,750
Low-density scenario				
Percent developed	60%	20%	10%	
Low value/acre/household	11,750	1,250	500	13,500
High value/acre/household	162,250	17,250	7,500	187,250

[1] See box "Methods for Estimating Cropland and Farmland Purchase of Development Rights Cost" for an explanation of urban influence.
[2]See appendix table 2 for details and box "Methods for Estimating Cropland and Farmland Purchase of Development Rights Cost."
[3]Present value of estimated annual benefits capitalized at 4 percent. See table 5 for details of estimated annual benefits.
Sources: ERS analysis of NASS June Agricultural Survey and USDA National Resources Inventory data.

VII. Potential Federal Roles

The right to control land uses exists and lies in the sovereign power of the state and may be exercised through the police power, eminent domain, and taxation....

(Ely and Wehrwein, 1964)

The primary direct authority over land-use matters under our constitutional system rests with the States. However, there have been issues raised throughout U.S. history about what role in land use, if any, the Federal Government should play. In the early 1970's, along with a tide of other environmental legislation, bills were introduced in the Congress by both political parties to establish a national land-use policy (Anderson et al., 1975). The proposals universally recognized the primacy of State authority but approached policy as a matter of "process reform," which would help the States meet the challenges of urbanization more effectively. In a foreshadowing of smart growth strategies, the proposals provided Federal grants to States to enable them to take back certain land-use control authorities historically delegated by them to local governments. Several States were already moving in this direction, having adopted more comprehensive State and regional planning processes in several areas, including Vermont, California, Hawaii, Florida, and Massachusetts (Bosselman and Callies, 1971; Healy, 1976; U.S. Senate, 1974). The national land-use policy bills were characterized as Federal enabling legislation to encourage States to exercise States' rights (U.S. Senate, 1973). Congress held hearings and debated proposals for 5 years. The Senate passed land-use policy bills in the 92nd and 93rd Congresses, but the issue died on a very narrow vote in the House on June 11, 1974 (Whittaker, 1976).

Against the backdrop of limited Federal land-use authorities has been the recognition that Federal Government programs can be powerful, and have pervasive influences on land-use decisions made by private and public actors (U.S. Senate, 1972). Federal income tax law, highway programs, sewer and water programs, and environmental programs have exercised great influence on land-use decisions. Most often, this pervasive Federal influence has been examined to see whether Federal policies aimed at other objectives are having unintended consequences for land use. Only occasionally have positive impacts from Federal leveraging been explicitly considered, and explicit leveraging of Federal spending to get land-use controls adopted at the State or local level has only rarely been attempted. Recent examples include the Coastal Zone Management Act Reauthorization Amendments of 1990 and the Clean Water Act (U.S. EPA, 1996, 1993).

With the costs and benefits of controlling growth being largely local, States and the Federal Government may be seen to have little rationale for involvement. The expansiveness of modern metropolitan growth patterns, however, makes it clear that problems of growth are not confined to local government boundaries. Increasingly, States find it easy to rationalize a major role, on economic and political grounds, to say nothing of constitutional authority. The case for Federal involvement is less clear. Growth control issues recur in nearly every metropolitan area across the Nation. In this sense, it is identical to other "local" problems ranging from water quality to education that have been redefined as "national" issues. There are no clear tests that divide Federal and local issues: If a majority in Congress decides that a Federal role is appropriate, the Federal Government will act. The current outpouring of concerns over land-use and growth control issues poses questions that have been raised before:

- What, if anything, should the Federal Government do about growth?
- What role does farmland preservation play in controlling growth?
- What is the unique contribution of the U.S. Department of Agriculture?

In this chapter, we examine the evidence for unintended impacts on growth from Federal actions and the arguments for Federal assistance to local governments to indirectly and directly affect urban growth.

