

**URBANIZATION AND LAND USE CHANGE
IN FLORIDA AND THE SOUTH**

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Introduction

Florida and other areas of the South have experienced rapid population growth. Urban areas have expanded into the rural areas to accommodate this growth. Along with urbanization of rural areas, comes changes that often alter the environmental amenities that many urban residents were seeking when they moved to rural areas. The quantity and quality of the natural resources in rural areas have been important factors in bringing about population growth in some rural areas. As urban growth expands into rural areas, the rural land base changes. One important impact on the natural resource base is the conversion of land formerly used extensively for agriculture, forestry and open space to urban uses. Such changes often result in a reduction of aesthetic and ecological values. Given our market economy, with its emphasis on private property rights and flexible, sometimes nonexistent, land use controls, the amount of land converted from rural use to urban use increases directly with the growth of population in an area (Reynolds and Dillman, 1991). If a pattern of land consumption could be established, then future urban land conversion could be better predicted and better judgements could be made in developing land use policies (i.e., restricting land use changes). This paper examines the conversion of land to urban uses, analyzes the differential rates of land conversion for different areas and discusses the implications of future urban land conversion.

Since 1960, population has increased faster in the South than in the rest of the United States. Population in the United States grew at a compound rate of 1.1 percent per year from 1960 to 1997. In the 14 states that make up the four southern USDA farm production regions¹

¹ The four southern USDA farm production regions include the following states: Southeast consists of Florida, Georgia, South Carolina and Alabama; Delta States consists of Mississippi, Arkansas and Louisiana; Ap-

(Southeast, Delta States, Appalachian and Southern Plains), population increased 1.5 percent compounded annually from 1960 to 1997. This might seem like a small difference but it is not. If these 14 states had grown at the national average rate during this period, there would have been 12.2 million fewer people living in the South in 1997. In addition, population growth was not evenly distributed throughout the South. Population change ranged from a slight decline in West Virginia to an increase of 2.95 percent per year in Florida. Population increased in Texas by 1.92 percent per year and in Georgia by 1.74 percent per year during this period.

During the 1900s, Florida's population about doubled every 20 years. In 1900, there were about 500,000 people living in Florida. By 1980, Florida's population had increased to over eight million people. Population in Florida is estimated to reach 15.5 million in 2000 and 20.3 million by 2020 (Bureau of Economic and Business Research, 1997).

Conversion of land from rural to urban use is more pronounced in Florida than in many other states. About three percent of the total land area in the United States is classified as urban. While Florida's urban land area is small (15 percent), it is still expanding more rapidly than in most other states. Land in urban areas in Florida increased from 1.2 million acres in 1964 to over five million acres in 1997 (Figure 1). In the South, the increases in urban land were greatest in the Southeast and Southern Plains regions (Figure 2). These increases were due to the large population increases in Florida and Georgia in the Southeast and in Texas in the Southern Plains.

Land Use Transition

As the demand for high value uses increases, land is bid away from more extensive uses such as pasture, forestland and other undeveloped uses. Those who want to develop land for ur-

palachian consists of Virginia, West Virginia, North Carolina, Kentucky and Tennessee; and Southern Plains consists of Oklahoma and Texas.

ban uses are usually able to bid land away from extensive uses because of the higher capitalized net returns in the more intensive uses. The urban conversion of rural land is illustrated in Figure 3. The vertical axis represents the level of net returns to land (rent) and the horizontal axis represents the distance from the center of the urban area. The lines that are labeled I and II are called bid rent surfaces. Each line represents the maximum rent per acre for a particular use as distance from the center of the urban area increases. There could be a number of different bid rent surfaces, each representing a different land use and having a different slope. The bid rent surface slopes downward and to the right, representing a higher rent near the center of the urban area and declining as the land is located farther from the urban center, eventually reaching zero rent at some distance from the urban center. For simplicity, let I represent the urban use of land, which produces a high rent at the urban center (or market) and decreases as distance from the urban center increases. Rent for urban use (I) would decrease to zero rent at distance d .

