



Land Use Dynamics in the Edwards-Trinity Aquifer Region

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Environmental and Societal Issue

San Antonio is the 9th largest U.S. city and depends almost exclusively on the Edwards Aquifer as the major source of water for more than 1.5 million people. The Environmental Protection Agency has designated the Edwards Aquifer as a “sole source” aquifer for sustaining continued urban growth (Figure 1) and land use development. Population projections forecast that the Austin Metropolitan Statistical Area (MSA) shall surpass San Antonio’s population by the year 2030 and the Austin region shall become even more dependent on ground-water resources. In 40-years, there shall be 4.8 million people competing for water resources with agricultural and commercial users as well as minimum flow requirements to sustain endangered species habitat at seeps and springs. Dependence on water availability of so many people and biota combine to make the water quality and quantity of the Edwards Aquifer a critical issue for the region.



Figure 1: Canyon Ridge Springs planned urban development land sales; west of Austin between US Highways 290 and 281

Scientific Partners

In collaboration with the University of Texas-Austin and the Greater Austin-San Antonio Corridor Council, USGS is reconstructing and visualizing the process of urbanization and land use change for the Austin-San Antonio urban corridor and adjacent Texas Hill Country.

Landscape Change Research Results

The USGS Geography Discipline is focusing our geographic science capabilities to investigate landscape change in South Central Texas by conducting National Land Cover Data (NLCD2000) mapping, Edwards Plateau ecoregion land cover trends analysis, urban landscape change for the Austin and San Antonio MSAs and agricultural land use trends research.

Quantifying landscape change involves analyzing the temporal landscape to understand the rates of growth, trends, and land use pattern relationships. Temporal land use mapping as exemplified by NLCD and ecoregion land cover trend analysis are techniques for monitoring land use transitions in the Edwards-Trinity region. Land surface characterization metrics such as total population growth and population composition are also methods used to measure the temporal footprint of humans on the land surface.

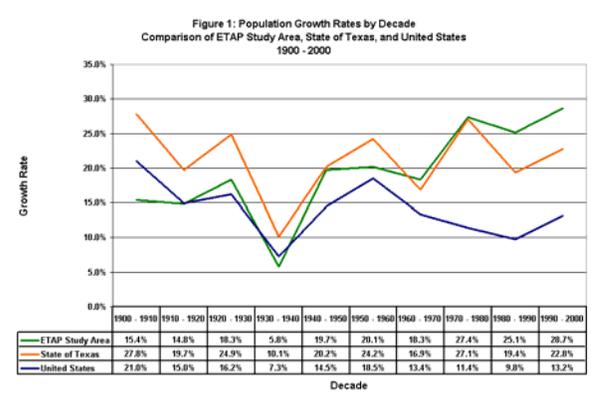


Figure 2: 20th Century population trends in the San Antonio-Austin region: total population growth rates by decade

Analysis of population trends (Figure 2) for the San Antonio-Austin region illustrate that while the State of Texas had a growth rate consistently higher than the United States, the Edwards-Trinity study area surpassed the U.S. growth rate after 1940 and has exceeded the State of Texas growth rate since 1960.

Since the early 1980s, the Austin region's population has increased by 800,000 people and the urban component of the landscape has expanded by more than 200,000 acres (Figure 3). During the 1990s, as the region's population and urbanized area grew, municipal groundwater consumption increased three percent annually. From 1983 to 2000, an annual eight percent growth rate more than tripled the urbanized area (Figure 4) while agricultural land decreased five percent annually. Expansion of Austin's urbanized area was the result of the region experiencing significant job growth during the 1980s and 1990s led by greater than five percent annual growth in the service sector. During the approximately 20-year period, Williamson County located north of the City of Austin led population growth with a six percent annual increase that was mirrored in the growth rates for building permits and housing units.