Helping Increase State and Local Planning Capacity

Because of the way that metropolitan areas grow, expectations of development often long antedate the development itself. Planning for development and the

design of growth controls need to be in place to contain such expectations, to avoid potential conflicts with property rights (National Commission on Urban Problems, 1969; ASPO, 1968). However, the ability to pay for all kinds of government services, including planning, is limited in rural areas with limited tax base. There is a disconnect between the time property transfers, leading to development, and the time tax revenues are available to pay for the planning capacity needed to control growth. There may also be a disconnect between jurisdictions approving development and those bearing the consequences. For example, by locating a shopping center on its border, a county can shunt traffic problems onto an adjacent county.

The conundrum regarding planning capacity and public responsibility for it in rural areas is longstanding. Rural residents have been antagonistic toward planning, and politicians are understandably wary about taking a stand on growth control, particularly well before it occurs.

In 1981, the National Agricultural Lands Study recommended that USDA "…assess the feasibility of providing small matching grants for 'capacity building' to state departments of agriculture (or other appropriate state agencies) that seek to manage agricultural land issues."

Before massive amounts of funding are made available exclusively for monetary incentives to preserve farmland, the case for a properly structured planning grant program needs to be revisited as a potentially more cost-effective use of Federal funds.

Coordinating Local, Regional, and State Efforts

Another potential role for the Federal Government in controlling growth is coordinating efforts across Federal agencies and across State and local government boundaries. U.S. GAO (1999) notes that there is increasing coordination among Federal agencies on growth-related issues, including the President's Council on Sustainable Development, and the EPA Smart Growth Network. GAO suggests that these efforts are too new, and the research is too limited, to provide guidance on how the Federal Government can better assist State and local governments in managing growth. There is a long history of Federal coordination through the Office of Management and Budget A-95 review process, which was designed to get feedback from surrounding communities and State agencies on Federal Government funding proposals for local communities. During the 1980's, the A-95 review and comment process was transferred to the States. A recent report suggests that the process has deteriorated because most States have not been committed to continuing the process (National Academy of Public Administration, 1998).

While 36-42 percent of local governments responded that coordination with Federal agencies was good or excellent (GAO, 2000, p. 27), over 40 percent of respondents to GAO's survey wanted increased Federal incentives to pursue regional growth management strategies, such as smart growth. Increased technical assistance from the Federal Government was favored by 29-37 percent of local governments. GAO also points to Federal regulatory review authorities in the National Environmental Policy Act (NEPA) and the Farmland Protection Policy Act (FPPA) as opportunities to consider the potential influence of their actions on patterns of growth. Both NEPA and FPPA processes focus on assessing the impacts of proposed development that are influenced by qualifying Federal actions. For FPPA in particular, the decision regarding what lands to protect is in the hands of State or local governments, and their planning processes presumably would determine how growth control is addressed in the decision.

The National Environmental Policy Act (NEPA), passed in 1969, was the first step in a new suite of national environmental protection laws (Stokes and Watson, 1989). NEPA's key provision is a requirement for environmental impact statements (EIS's) for proposed actions that might affect the environment. Land-use changes are properly considered as impacts because the guiding language of the act discusses irreversible and irretrievable commitments of resources, relationships between short-term uses and maintenance and enhancement of long-term productivity, and alternatives to actions that can be avoided, all of which characterize land-use change. Private projects with major Federal funding are also covered by NEPA, in addition to agency actions.

The Farmland Protection Policy Act (7 USC 4201) directs USDA to work with other Federal agencies to develop criteria for identifying the effects of Federal programs on the conversion of farmland to nonagricultural uses. Federal agencies are to:

- use the criteria to identify and take into account the adverse effects of their programs on the preservation of farmland;

- consider alternative actions, as appropriate, that could lessen adverse effects; and
- ensure that their programs, to the extent practicable, are compatible with State and local government and private programs to protect farmland (7 USC 4202).

One of the beneficial features of the FPPA is that it is a potential source of information about conversions resulting from Federal actions.

The White House Task Force on Livable Communities required the establishment of a USDA task force to identify actions for maintaining agriculture and forestry in rapidly growing regions (White House, 2000). Among the charges to the task force was the admonition to "…consider the extent to which actions by Federal agencies, such as construction, development grants and loans and federal land management decisions, contribute to the loss of farm and forest lands and whether additional measures or policy changes can be taken to lessen their impact."