Assume bid rent surface II represents agricultural land use. Bid rent surface II has less slope because there is little or no advantage of being located near the urban center. While agricultural land rents generally are much lower, at some distance from the urban center a margin of transference will be reached. The margin of transference represents the point at which it is more profitable to shift from one use to another rather than continue the former use. At this point, rational use will change from urban to rural (point d_1).

As population increases and the demand for urban land increases (the combined demands for commercial, industrial and residential uses), the urban bid rent surface increases to I' , and the margin of transference shifts outward to d_2 . The distance d_1 to d_2 represents the amount of urban expansion into the rural area and, as a result, urban development accompanying population increases. Rotating the figure around the vertical axis produces the classic von Thunen concentric

rings, which represent encroachment of urban development into the rural areas. Realistically, natural physical features, transportation corridors, institutional impediments and other barriers create irregular boundaries.

Urban Land Conversion in Florida

A century ago, most people lived in rural areas. As population increased and fewer people were required to produce our food supply, people migrated from the rural areas to live in cities. Today, most of the population in the United States live in Metropolitan Statistical Areas. A Metropolitan Statistical Area (MSA) is a geographic area with a large population nucleus and adjacent communities which have a high degree of economic and social integration with the nucleus (Bureau of Economic and Business Research, 1997). MSAs may include a single county or several counties that have close economic and social ties to a central city or urban area. In Florida, there are 34 counties that comprise 20 MSAs. MSA counties represent 58 percent of the total land area of the state. About 93 percent of Florida's population live in counties classified as MSAs.

As population centers grow and mature as urban areas, urban development becomes more compact as population density increases and the price of building sites rise. Consequently, urban land conversion rates vary substantially between MSA and non-MSA counties (Reynolds, 1993). Because of the different land settlement patterns within Florida, urban land conversion rates also differ among regions.

Florida is a very diverse state with more population located in the central and southern parts of the state relative to northern Florida. The state has been divided into two regions using the 11 Planning Districts in Florida (Figure 4). The North region is comprised of Planning Districts 1 through 5, and the Central and South region is made up of Planning Districts 6 through

11. The North region is comprised of Planning Districts that lie north of Pasco, Lake and Volusia Counties. The Central and South region is comprised of Planning Districts 6 through 11 and includes Pasco, Lake, Volusia and other counties to the south. In 1996, population density in the North region was 121 people per square mile as compared to 412 people per square mile in the Central and South region. About 97 percent of the population in the Central and South region live in MSA counties, while about 75 percent of the people in the North live in MSA counties.

Urban Land-Use Coefficients

The urban land-use coefficients estimated in this study represent the amount of additional land converted to urban use for each person added to the population base. Urban land-use coefficients (U) are defined as the change in urban land divided by the change in population:

$$U = \frac{(UL_2 - UL_1)}{(P_2 - P_1)}$$

where:

UL₂ = acres of urban land in period 2,

UL₁ = acres of urban land in period 1,

P₂ = population in period 2, and

P₁ = population in period 1.

Estimates for Florida

The urban land use data for Florida estimates were obtained from The Mapping and Monitoring of Agricultural Lands Project conducted by the Department of Community Affairs (1987), which consisted of an inventory of land use for 1973 and 1984. Aerial photography was used to calculate the amount of land in a number of different categories including urban and ru-

ral-urban transition uses for 1973. Interpretations of LANDSAT data were used to inventory the 1984 land use. The amount of land in nonvegetated urban, vegetated urban and rural-urban transition categories were estimated for 1984. These data represent an inventory of the urban land use in Florida counties for 1973 and 1984. County population estimates for 1973 and 1984 were developed by the Bureau of Economic and Business Research (1974 and 1985).

The estimated urban land-use coefficients for MSA and non-MSA counties are presented in Table 1. Land use and population patterns differed substantially between the Central and South region and the North region of Florida. The urban land use coefficient for the MSA counties in the Central and South was .363 acres/person. The coefficient for MSA counties in the North was .845 acres/person, about 2.3 times larger than the coefficient for the Central and South.