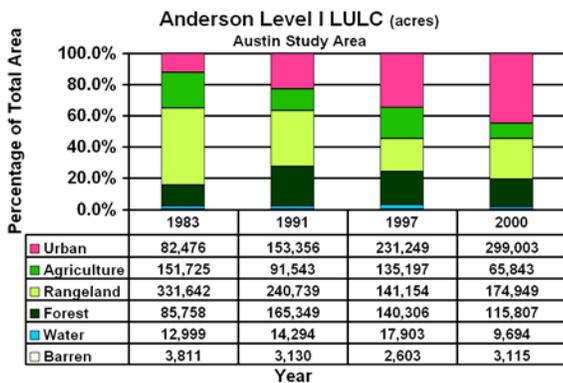


Figure 3: Austin landscape composition from 1983 to 2000

Geographic Products and Outreach

As part of the Edwards-Trinity project, Austin historical land use and land cover data was provided to the USGS National Water Quality Assessment Trinity project to use for locating a monitoring well to evaluate the impact of residential development, pollutant runoff, and water quality.

Landscape change research for South Central Texas was presented to the Greater Austin-San Antonio Corridor Council (ASACC). Scientific investigation maps such as Figures 4 and 5 illustrating Austin's urban growth through time and Edwards-Trinity Agricultural Land Use Trends were distributed to the ASACC Land & Greenspace Committee members to use in educating the community about the benefits of open space acquisition.

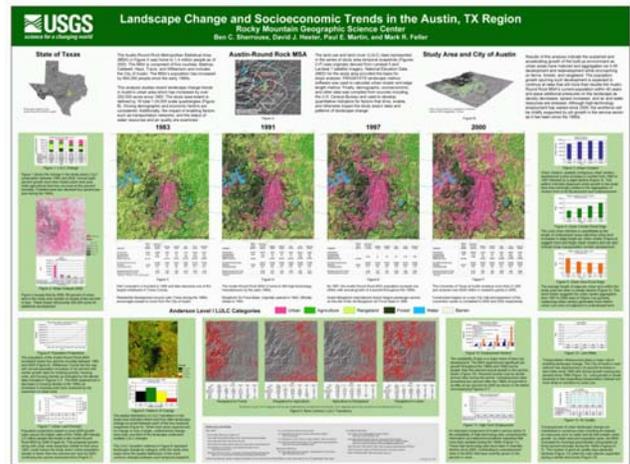


Figure 4: Landscape Change and Socioeconomic Trends in the Austin, Texas Region from 1983 to 2000

To quantify agricultural land use trends, the number of farms, farm acreage, and average farm size were statistically tested for significant differences between regional, state, and national rates of change. The region's average farm size, at varying distances from metropolitan areas, was correlated to non-agricultural land value to discern any relationship between the two parameters (Figure 5). Recent farm number increases and average size decreases in the region and state have resulted from the conversion and fragmentation induced by urbanization. A significant negative correlation exists in the region between non-agricultural land value and average farm size.

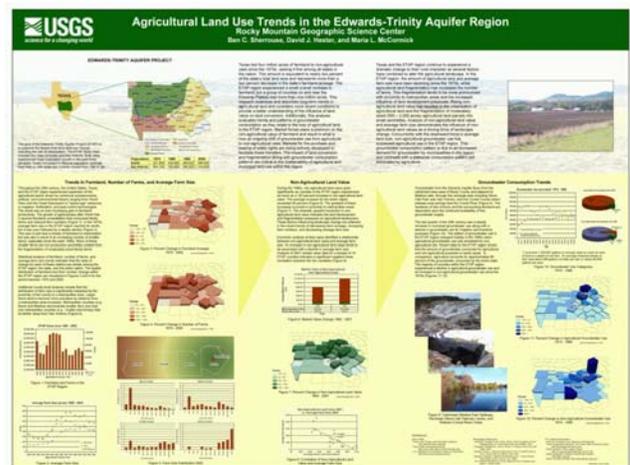


Figure 5: Agricultural Land Use Trends in the Edwards-Trinity Region from 1900 to 2002

USGS Geography Discipline Programs

The Edwards-Trinity investigation is being supported by the Geographic Analysis and Monitoring Program.