In response, a USDA Task Force categorized an impressive array of programs that "protect or convert farm or forest land," but concluded that the lack of compliance with the Farmland Protection Policy Act by other Federal agencies had resulted in a lack of information about the impacts of Federal programs.

Coordinating Federal Development Activities and Growth Management Goals

The Federal Government has had long experience in stimulating economic growth and development in rural and urban areas alike, but less experience in controlling growth. If both roles are undertaken, potential conflicts between the roles, and between different Federal agency goals could easily develop. In documenting the land development process, we noted the critical role of infrastructure investments in the growth process. Focusing NEPA and FPPA review on Federal programs involved in supporting infrastructure development, like sewer and water programs, would permit tradeoffs to be made between development and other quality-of-life factors better served by conserving rural land. For example, Section 201 Municipal Facilities Construction grants for wastewater treatment facilities and the Rural Housing Service's waste disposal and water supply system grants and loans help State and local governments finance sewer and water investments. These programs provide incentives and financing for construction and upgrading of systems designed to address point source water pollution concerns and concerns over safe drinking water supplies (figure 11). There are potential conflicts between social objectives of clean water, safe drinking water, and rural development and the desire to control urbanization and reduce problems from growth. Facilities greatly oversized for the current population or inappropriately located relative to existing development centers contribute unduly to growth.

An oft-cited argument for a Federal role is the contention that powerful and pervasive influences on land-use decisions are inadvertently exercised by Federal programs aimed at other objectives (U.S. House, 1980; U.S. HUD, 2000). Most often identified as influential have been the interstate highway construction program, tax deductions for interest on home mortgages, and various programs for infrastructure investments in sewers, water supply, and schools. The U.S. General Accounting Office completed the most recent review of this argument, focusing on Federal programs and policies "reflecting decisions on spending, taxation, and the location of Federal facilities." GAO concluded that so many factors contributed to "sprawl," and that the relationships among factors were so complex, that researchers have great difficulty isolating the impact of individual factors (U.S. GAO, 1999). Anecdotal evidence supports the belief that the Federal Government influences growth, but quantitative results showing the magnitude or extent of influence is lacking. Program agencies have responded to such criticisms over the years as well, building review and mitigation features into their programs that reduce unintended negative impacts. GAO points out that the lack of evidence to measure the influence does not mean that Federal policies and programs have no effect.

A second GAO report surveyed local communities regarding the impacts of Federal programs (U.S. GAO, 2000). About half of the communities surveyed said that the Federal impact was low, very low, or nonexistent, compared with only 17 percent that rated Federal influence as high or very high. Many of the latter communities had large Federal facilities located in them or nearby (GAO, 2000, p. 18). Local officials cited three areas in which Federal programs affect their growth management activities: programs to construct infrastructure or other physical improvements; programs for infill development or urban redevelopment; and programs to preserve or protect farmland or open space (GAO, 2000, p. 17). Local complaints about Federal programs are generally not that the programs exist, but that there is insufficient flexibility to tailor the pro-

grams to local needs. In the case of farmland preservation, local officials sought more assistance (GAO, 2000, p. 26).

Past Federal programs may have inadvertently contributed to problems with urban growth. However, it is unlikely that new programs will be developed of a scale similar to the interstate highway construction program or the EPA Section 201 sewage treatment program. While tax deductions, like that for mortgage interest, are used in areas with new residential construction, short of abandoning a competing goal of increased homeownership, it is unlikely that these provisions will be repealed. Tax breaks for home mortgages could work just as effectively to subsidize new residential construction in compact suburbs or as infill development in cities.

Funding Monetary Conservation Incentives

The Federal Farmland Protection Program (FPP) was established in the 1996 Farm Act to provide funding to State, local, or tribal entities with existing farmland protection programs for purchase of conservation easements or other interests. The goal of the program, run by USDA's Natural Resources Conservation Service, is to protect between 170,000 and 340,000 acres of farmland. Priority is given to applications for perpetual easements, although a minimum of 30 years is required. FPP was funded at $35 million (NRCS, 2000), and it was spent to protect 127,000 acres in over 19 States. FPP funding to date represents just 2.5 percent of total State funding on PDR, and less than 1 percent of potential PDR expenditures in highly urban influenced areas. Given these small percentages of past and potential PDR effort, the ultimate goal of Federal assistance to PDR programs is unclear.

