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*This study analyzes the sales prices of vacant land for a distinct growth area within a medium-size southern metropolitan area. One hundred and fifty land sales that occurred between 1984 and 1995 are examined using a traditional valuation model enhanced by the use of geographic information system procedures and data. The results show that parcel size, distance to the central business district, population and zoning classifications have strong implications for land values. In addition, the authors demonstrate how the model may be used to predict vacant land values.*

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# Determinants of Vacant Land Values and Implications for Appraisers

When real estate professionals, especially appraisers, are called on to appraise land, they must determine the effects and importance of area factors such as distance to the central business district (CBD) and population, as well as traditional property factors such as parcel size. Land sales in a “growth” location within a metropolitan area are evaluated and compared in an attempt to better understand the variables that influence land prices. The area examined in this study is easily accessible to major limited access highways, thus enhancing its desirability for development and growth. The metropolitan area’s growth coincides with the pattern of development for many modern cities characterized by Arthur Sullivan as a system of urban villages, or suburban subcenters where increases in population, retail stores and medical service providers follow a pattern consistent with a multicentric suburbanized city.<sup>1</sup>

It is important to understand factors affecting vacant land values, especially in rapidly growing areas. The use of geographic information systems (GIS) technology in the land valuation models is also demonstrated.<sup>2</sup>

## Study Area, Model and Data

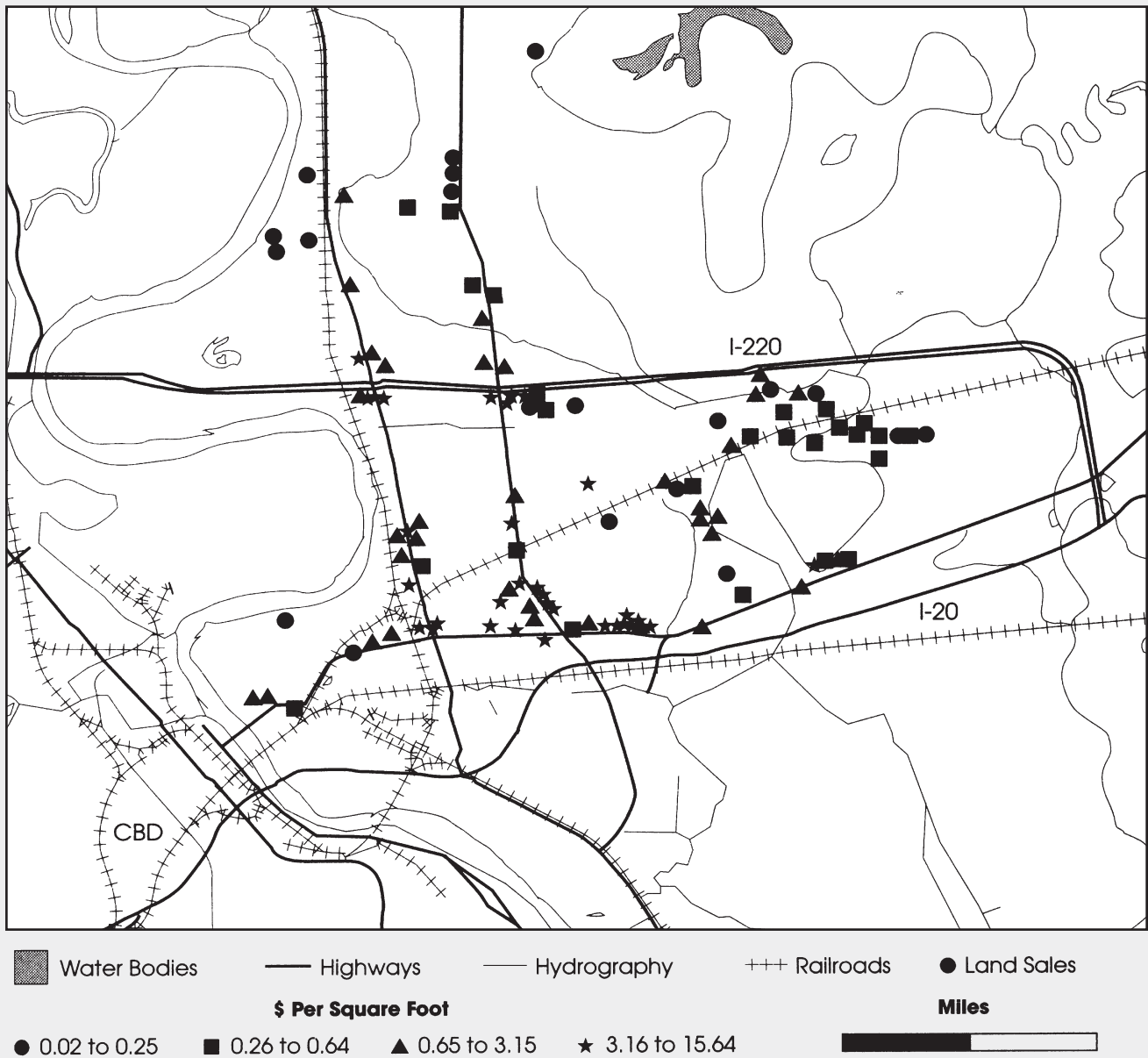
The sales data are based on recorded transfers of vacant land (except for single-family residential lots) as reported by the Clerk of Courts' offices in Caddo and Bossier Parishes, Louisiana, during January 1984 through February 1995. The area under study has been identified by developers, appraisers and the authors as a growth location for business activities. The location of land sales is shown in Figure 1 with a geographic information systems thematic map based on sales price per square foot.

