

Suburban Development in San Antonio: 1985 – 2003

Spenser Murphy

Abstract

The goal of this study was to determine the amount of suburban growth that San Antonio has experienced. Suburban growth was sampled from images in 1985 and 2003. The Landsat remote sensing platforms provided the images used in this study. For quantitative purposes, ENVI was employed for change detection and statistical analysis of the images.

Introduction

Over the past three decades, San Antonio has experienced significant population growth. In 1980, San Antonio's population was 786,023. A decade later in 1990, San Antonio's population increased to 935,933; a 19.1% increase. From 1990 to 2000, San Antonio saw population growth similar to the preceding decade. The population of San Antonio in 2000 was 1,114,646. When compared with 1990 data, San Antonio's population grew by another 22.3%. Averaged together, San Antonio experienced 20.7% per decade from 1980 to 2000. This is an impressive growth rate for a large metropolitan area. Clearly, the increase in population would generate an increase in housing development (City).

Study Objective

The question this study intends to answer is how much suburban growth has San Antonio undergone. I hypothesize that San Antonio has experienced large amounts of development on the north side. A second premise this study will answer is which area of town experienced more suburban growth. Anecdotal evidence suggests that San Antonio's northwest side has seen the most suburban growth.

Study Area / Data

The primary area study was derived from Landsat imagery covering the area surrounding San Antonio. Smaller areas were selected within the primary image area for study. These smaller areas were selected because of high population growth through the 1990's. The map (graphic A) illustrates population growth by census tract. The high density of red dots is overwhelmingly distributed along the northern half of San Antonio outside of Loop 410. Based on this evidence I chose an area centered on highway 151 and 1604 and, for comparison, an area centered on Converse and Randolph AFB. These smaller study areas made data collection much easier.

As previously stated, the source of the images is the Landsat program. The 1985 image was a product of an older Landsat platform, Landsat 5 TM. The Landsat 5 TM capabilities were more than adequate for this study. The satellite gathers data in seven bands from 0.45 to 2.35 μ m. The radiometric resolution for these bands is eight bits. All bands have a pixel size of 30m except for band six (10.40 to 12.50 μ m) which has a pixel size of 120m. Sampling of the same area occurred every 16 days with a swath of 185 km (115 mi). The image from 2003 was taken by the latest Landsat satellite, Landsat 7 ETM+ (USGS a).

Landsat 7 ETM+ has more advanced capabilities than Landsat 5. Landsat 7 has the same number of and width of spectral bands, seven bands from 0.45 to 2.35 μ m, as Landsat 5. However, Landsat 7 has a new eighth panchromatic band detecting from .52 to .90 μ m. The spatial resolution of Landsat 7 is the differentiating feature between the two platforms. Landsat 7 pixel size in all bands except band six (thermal) and band eight (pan) is 30m. Band six's spatial resolution is 60m, which is half the resolution for the same band on Landsat 5. The new panchromatic band has a spatial resolution of 15m. The temporal resolution and swath is the same as Landsat 5 (USGS b).

The similarities between both platforms allowed for comparison of images from each platform. Each image of San Antonio had the same 30m resolution and image size. These identical characteristics allowed the images to overlap for the change detection algorithm.

Methods

To determine amount of suburban growth in each study area I used the Spectral Angle Mapper (SAM). In the 1985 images I setup classification areas according to different types of terrain. I classified the existing suburban development in yellow and vegetation in other colors. Once the classifications were established, I used the SAM to run a classification on the 2003 study areas. Output from the SAM produced classified 2003 images (Graphics B&C). I then ran the change detection algorithm on the classified images for 1985 and 2003. I did a class to class comparison for consistency. The change detection produced the quantitative data needed to determine the amount of suburban growth. Data was compiled into tables showing percent change, pixel count change, and change in area for the classes from 1985 to 2003.

Results

The statistics produced by the change detection program illustrated significant suburban growth in both study areas. The Converse and Randolph AFB study area saw an 82% increase in suburban housing tracts. In surface area, this percentage increase translated to 507.69 ha or 1254.53 acres. The study area on San Antonio's eastside centered on 1604 and Culebra Rd. saw similar growth patterns. Statistically, the study area saw a 60% increase suburban development. In area, there was an increase of 437.76 ha or 1081.73 acres.