The Farmland Protection Program is the only Federal program that provides direct financial incentives to address the farmland conversion issue through conservation easements. The Federal Government also supports farmland protection indirectly through Section 170 (h) charitable deductions under the Internal Revenue Code.

Several observations emerge from our analysis:

- Collectively, the amount spent by the public to preserve farmland through State and local purchase of development programs and Federal contributions to these programs amounts to more than $2 billion, in total. Annual tax expenditures for State use-value assessment programs are an additional $1.1 billion per year.
- However, current efforts are only a small fraction of the $130 billion cost of easements to protect all urban-influenced cropland.
- There are substantial tradeoffs between relatively weak instruments like preferential assessment versus purchasing development rights through a conservation easement. The annual expenditure on use-value assessment would cover a significant part of the cost of purchasing easements on cropland most heavily influenced by urban pressure. Purchase of development rights is the preferred tool in terms of effectiveness, but such programs have a higher up-front cost.
- To be used effectively, public funds for purchase of development rights should be used strategically. There are substantial tradeoffs between saving more acres under less development pressure, versus using available funds to purchase development rights on those fewer acres that are under more immediate pressure for development.

Federal direct support for farmland protection is arguably modest, amounting to less than 3 percent of State and local expenditures to date (American Farmland Trust, 1998). However, a clear rationale for a more expansive program is similarly lacking. The total amount of expenditures needed to acquire development rights on all cropland or farmland that could be expected to be developed over the next several decades ranges from $87 to $130 billion. Purchase of development rights should likely be done strategically, in conjunction with other growth management tools, rather than rely solely on monetary incentives. Absent some clear, mutually exclusive, Federal interest, the role the Federal Government can play in providing monetary incentives to preserve farmland is uncertain. The case for Federal involvement may simply rest on the argument that seed money is needed to persuade States to act. If that is the rationale, funds should be targeted to States with a demonstrable urbanization problem that is not being addressed by State programs. Another rationale could be that some Federal cost share is appropriate to support successful State initiatives. In this case, funding should go to States that can demonstrate a degree of effort in addressing farmland conservation, perhaps leavened by objective evidence on the scope of the problem occurring in each State.

Conserving Rural Amenities Part of Greater Agricultural and Trade Policy Goals

Policies that support agriculture could be tools for controlling growth. Agricultural land provides various public benefits, such as open space and scenic amenities. Many countries are actively trying to increase the supply of these benefits, and to reduce the negative byproducts of agriculture, such as soil erosion. However, a word of caution is required when considering agricultural policy in what is increasingly a global trade context. As part of the 1994 Uruguay Round Agreement on Agriculture (URAA), member countries of the World Trade Organization (WTO) agreed to limit policies that cause trade distortions in international agricultural markets. These limits are not focused on policy objectives. Rather, countries have agreed to restrictions on the policy instruments used to achieve domestic objectives.

Policies that cause minimal or no trade distortions are considered to be part of what is called the "green box" (Vasavada and Warmerdam, 1998). The URAA places no restrictions on how much green box support can be given to farmers. Policies that do create trade distortions are placed in the "amber box." WTO members have agreed to limit the amount of support provided by amber box policies, and to work to reduce amber box support levels in subsequent rounds of trade negotiations. Policies that directly target agricultural production may cause trade distortions by affecting relative international prices. Thus, agricultural price supports and production subsidies are likely to be subject to the amber box restrictions.

In general, policies that are not linked to production are likely to be considered part of the green box. Fortunately, it is also the case that many policy objectives can be more efficiently met by directly targeting the desired amenities than by targeting agricultural production (Bohman et al., 2000). In fact, for many desirable agricultural byproducts, there is no consistent relationship with increased agricultural production. For example, a scenic landscape may be no more lovely with 40 cows than it is with 30 (Mullarkey, Cooper, and Skully, 2000).

