# Urbanization in Rural Towns: A Case Study of West Columbia, Texas

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**Abstract**

Many rural towns across the country, including my hometown of West Columbia, Texas, are slowly facing the oncoming threat of urbanization. Thousands of acres, once used to ranch cattle, are being sold to housing developments to build multi-hundred-million-dollar neighborhoods. My study moved to investigate the capabilities of land cover tools in monitoring urbanization in rural communities. The area of interest to be monitored was a ranch home built in 1952 that is adjacent to a river and a highway. Satellite imagery was used to monitor changes in physical geography, urbanization, and the amount of fauna around the area of interest. Satellite imagery for this location was not available before 1984, so interviews with one of the original residents of the home were conducted. The data was organized ascending chronologically, and showed that as time progressed, satellite imagery showed the changes in the landscape and the effects that urbanization had on the area, such as the building of a four-lane highway instead of the previous two lane. Satellite images were not completely up to date, however, personal testimony revealed that the home that was still seen in the satellite imagery was recently bulldozed. The conclusion of the study revealed that satellite imagery is a great tool when recognizing urbanization in rural communities, but it is not completely accurate.

*Keywords:* rural, urbanization, satellite imagery, land cover tools

**Research Question**

With the world constantly changing due to ecological changes and the effects of urbanization, are the effects of urbanization and changes in land cover recognizable from satellite imagery and land cover data?

Rural communities are often underrepresented when it comes to societal, historical, and economic factors. Changes that happen because of urban sprawl can be lost to time due to a lack of historical preservation. If these changes can be documented through satellite imagery and land cover data, it would be invaluable to small rural communities when documenting changes over time in their hometowns.

**Introduction and Review of Literature**

Urbanization is quickly spreading across the country, with rural communities being engulfed by housing development companies that want to build on the abundant land that is sprawled across the country roads of America. This urban sprawl is frightening to some that have resided in these rural communities for their entire lives. Homes that have stood for nearly centuries are being torn down in front of their original owners. It is important for people in communities to recognize the effect that urbanization has had on their communities.

Satellite data is a free of cost and easy way for people to monitor the spread of urbanization in their communities. Many free programs are available that show multitudes of different forms of urbanization. Land cover change from floods can be seen simply from Google Earth's Time Machine program. It shows year by year images of a selected area on Earth, which could allow people to see changes in their communities. Encroaching housing developments can be seen through this program as they tear down landscape to build. Satellite imagery can also be

used to monitor the changes in weather and its effect on flora in an area. Years where droughts were prevalent showcase the regions that received the least amount of moisture, while also pointing out the contrary of wet places in this time of drought.

Satellite images can be invaluable to a community when monitoring urbanization, but it is not always accurate. The images cannot be updated constantly, so changes in landscape or flora may not be monitored quickly. This is where the data of the people living in these communities come into play. They know the land they live on and can recognize things that the satellites have failed to pick up just yet.

**Methodology**

I selected a little ranch house on the outskirts of West Columbia, Texas, which is adjacent to the Brazos River and the Jimmy Phillips Highway. This small farmhouse, that was once used to run cattle, was next to major land cover facilities that would be noticeable from ground and satellite images.

I employed a multitude of different technologies and ideas when studying this topic. Multiple different satellite imaging programs were used to pull images of the area and compare them across different years. Google Earth was used to create a timelapse of the area from 1984 to 2022. The changes in land cover and land use were screenshotted and put into their own timeline.

Google Earth was also used to get exact coordinates of the area of study for other satellite programs. Landsat Time Series Explorer was used to map flora levels across different years. Years that experienced droughts were splotched with red, signifying dead flora, while wet years were covered in green, signifying lush plant life. Nasa Worldview was used to monitor the cloud coverage over a course of many years, which showed the drastic changes that this coastal town

sees. GLOBE and GLOBE observer data were also used to study the physical land cover of parts of the area of interest.