The coefficient for non-MSA counties in the North was 1.904 acres/person, three times the coefficient in the Central and South (.611). The amount of land converted to urban uses in the non-MSA counties are two to three times higher than in MSA counties. Other studies have also found that urban land-use coefficients are consistently higher in non-MSA counties (Heimlich and Anderson, 1987; Zeimetz, *et al.*, 1976). Counties in the Central and South are more densely populated, land values are higher and there is stronger competition for land. Therefore, urban development to accommodate population growth tends to be more compact.

To assess the implications of these rates of urban land conversion on the loss of rural land, the amount of land expected to be converted to urban uses during the period of time from 2000 to 2020 was estimated using these coefficients. Urban land-use coefficients estimated for MSA and non-MSA counties in each of the regions were multiplied by the expected increases in population for each county to estimate the amount of urban land conversion during the period

2000 to 2020. Population increases were calculated from the population projections for 2020 by the Bureau of Economic and Business Research (1997).

Population growth in the Central and South region is expected to be 3.7 million people between the years 2000 and 2020. In the North, population is projected to increase by 1.1 million people. Using the urban land-use coefficients estimated in this study and the county population projections by the Bureau of Economic and Business Research (1997), the amount of land converted to urban uses during the period 2000 to 2020 is expected to be 2,584,435 acres (Table 2).

Urban land conversion varies by region and the level of urban development of an area. Of the 2.6 million acres of land expected to be converted to urban uses, 1.4 million acres (53 percent) are expected to be converted in the Central and South, with 1.3 million acres of the urban land conversion occurring in MSA counties. In the North, 1.2 million acres are expected to be converted to urban uses with 752,695 acres converted in MSA counties. In the North, 38 percent of the urban land conversion is expected to occur in non-MSA counties as compared to only six percent in non-MSA counties in the Central and South region.

The amount of land expected to be converted to urban use during the period from 2000 to 2020 accounts for 7.5 percent of the total land area of Florida. If all of the 2.6 million acres expected to be converted to urban uses came from agricultural land, urban land conversion would consume 24.7 percent of Florida's land in farms during this period. However, this is not likely to happen since not all of the land surrounding urbanizing areas is in agricultural use.

Identification of Areas of Strong Competition between Rural and Urban Uses

Population growth and the resulting conversion of land to urban uses will affect some areas of the state more than others. Five counties (Dade, Broward, Palm Beach, Duval and Orange) are expected to have more than 125,000 acres converted to urban uses between the years 2000 and 2020. The land converted to urban uses in these five counties would account for 28 percent of the total urban land conversion in the state during this period. Sixteen counties are expected to have more than 50,000 acres of land converted to urban uses (the above five counties, plus Citrus, Marion, Hillsborough, Leon, Hernando, Brevard, Lee, Seminole, Clay, Volusia and Okaloosa Counties). The land converted to urban uses in these 16 counties is expected to account for 57.3 percent of the conversion of land to urban uses during the next two decades.

Some of these counties are important agricultural producing counties. The top 10 agricultural producing counties in terms of value of farm products sold are: Palm Beach, Dade, Hillsborough, Hendry, Collier, Polk, Orange, Manatee, Highlands and DeSoto Counties. These 10 counties produced and sold \$3.347 billion of agricultural products in 1997, or 56 percent of the state total (National Agricultural Statistics Service, 1999). During the period 2000 to 2020, urban expansion in these 10 counties is expected to result in the conversion of 685,169 acres of land to urban uses (1070.6 square miles) and to account for 27 percent of all urban land conversion. If all of the conversion came from farmland, it would consume 18.5 percent of the farmland in these counties.