There is a desire, both in the United States and Europe, to keep farmland in farming, as evidenced by the "Working Lands" concept in the United States. Some degree of agricultural production is critical to achieving this policy objective. These objectives do not require trade-distorting subsidies, however, because there is a range of policy alternatives available that do not fall into the amber box. In the United States, purchase of development rights programs and the Federal Farmland Protection Program to assist State programs are examples. Other options include cost-share payments for adopting best-management practices, and support for metropolitan agriculture through research, training, and extension.

The European Community is discussing many policies that can help provide open space and other amenities (see Potter, 1991). Hodge (2000) discusses a range of policy options that are not linked to agricultural production. For example, European Conservation, Amenity and Recreation Trusts (CARTs), and U.S. conservation groups like Ducks Unlimited and The Nature Conservancy, purchase and manage lands in order to provide and protect various public benefits. These types of land purchases and management are facilitated by Federal and State laws granting tax-exempt status to nonprofit organizations (Wiebe et al., 1996). Other green box policies include agricultural zoning, urban growth boundaries, agricultural use taxation, and programs like the Conservation Reserve Program and Wetlands Reserve Program.

While there are some parallels between rural amenity goals in Europe and the United States, there are important differences. Farmlands provide a much larger percentage of the total landscape in Europe than in the United States, and thus are a much more important component of wildlife habitats and ecosystems. Development restrictions in Europe are generally more severe than in the United States, and property rights prohibitions against regulation less stringent. Agricultural landscapes in Europe are generally threatened more by abandonment to less intensive uses, compared with pressures for urbanization in the United States.

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Appendix table 1—Implicit tax subsidy attributable to tax expenditures on use-value assessment, by State, 1995

State	1995 tax rate per $100 of full market value	Total tax subsidy	Amortization of tax subsidy at 4 percent
	Dollars per $100	*Dollars*	*Dollars*
California	0.85	218,227,211	5,455,680,283
Illinois	0.99	122,342,509	3,058,562,728
Arizona	2.03	90,664,131	2,266,603,272
Pennsylvania	0.99	72,228,470	1,805,711,746
Ohio	0.81	59,040,192	1,476,004,790
New Jersey	0.99	45,305,354	1,132,633,850
Massachusetts	0.68	38,472,196	961,804,901
Wisconsin	1.86	37,244,494	931,112,347
Texas	0.61	36,385,104	909,627,596
Nebraska	1.59	30,957,149	773,928,732
Michigan	1.32	29,795,084	744,877,098
Iowa	0.94	28,800,328	720,008,205
New York	1.60	26,911,431	672,785,784
Florida	0.80	26,696,426	667,410,662
Indiana	0.56	23,745,892	593,647,303
Connecticut	0.64	18,791,742	469,793,544
North Carolina	0.50	16,839,904	420,997,609
Oregon	0.51	15,235,621	380,890,519
Minnesota	0.88	13,781,163	344,529,075
Colorado	0.67	13,250,874	331,271,862
Tennessee	0.43	12,201,871	305,046,787
Maryland	0.41	10,003,056	250,076,402
Utah	0.36	8,566,680	214,167,008
Virginia	0.56	7,921,353	198,033,835
Missouri	0.37	7,547,210	188,680,256
Washington	0.74	7,411,916	185,297,907
Idaho	0.40	7,283,765	182,094,128
Montana	0.50	6,102,508	152,562,690
Kentucky	0.28	5,462,798	136,569,958
Georgia	0.52	4,182,142	104,553,558
North Dakota	0.62	4,029,474	100,736,841
Louisiana	0.26	3,888,120	97,202,988
Kansas	0.45	3,868,966	96,724,139
South Carolina	0.46	2,569,992	64,249,802
Maine	1.08	2,292,155	57,303,864
Alabama	0.14	1,744,730	43,618,262
Rhode Island	1.11	1,365,195	34,129,864
New Hampshire	1.04	1,130,948	28,273,688
South Dakota	0.74	1,097,834	27,445,847
New Mexico	0.17	1,081,109	27,027,732
Mississippi	0.27	1,048,629	26,215,718
Vermont	1.27	995,566	24,889,155
Nevada	0.36	940,808	23,520,188
West Virginia	0.21	930,258	23,256,450
Oklahoma	0.37	878,075	21,951,885
Arkansas	0.40	589,568	14,739,205
Delaware	0.09	253,888	6,347,189
Wyoming	0.47	25,467	636,675
U.S. total	na	1,070,129,357	26,753,233,926

Source: ERS analysis of farm real estate tax and NASS June Agricultural Survey land value data.

