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Ref #545(L-118)
USGS 2000

MIDDLE RIO GRANDE BASIN STUDY

URBAN DYNAMICS OF THE MIDDLE RIO GRANDE BASIN

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Introduction

Urban dynamics is the study of land transformations occurring in metropolitan areas through time. A new housing subdivision, such as Huning Highlands, or a new shopping center, such as Winrock, are examples of land transformations. Analyzing the rate of land-use change, and calculating increases in population density, housing-unit density, density of the transportation network, and water-consumption rates are techniques to characterize growth-driven land transformations. Urban growth in the Albuquerque area is resulting in increasing ground-water withdrawal which reduces flow in the Rio Grande (McAda, 1996). Modeling to predict urban growth helps us understand the impact of urbanization on the region's water resources, economy, and people.

Population Growth

From 1900 to 1990, the population of New Mexico increased from 195,000 inhabitants to 1,515,000 (Chourre and Wright, 1997). The city of Albuquerque contributed 30 percent to New Mexico's population growth during this time. In 1990, the population of the Middle Rio Grande Basin (MRGB) was about 564,000, which amounted to about 35 percent of the inhabitants of the state of New Mexico (U.S. Department of Commerce, 1991). The Albuquerque area accounts for about 90 percent of the residents of the MRGB. Until the 1970's, growth was greatest in the North Valley and East Mesa of Albuquerque; however, lower land prices drove urbanization to the West Side area in the mid-1980's. The Greater West Side Area, including Rio Rancho and Corrales, accounted for 60 percent of Albuquerque's total urban growth between 1980 and 1995 (Middle Rio Grande Council of Governments, 1997). If Rio Rancho's population continues to increase at the same growth rate, the municipality will soon surpass Santa Fe as the second largest city in New Mexico.

Land Transformations

a increase runoff.

From 1970 to 1990, a 1-percent increase in national population resulted in a 6- to 12-percent increase in land use (Middle Rio Grande Council of Governments, 1997). These transformations from land cover to land use have typically meant a decrease in areas conducive to ground-water recharge such as agricultural lands, forestlands, and wetlands. From 1945 to 1992, general land-use trends for the southwestern U.S. were the transformation of forest and pasture land to transportation, industrial, and urban uses (O'Donnell, 1997). In the Albuquerque area, 14,000 acres were irrigated in 1975, compared

to 9,600 acres in 1992 (McAda, 1996). Concomitant with a 30-percent decline in irrigated agriculture, from 1973 to 1991, urbanized land in the Albuquerque metropolitan area grew by about 70 percent or 35,000 acres (Braun and others, 1997).

Water Consumption

total or annual?

Albuquerque's annual ground-water withdrawal has increased from about 2,000 acre-feet in 1933 to about 123,000 acre-feet in 1994, with more than 50 percent of the withdrawal occurring from 1980 to 1994 (McAda, 1996). New high-technology industries, for example, Intel's Rio Rancho plant which consumed nearly 4-million gallons per day in 1996, place a high demand on existing ground-water resources. Natural resources, such as water, sustain an urban area's economic and population growth. The availability, collection costs, and distribution of water resources influence future land-use patterns.

Urban-Growth Modeling

An urban-growth model (UGM) can be used to predict future urbanization. The UGM produces both quantitative data and a pictorial view of predicted urban expansion. The USGS-NMD plans to use the UGM for a pilot area in the MRGB encompassing Albuquerque, Rio Rancho, Edgewood, and Moriarty. The UGM requires datasets of historical urban extent, slope, historical roads, areas excluded from development, and shaded relief. The UGM incorporates four types of growth-spontaneous, diffusive, organic, and road-influenced-as well as five growth parameters and five growth constants (Clarke et al., 1996a, 1996b). Aerial photographs from 1935, 1951, 1973, and 1996 will be interpreted to map historical urban extent and to calibrate model output. Calibration is an iterative process; that is, actual growth in each successive aerial photo is compared with that predicted by the UGM. Initial growth values are then modified such that predicted urban area matches actual urban area recorded in the aerial photographs. Once calibration is complete, the UGM can predict future urbanization for a time period similar to that of the historical data.

Conclusion

From 1891 to 1995, the developed Albuquerque metropolitan area increased from 2000 acres to 103,000 acres (Price, 1996). Public and Indian lands cover approximately 40 percent, or 3,900 square miles, of the MRGB (Middle Rio Grande Council of Governments, 1997) which will likely constrain future urban growth. The USGS-MRGB urban-growth modeling will help identify areas of future urbanization and analyze the potential impacts of the resulting urban-land transformation.

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Last modified: 15:09:41 Mon 10 Jan 2000