Five of the top seven agricultural counties (Palm Beach, Dade, Hillsborough, Polk and Orange) account for a large share of the value of agricultural products sold and the urban land converted. These five counties produced \$2.12 billion of agricultural products in 1997 (35.3 percent of the state total). Urban land conversion in these counties is expected to consume

576,003 acres of land for the years 2000 to 2020, or 23.3 percent of the state total. If all of the land converted to urban uses came from farmland, it consume take one-third of the land in agricultural use.

Urban Land Conversion in the South

SERA-IEG 30 membership comes from the states in the Appalachian, Southeast, Delta States and Southern Plains farm production regions of the United States Department of Agriculture (USDA). The states in these four farm production regions comprise the South in this paper. As noted before, population has increased faster in the South than in the rest of the United States. In Figure 2, the increases in urban land for the years 1964 to 1992 was presented for the farm production regions in the South. This section of the paper estimates urban land-use coefficients for the South, using the methodology in the previous section and the urban land data available from the Economic Research Service, USDA.

The USDA's Major Land Uses database was used as the source of land use information. This database contains acreage estimates of major land uses by region and states for each Census of Agriculture year from 1945 through 1992. The Major Land Uses database has not been updated to include comparable data for the year 1997. Their definition of urban land consists of land in incorporated and unincorporated places of 2,500 population or more. Population data were obtained from the Statistical Abstract of the United States (U.S. Census Bureau). The urban land-use coefficients were estimated for the period 1974 to 1987 to correspond to the dates of the county-level data available in the analysis for Florida. The changes in urban land use and population for the period 1974 to 1987 and the estimated urban land-use coefficients for the farm production regions in the South are presented in Table 3.

The urban land-use coefficients ranged from 0.652 acres per person in the Southern Plains to 0.772 acres per person in the Delta States. The urban land use coefficient for the Southern Regions and the United States (48 states) was 0.69 acres per person. Coefficients for the Southern Regions did not vary as much as expected. In the analysis of Florida data, the coefficients for the more densely settled areas (urbanizing areas) were lower than those in rural areas. Perhaps, when analyzing the data across broad heterogeneous areas, these differences get averaged out. In states that have rapidly urbanizing areas (such as Florida, Texas and Virginia), the coefficients were smaller, ranging from .45 persons per acre in Florida to .54 persons per acre in Texas and Virginia.

To assess the future implications of urban expansion in the South, urban land-use coefficients were multiplied by the expected increases in population for each state to estimate the urban land conversion that is expected to be converted during the period 2000 to 2020. Population increases were calculated from the population projections in the Statistical Abstract of the United States. Population is projected to increase by 18.5 million in the 14 southern states that comprise the four regions of the South. By multiplying the regional population projections by the regional urban land-use coefficients, the amount of rural land converted to urban use was estimated for each region. About 12.6 million acres of rural land is expected to be converted to urban use in the South during the period 2000 to 2020 (Table 4). More than 70 percent of the urban land conversion is expected to occur in the Southeast and Southern Plains regions. Over 60 percent of the estimated urban land conversion is expected to occur in the five states with the largest population increases (Texas, Florida, Georgia, North Carolina and Virginia).

Summary and Conclusions

Urban land-use coefficients were estimated for Florida, using county data for the period 1973 to 1984, and for the fourteen states in the four southern farm production regions, using aggregate state data for the period 1974 to 1987. In the Florida analysis, the urban land-use coefficients ranged from .363 acres per person for MSA counties in the Central and South region to 1.904 acres per person for non-MSA counties in the North region. The coefficients were two to three times higher in the North region than in the Central and South and the coefficients were also two to three times higher for non-MSA counties than for MSA counties. The urban land-use coefficients for the state-level data ranged from .652 acres per person for the Southern Plains to .772 acres per person for the Delta States.

The Florida analysis reinforces the hypothesis that, when cities increase in size and mature as an urban area, the land use coefficient declines. Therefore, in the larger urbanizing areas, less land is added to the urban land base as each additional person is added to the population base.