Appendix table 2—Estimated purchase of development rights expenditures for urban-influenced cropland, compared with actual expenditures, acreage, and use value assessment tax expenditures, 1995

State	Urban sprawl potential				Actual PDR expenditure, February 2000	Total PDR funds spent as a percentage of total farmland easement value	Actual PDR acres protected February 2000
	Low	Medium	High	Total			
	Million dollars				*Percent*		*Thousand acres*
Maryland	764	668	1,008	2,440	303	12.4	207
Pennsylvania	1,311	1,558	4,427	7,296	269	3.7	166
Colorado	359	330	1,289	1,978	24	1.2	84
Vermont	1,054	26	335	1,415	42	3.0	83
New Jersey	152	144	341	636	169	26.6	59
California	3,623	2,595	19,456	25,674	54	0.2	55
Massachusetts	203	9	0	212	109	51.4	44
Delaware	11	230	41	282	40	14.2	37
Connecticut	0	893	2,043	2,936	76	2.6	26
Washington	19	504	479	1,002	61	6.1	16
New York	358	31	261	650	48	7.4	11
New Hampshire	0	722	3,854	4,576	11	0.2	9
Michigan	85	645	1,528	2,257	15	0.7	6
Virginia	45	34	0	78	2	2.6	4
North Carolina	506	404	1,037	1,947	3	0.2	3
Rhode Island	0	68	55	123	15	12.2	3
Maine	598	593	4,467	5,658	2	0.0	2
Kentucky	568	225	1,157	1,951	1	0.1	1
Wisconsin	411	0	32	443	1	0.2	1
Alabama	64	329	854	1,246	0	0.0	0
Arkansas	0	1,197	3,269	4,466	0	0.0	0
Arizona	29	25	93	147	0	0.0	0
Florida	954	1,352	1,031	3,337	0	0.0	0
Georgia	169	363	273	804	0	0.0	0
Iowa	182	40	1,599	1,821	0	0.0	0
Idaho	1,068	1,948	9,342	12,358	0	0.0	0
Illinois	620	1,589	2,031	4,240	0	0.0	0
Indiana	125	537	2,402	3,064	0	0.0	0
Kansas	116	317	427	860	0	0.0	0
Louisiana	62	212	1,220	1,495	0	0.0	0
Minnesota	449	497	620	1,566	0	0.0	0
Missouri	37	0	351	388	0	0.0	0
Mississippi	141	251	1,648	2,040	0	0.0	0
Montana	547	497	176	1,221	0	0.0	0
North Dakota	216	0	45	261	0	0.0	0
Nebraska	3	94	13	109	0	0.0	0
New Mexico	459	421	803	1,682	0	0.0	0
Nevada	322	888	2,158	3,368	0	0.0	0
Ohio	242	379	6,667	7,289	0	0.0	0
Oklahoma	40	110	88	237	0	0.0	0
Oregon	214	1,254	1,520	2,987	0	0.0	0
South Carolina	13	139	408	559	0	0.0	0
South Dakota	62	53	33	148	0	0.0	0
Tennessee	717	754	1,366	2,838	0	0.0	0
Texas	440	973	4,553	5,965	0	0.0	0
Utah	344	369	1,666	2,380	0	0.0	0
West Virginia	195	472	1,336	2,002	0	0.0	0
Wyoming	0	5	0	5	0	0.0	0
Total	17,894	24,741	87,803	130,438	1,245	1.0	819

Sources: ERS, USDA; American Farmland Trust, 2000