The study area is located in the northeast sector of the

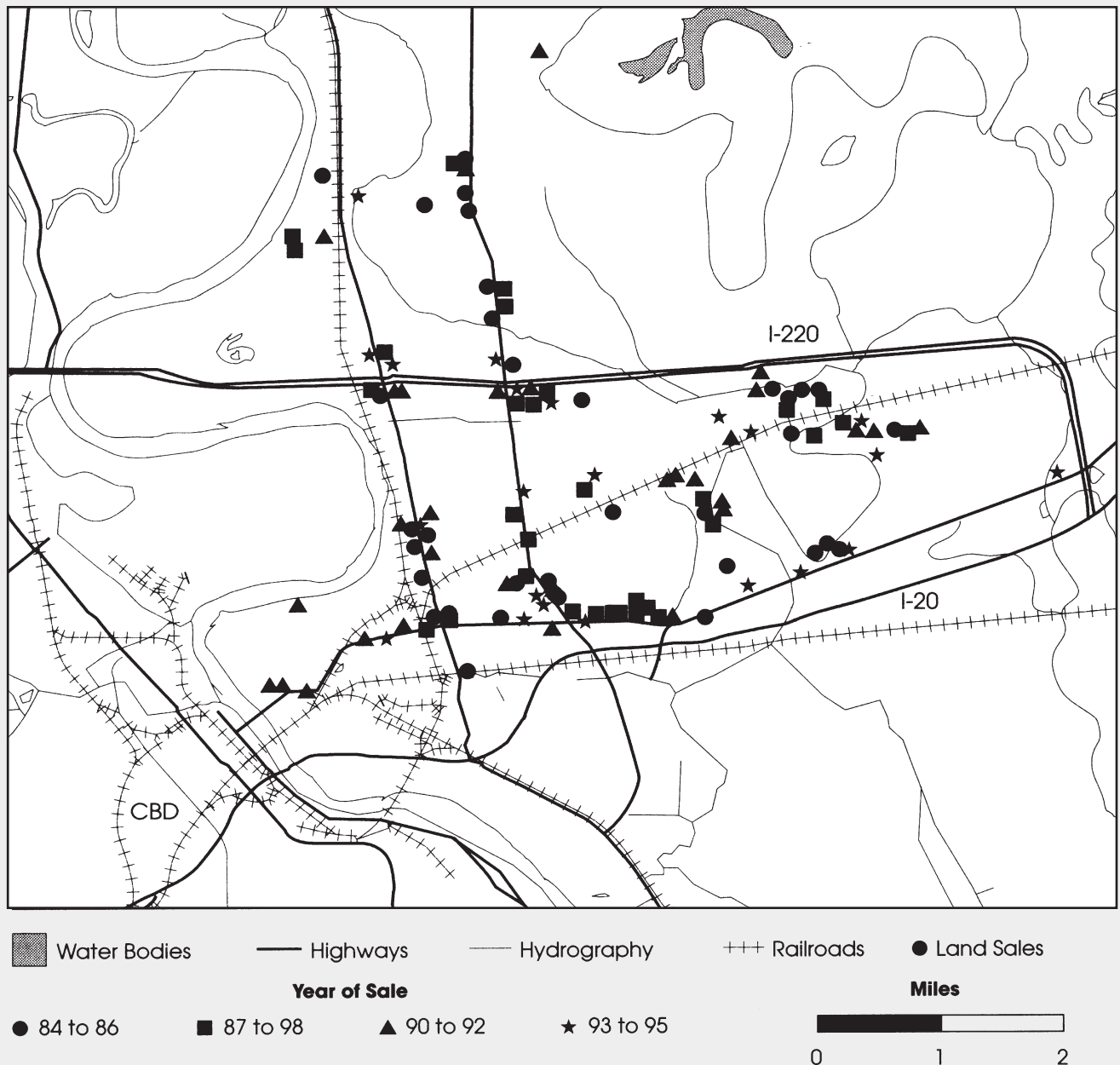
metropolitan area near I-20 and I-220. This area has shown rapid development in recent years, with higher concentrations of sales in the \$90,000 range (see Figure 2). Growth in this area has been attributed to the expansion of Barksdale Air Force Base, the addition of riverboat casinos, intraurban migration (from Shreveport and Bossier City) and immigration from people outside the metropolitan area. (The two riverboats in Bossier City, along with one in Shreveport, are permanently docked and each has gross revenues of approximately \$13 million per month.)