The Florida analysis also indicates that disaggregating the data to the county level and separating MSA and non-MSA counties allows more accurate estimates for specific areas. For example, the use of the state-average coefficient (.535) for the Central and South instead of the coefficient for MSA counties in the Central and South (.363) would have resulted in an estimate of 614,711 additional acres of land to be converted to urban uses by the year 2020.

The National Resource Inventory data that was released by the Natural Resource and Conservation Service, USDA in December yields even higher rates of urban land conversion for the period 1992 to 1997. According to their 1997 inventory, six of the top ten states for acreage taken out of cropland, forests and other open spaces for development between the years 1992 and

1997 were in the South (Texas, Georgia, Florida, North Carolina, Tennessee and South Carolina). The urban land-use coefficients estimated from these data were .83 acres per person for Florida, .69 acres per person for Texas, 1.35 acres per person for Virginia and ranged as high as 3.27 acres per person for South Carolina. They are re-examining the database and their estimating procedures and expect to release revised estimates later this year. We need to examine that data when they become available and see how they compare to the data that are available from other sources. Have urban land-use coefficients increased in the 1990s as suggested by the National Resources Inventory data?

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Table 1. Urban land-use coefficients for MSA and Non-MSA counties in Florida

	MSA Counties	Non-MSA Counties	All Counties
	-----Acres/Person-----		
Central and South*	.363	.611	.372
North**	.845	1.904	1.093
Florida	.454	1.457	.535

* Central and South region includes Planning Districts 6 to 11.

** North region includes Planning Districts 1 to 5.

Table 2. Estimated urban land conversion in Florida

	Central and South	North	Florida
MSAs	1,296,968	752,695	2,049,664
Non-MSAs	79,835	454,936	534,771
Total	1,376,804	1,207,631	2,584,435

Table 3. Urban land-use coefficients (ULC) for farm production regions in the South

Region	Change in Urban Land Use 1974-1987 (million acres)	Change in Population 1974-1987 (million people)	ULC (acres/person)
Southeast	4.33	6.41	0.675
Delta States	1.00	1.31	0.772
Appalachian	2.34	3.23	0.727
Southern Plains	3.49	5.35	0.652
Southern Regions	11.17	16.29	0.686
United States	21.83	31.63	0.690

Table 4. Estimated urban land conversion in the South from 2000 to 2020

State/Region	Population Growth (thousands)	Urban Expansion (thousand acres)
Southeast	7,386,000	4,988,113
Delta States	1,209,000	933,344
Appalachian	5,287,000	2,695,263
Southern Plains	6,167,000	4,022,909
Southern States	18,470,000	12,639,630