Conclusions

We can now reexamine the questions posed by this study. 1. How much suburban development has San Antonio experienced over 18 years? Even though the two sample areas insufficient to make a citywide generalization, they still provide insight in to San Antonio's growth. The sample areas are instructive regarding San Antonio's north side. Therefore, it can be inferred from this data that San Antonio's north side saw at least a 50% increase in suburban growth. 2. Which area of San Antonio had more suburban development? Accords to the statistics, the Converse Randolph AFB study area was the faster growing area. This area saw 16% greater increase in growth over the 1604 and Culebra Rd study area.

There area several implications that can be drawn from these results. The rapid growth rates in both study areas would drive up real estate prices. These prices would

benefit existing home owners with an increase in their home values. For homebuyers, they can expect to pay higher prices for homes in the Converse area over the Culebra Rd. site. This assumes that factors that affect housing prices are constant in both areas. The effects of suburban growth in these areas of San Antonio not only affect the real estate market but also impact the environment.

A drawback to suburban housing tracts is they use more water than urbanized housing. The primary reason for suburban housing using more water than urban dwellings stems from the watering of lawns. The water usage from San Antonio's growth has started to strain the aquifer. San Antonio's water usage has increased to a point where the city is developing an alternative water supply, a water pipeline (Needham).

Furthermore, suburban housing contributes to air and water pollution. The nature in which suburban housing tracts are developed leads to sprawl. A simple definition for sprawl is the construction of low density housing over large areas away from city centers. This in turn, leads to an increase in drive time and traffic which causes a rise in air pollution. Suburbs increase water pollution mainly through their lawns. The use of pesticides, herbicides, and fertilizers on yards by home owners can lead to runoff. This runoff may find its way into the aquifer (SAWS).