The ordinary least squares procedures are employed to estimate a land valuation model where the logarithm of the

**FIGURE 1 Price Per Square Foot of Land Sales, 1984-1995**



**FIGURE 2 Rate of Growth, 1984-1995**



**It is expected that locations closer to the CBD will have higher values.**

price per acre is the dependent variable. The price is adjusted for inflation, using the Consumer Price Index. During the time frame examined, 1984-1995, the local economy experienced a moderate decline in real estate prices, followed by a leveling off with price increases near the end of the time period. In general, vacant land in this area did not experience large declines,

probably because most landowners adopted a wait-and-see approach. The independent variables are:

1. The zoning classification (ZB)
2. The logarithm of parcel size in number of acres (LACRES)
3. The logarithm of the distance to the central business district in number of miles (LCBD)
4. The logarithm of the population in the region (LPOP)

The metropolitan area has not used zoning to preserve farmland. (Zoning changes from agricultural to business are routinely granted unless the new use will be detrimental to

neighboring residential uses; agricultural to residential zoning use is also routinely granted.) Rather, land is often maintained in an agricultural classification by the owner to take advantage of the low property tax burden. Typically, zoning changes have been relatively easy to secure except for occasional cases involving controversial uses such as video poker. In the model, the zoning variable (ZB) takes on a value of 1 for business zones and 0 otherwise.

Distance to the CBD, calculated using GIS procedures, is included as a measure of accessibility. It is expected that locations closer to the CBD will have higher values.

Figure 1 (on page 7) shows the individual land sales along with the major roads, railroads and hydrography features. The individual property sales data are imported into the GIS as datapoint files and then assigned specific geographic locations with latitude and longitude fields through an address-matching procedure. Attribute files containing census data are imported and merged with the geographic files according to census tracts.

To develop additional location or neighborhood characteristics for each of the land sales in this study, a separate layer consisting of regions (circles with a one-mile radius around each land sale) are established using GIS software. The GIS program assigns attribute values of the underlying census tracts to the regions based on a geographic area-weighted procedure that assigns values according to the proportion of each tract contained in the region. For example, if

the underlying census block data and includes 1990 census data as well as projections for the years 1984-1990 and 1991-1995.<sup>3</sup> Summary statistics for all the variables are reported in Table 1.

## Results

Table 2 shows the regression results. In the model, the dependent variable is the logarithm of the price per acre adjusted for inflation. The number of acres is significant with a negative regression coefficient, indicating that, as might be expected in vacant land sales, the smaller parcels tend to sell for more per acre than do the larger parcels. Often the larger parcels involve more development work and sometimes result in unused segments sold to other businesses later.

The population variable is significant and positive for this area, indicating that as the population increases, land values also increase. Distance to the CBD is significant and negative, indicating that a greater distance from the CBD decreases land values. In recent years, more new activities and land sales have actually taken place farther from rather than closer to the CBD.