URBAN LAND USE Florida

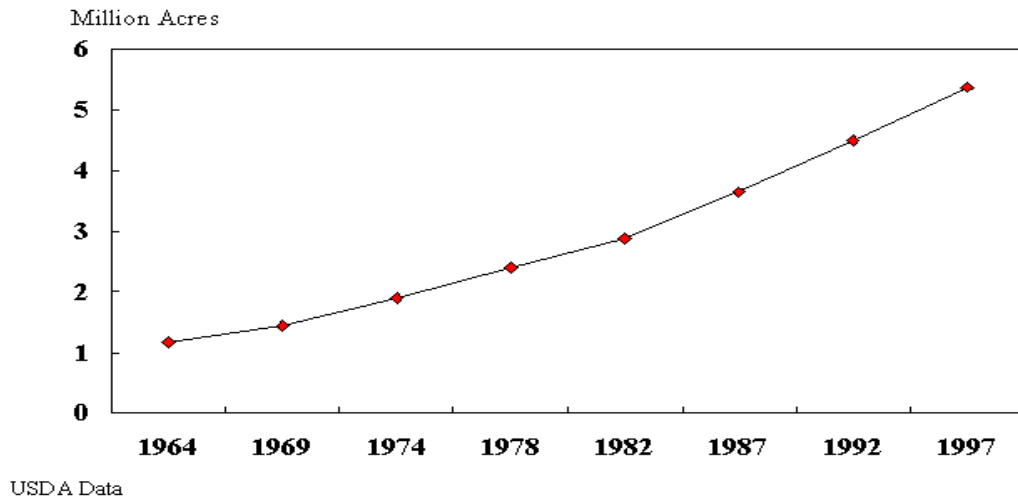
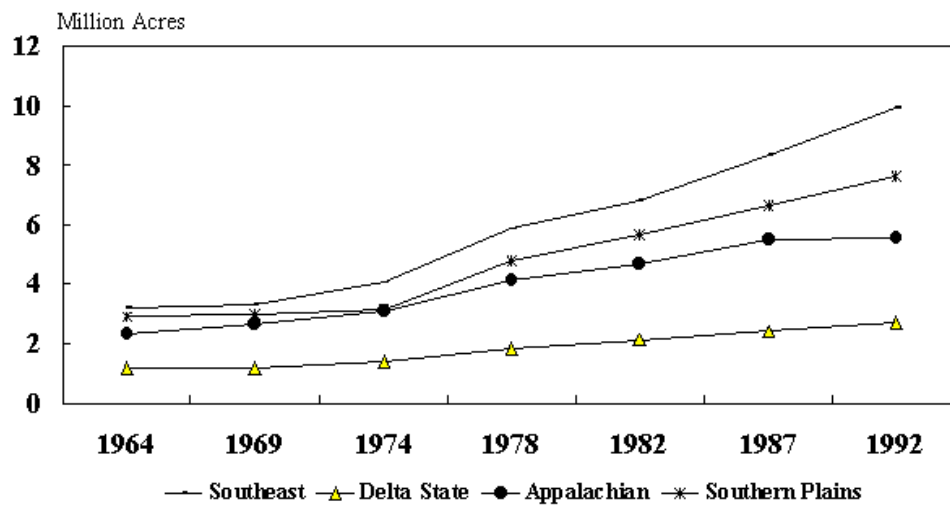


Figure 1. Urban Land Use in Florida, 1964-1997.

URBAN LAND USE Southern Regions



USDA Data

Figure 2. Urban Land Use in Southern Regions, 1964-1992.