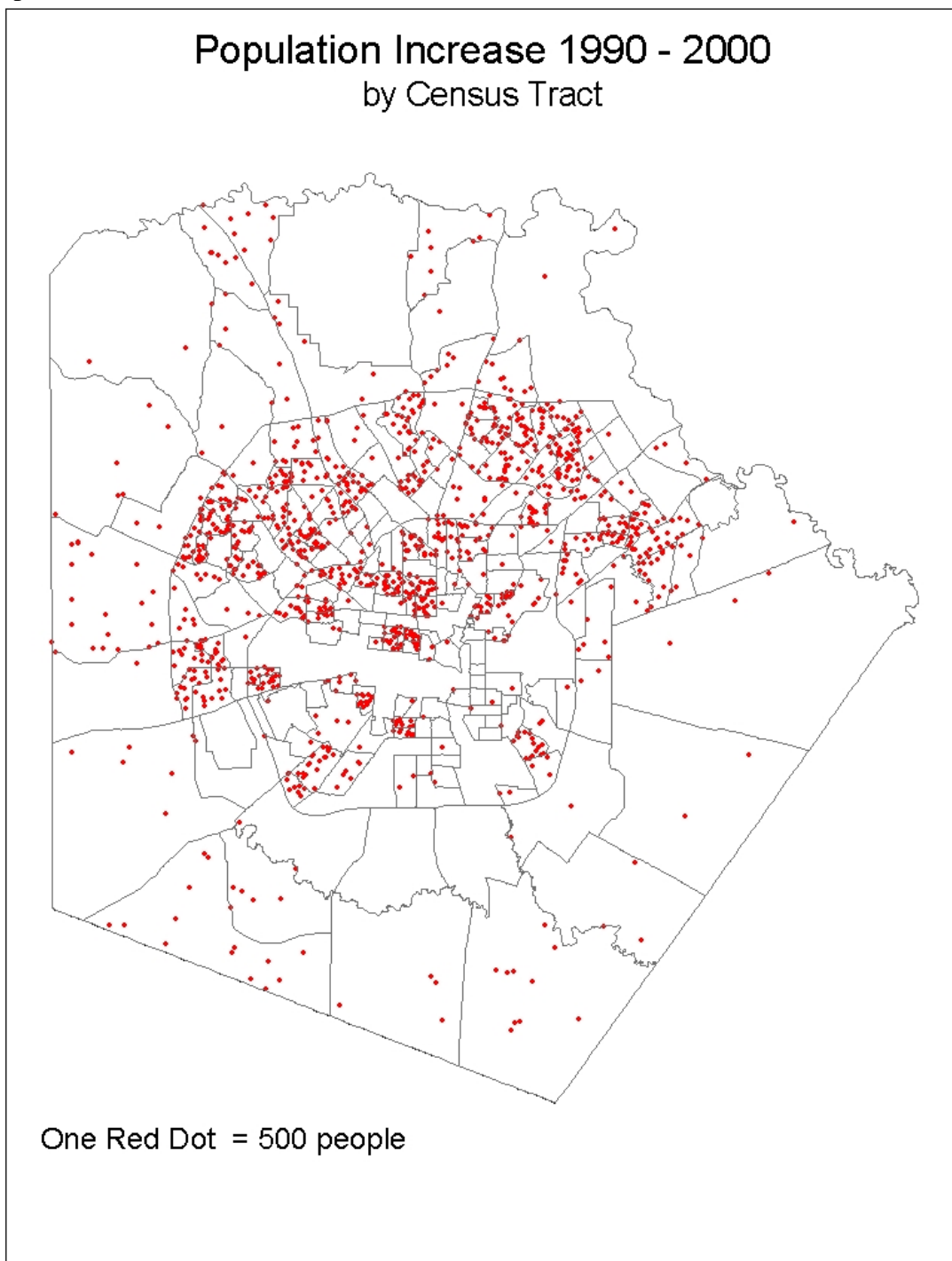
Acknowledgments

I would like to thank Dr. Xie for his assistance with this project. Dr. Xie provided me with the Landsat 5 image; without this image I would not have been able to complete my project.

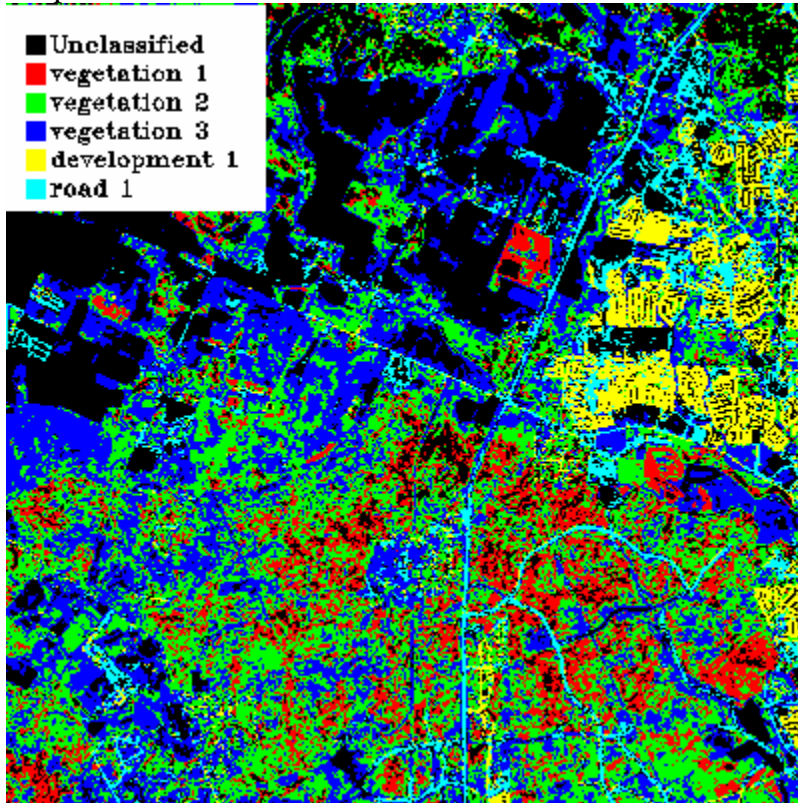
References

- City of San Antonio, Planning Department. Population Change: 1960 – 2050, San Antonio and Bexar County. San Antonio: City Planning Department, 2005.
- Needham, Jerry. "50-Year Water Plan Hashed Out." San Antonio Express-News 2 December: 1B.
- Clean Water: 101. San Antonio Water System (SAWS).
<http://www.saws.org/our_water/waterquality/Water_101/index.shtml>
- United States Geological Survey a. Landsat 5 History. 10 Nov. 2005.
<http://landsat.usgs.gov/project_facts/history/landsat_5.php>.
- United States Geological Survey b. Landsat 7 History. 10 Nov. 2005.
<http://landsat.usgs.gov/project_facts/history/landsat_7.php>.

