the valuation declines at a lesser rate to the margins of that built-up area.

With one important variation, the population density pattern of the central city shows a comparable distance-decay arrangement, as suggested by Figure 12.22. The exception is the tendency to form a hollow *at the center,* the CBD, which represents the inability of all but the most costly apartment houses to compete for space against alternative users desiring these supremely accessible parcels. Yet accessibility is attractive to a number of residential users and brings its penalty in high land prices. The result is the high-density residential occupancy of parcels *near the center* of the city—by those who are too poor to afford a long-distance journey to work; are consigned by their poverty to the high-density, obsolescent slum tenements near the heart of the inner city; or are self-selected occupants of the high-density apartments whose high rents are made necessary by the price of land. Other urbanites, if financially able, may opt to trade off higher commuting costs for lower-priced land and may reside on larger parcels away from high-accessibility, high-congestion locations. Residential density declines with increasing distance from the city center as this option is exercised.

As a city grows in population, the peak densities no longer increase, and the pattern of population distribution becomes more uniform. Secondary centers begin to compete with the CBD for customers and industry, and the residential areas become less associated with the city center and more dependent on high-speed transportation arteries. Peak densities in the inner city decline, and peripheral areas increase in population concentration.

The validity of these generalizations may be seen on Figure 12.23, a time series graph of population density patterns for Cleveland, Ohio, over a 50-year period. The peak density was 2.8 miles from the CBD in 1940, but by 1990 it was at 5.8 miles. As the city expanded, density close to the center decreased.

Models of Urban Land Use Structure

Generalized models of urban growth and land use patterns were proposed during the 1920s and 1930s describing the results of these controls on the observed structure of the central city. The models were simplified graphic summaries of United States mass-transit city growth processes as interpreted by different observers. Although the culture, society, economy, and technology they summarized have now been superseded, the physical patterns they explained or summarized still remain as vestiges and controls on the current landscape. A review of their propositions and conclusions still helps our understanding of the modern U.S. urban complex.

The common starting point of the classical models is the distinctive central business district found in every older

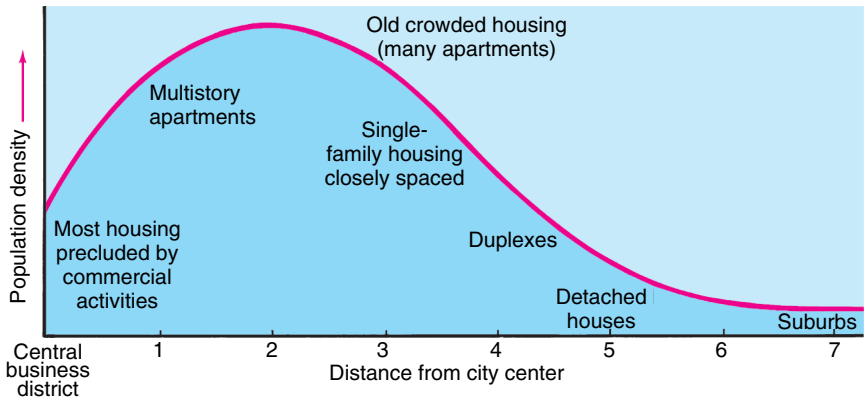

Figure 12.22 **A generalized population density curve.** As distance from the area of multistory apartment buildings increases, the population density declines.

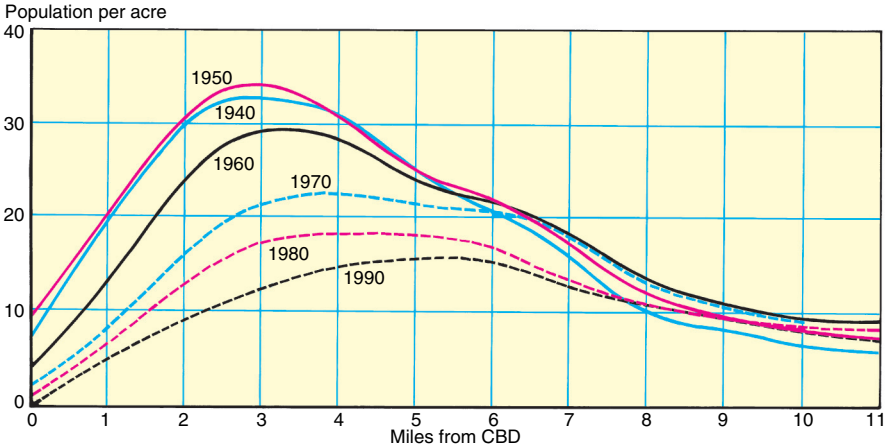

Figure 12.23 **Population density gradients for Cleveland, Ohio, 1940–1990.** The progressive depopulation of the central core and flattening of the density gradient to the margin of the city are clearly seen as Cleveland passed from mass transit to automobile domination. The Cleveland pattern is consistent with conclusions drawn from other studies of urban density: density gradients tend to flatten over time, and the larger the city, the flatter the gradient.

Source: Anupa Mukhopadhyay and Ashok K. Dutt, "Population Density Gradient Changes for a Postindustrial City—Cleveland, Ohio 1940–1990," *GeoJournal* 34:517, no. 4, 1994. Redrawn by permission of Kluwer Academic Publishers and Ashok K. Dutt.