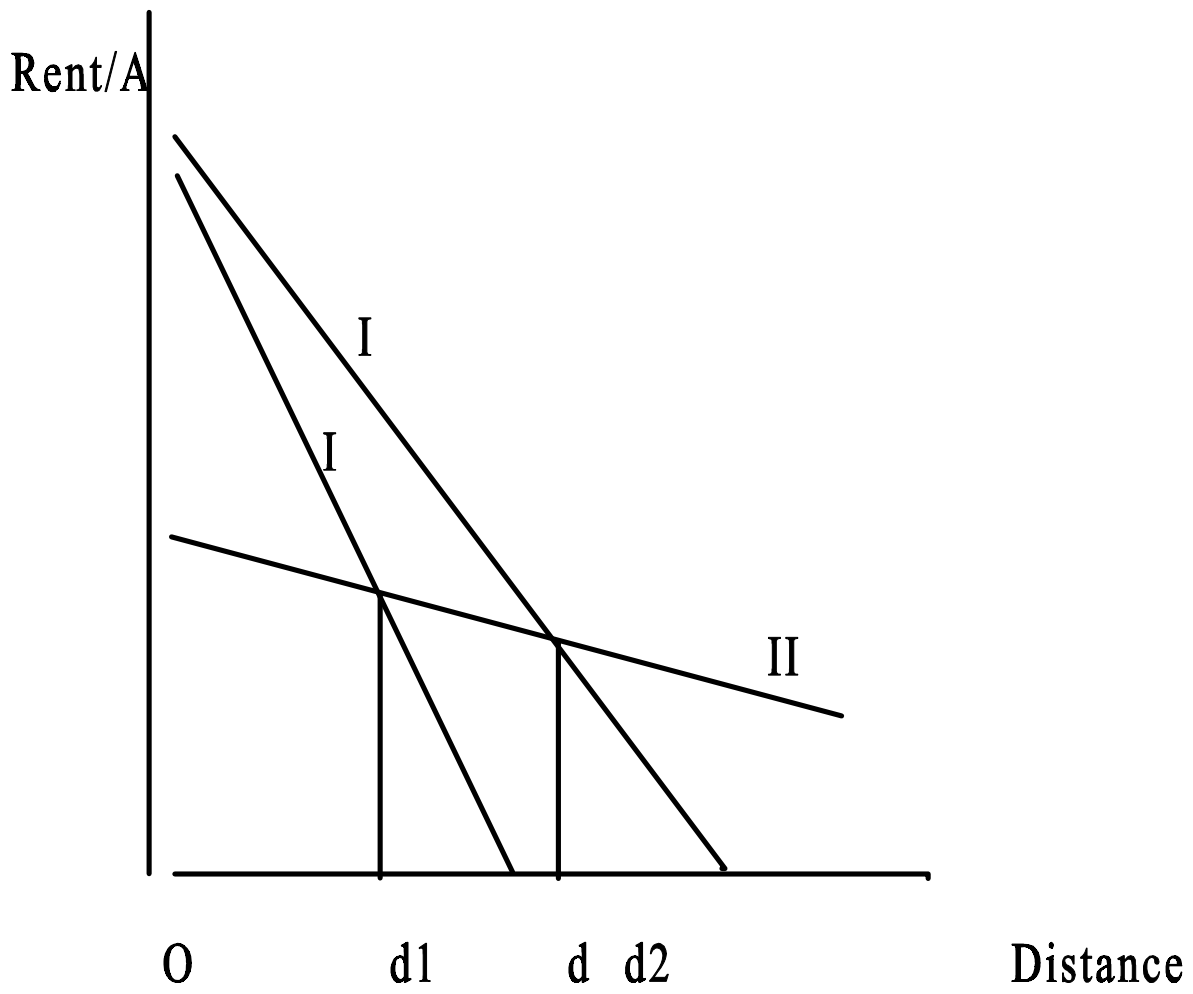


Figure 3. Bid Rent Surfaces with Population Increases

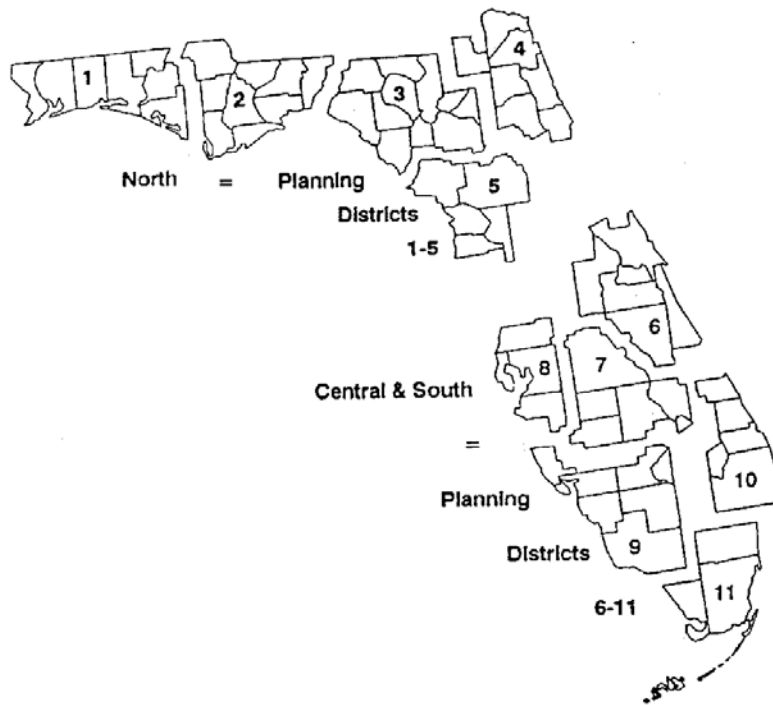


Figure 4. Planning Districts in Florida