The existence of a B zoning classification (business zoning) is proof positive for the area, an indication that this type of zoning contributed, as expected, to higher land prices. Business zoning is the prevalent type of zoning (often with retail, hotel and medical facilities uses) in this study with

**TABLE 1** - Statistics for Sample Land Sales in the East Area:  
150 Observations in 1984-1995

Variables	Mean	Standard Deviation	Minimum	Maximum
LPA	10.63	1.48	6.59	13.30
LACRES	0.43	1.69	-2.79	6.40
LPOP	8.44	0.41	7.10	9.16
LCBD	1.32	0.38	-0.12	2.13
ZB	0.59	0.49	0	1.00

LPA = log of price per acre    LACRES = log of acres    LPOP = log of population  
LCBD = log of distance to CBD    ZB = Business zoning

one half of a census tract's area is included within a region, then one half of the underlying variable's value would be included for that region.

After the regions are established, the variable, the size of the population, is calculated using GIS procedures. It is also expected that greater population leads to higher demand for retail and business land use and thus higher land value.

The population variable is based on

**TABLE 2** - Regressions of Log of Price per Acre on Property Variables:  
150 Observations in 1984-1995

Variables	Parameter	t-value
INTERCEPT	-2.584	-0.654
LACRES	-0.3217	-6.327 <sup>a</sup>
LPOP	1.674	3.033 <sup>a</sup>
LCBD	-1.432	-2.333 <sup>b</sup>
ZB	1.8807	10.845 <sup>a</sup>

LACRES = log of acres    LPOP = log of population  
LCBD = log of distance to CBD    ZB = Business zoning

a. Significant at 99% level.    b. Significant at 95% level.    Adjusted R<sup>2</sup> = 0.6457



some residential, agricultural and industrial zoning classes identified to a lesser extent.

This model may be used to estimate vacant land values. For example, using the average values for the independent variables as found in Table 1 results in a price per acre of \$41,357. This is found by substituting 0.43 for LACRES (which translates into 1.54 acres), 8.44 for LPOP (equivalent to 4,628 persons), 1.32 for LCBD (equivalent to 3.74 miles) and 0.59 for zoning. For example, the following equation:

log price =	-2.584 + -0.3217 (log of acres) + 1.674 (log of population) - 1.432 (log of distance from CBD) + 1.88 (zoning class value)
becomes:	
log price =	-2.584 + (-0.3217)(0.43) + (1.674)(8.44) - (1.432)(1.32) + (1.88)(0.59)

The result is a value estimate of 10.63 for the log of price per acre, which is \$41,357 per acre. In a separate test, the year 1984 is used as a base year and a dummy variable for each year from 1985 to 1995 was added to the model. The purpose is to see whether time is an important explanatory variable in addition to inflation. The results show that land value was significantly different from 1984 in only three years: 1985, 1987 and 1995. Thus, it appears that the inflation-adjusted



**In recent years, more new activities and land sales have actually taken place farther from rather than closer to the CBD.**

model accounts for the effects of time.

This study provides an approach to studying land sales in an area identified as a growth area in an urban subcenter. The distance to the CBD is generally significant and negative. This finding is not surprising since more of the development has been taking place on the fringes of the urban area and as expected, population was positive, showing that increasing population results in higher values. The existence of business zoning always has a positive influence on the price per acre and the size of the parcel is inversely related to sales price. ■

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**Notes**

1. A discussion of these suburbanization concepts is found in Arthur M. Sullivan, *Urban Economic* (Irwin Publishing: Homewood, Illinois, 1990), chapter 10.
2. For further discussion of GIS applications, see Douglas Bible and Robert J. Aalberts, "Geographic Information Systems," *The Appraisal Journal* (October 1992): 483-492; Douglas Bible, "Using GIS to Enhance MLS," *The Appraisal Journal* (October 1995): 440-444; Devlin Fung, Hsiang-te Kung and Melvin C. Barber, "The Application of GIS to Mapping Real Estate Values," *The Appraisal Journal* (October 1995): 445-452.
3. PCensus provided updates to the 1990 census for population and occupation for 1995. Estimates for years not included were made using linear interpolation. PCensus data is available through Tetrad Computer Applications, Inc., on the Internet at [www.tetrad.com](http://www.tetrad.com). The forecasts are based on estimates provided by the WEFA Group, [ecwpa.wustl.edu/EconFAQ/StatSoft/AREWEFGro.html](http://ecwpa.wustl.edu/EconFAQ/StatSoft/AREWEFGro.html).