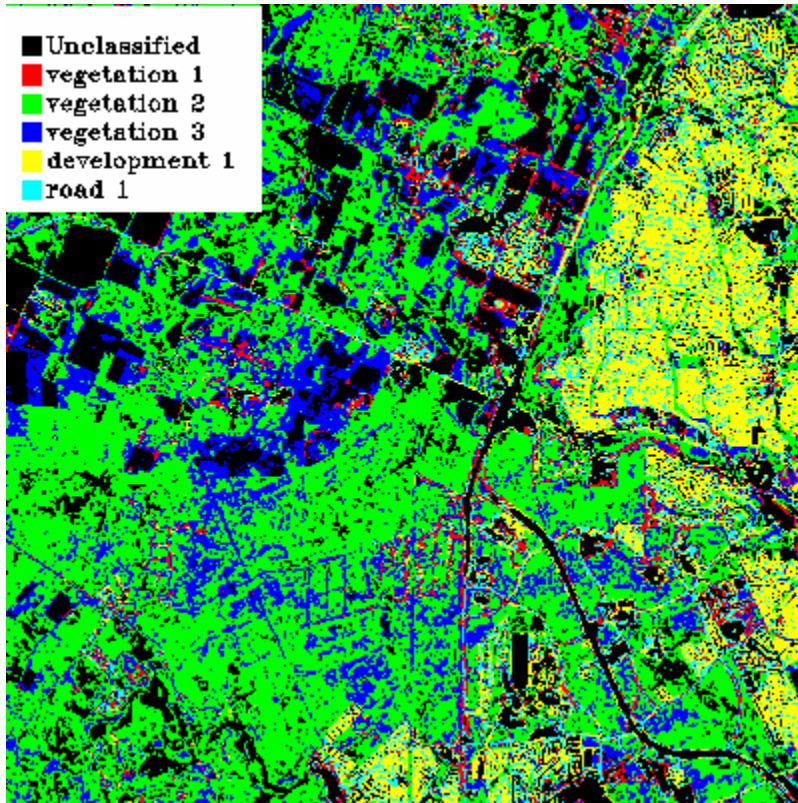
Graphic A



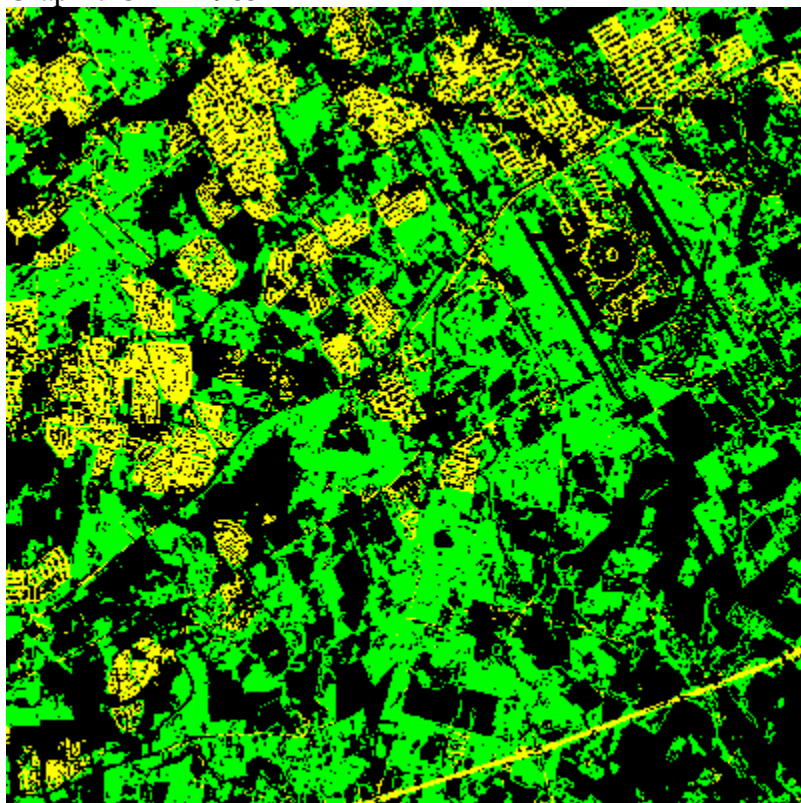
Graphic B 1985



2003



Graphic C 1985



2003