| 2000 | 2006 |
|------|------|
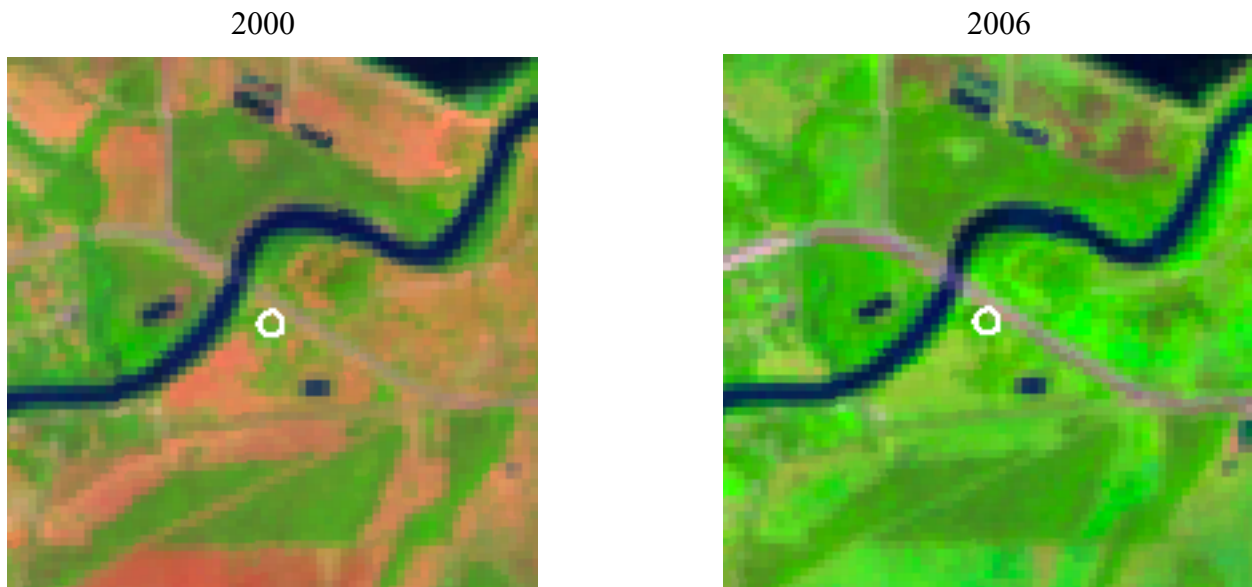


These maps are of flora levels from two separate years. The region experienced a drought in 2000, which is represented by the orange markings across the image. 2006 was a lush year, as indicated by the green markings.

1984                                                          2022



These satellite images were collected through Google Earths Timelapse feature of the same area of interest. The earliest satellite images available of this area are from 1984. Although significant changes can be seen in the images, many important events in the development of West Columbia happened before satellite imaging was available.

Personal testimonies from a previous resident of the ranch house were conducted to gain a further understanding of the changes that happened before Landsat satellites were around, and to learn of things that the satellites are unable to pick up or have not picked up yet. Rose Anne Smith, a native of West Columbia, Texas, since 1950. shared her story about how drastically the world changed around her. The interview brought to light the drastic changes in infrastructure that were seen before the time of satellites, such as construction of bridges and the development of the four-lane highway. She also provided an understanding of the population demographic that contributed to the early urbanization of West Columbia. She detailed the time when the city was segregated, which led to neighborhoods for white people and neighborhoods for minorities. Her

testimony was invaluable to the data collection for this study, simply because that data cannot be gathered from anywhere except someone who lived through that time period.

*Note:* See Appendix for transcript.

## Results

The programs used to identify the different types of urbanization and changes in land cover worked splendidly. The Landsat Time Series Explorer's timeline of dead flora tied in perfectly with the droughts that were reported in the area at that time. Changes can also be seen in the curve of the river by the ranch house, as erosion and floods have slowly chipped away at the banks. The only issue that arose was the inability for the satellites to take frequently updated photographs of the sites. The ranch house that is seen in many of the photographs was demolished in early April of 2023, which was not picked up by satellite imaging.

Although satellite imaging is not quick enough to pick up detailed physical changes at a rapid pace, it is still useful as a tool to monitor change over time.

2011                                                                 2019



These over time satellite views show the difference between a year during a drought (2011), and a year where the land flooded (2019). New structures can also be seen.

**Discussion**

Throughout the study, the only thing that could have potentially been misinterpreted in the research would be an iniquity in the testimonial. It is common for people to slip up in their speech, so it is possible for some facts to be slightly skewed away from what they originally were.

This research utilized NASA Land Cover and Land Use Change Program (LCLUC). This study is addressing observations and data from ground land cover photos and comparing them with Landsat satellite imagery. The comparison between satellite imagery and the ground imagery provides a more complete view of the area of study, while a testimonial can almost solidify the facts about the area.

This study provided me with a great deal of insight about what should lead you to study something. A connection must be made for the research to truly mean something and provide insight for future readers.

**Conclusion**

Through analysis of satellite imagery over several decades and personal testimony from a local resident, I have concluded that land cover tools can be used to monitor urbanization in rural communities, but the lack of constant updates from satellites leads to inaccuracies in the monitorization of the communities. To further expand on this topic, the entire city of West Columbia, Texas, should be incorporated into the study. The larger scale would allow for a greater analysis of the spread of urbanization and how it can be monitored on a city-wide level.

Incorporating the study on a city-wide level would provide more residents with access to information that could prepare them for future urbanization as it continues to spread across the country.

**Acknowledgements**

**Globe IVSS Badges**

### I Make An Impact
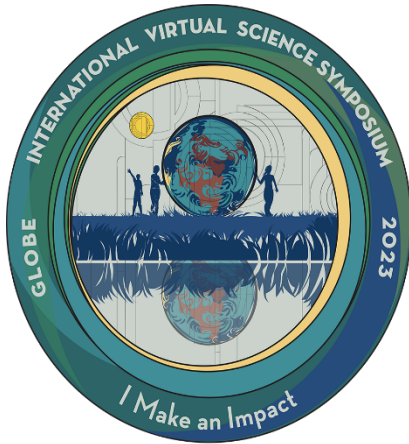
I made an impact by focusing my research question on my hometown and involving my community in my research. Through my research in the community, I was able to bring the stories of residents to a new, scientific, light. I also was recognized by the mayor of my town who invited me to present my research to the rotary club, and she wanted to help in furthering my research into the history of my town.
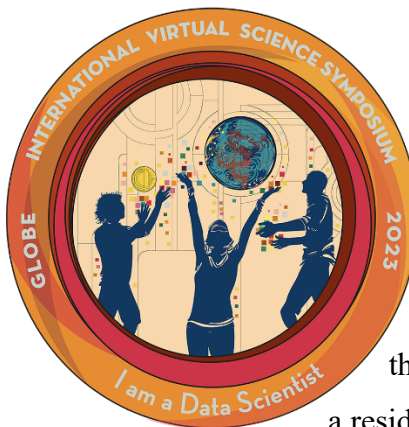
The research in my project focused on satellite and land cover. imagery in rural towns. I used Google Earth's timelapse feature, LandSat Time Series Explorer, GLOBE, and GLOBE Observer. These sources gave me an excellent representation of the change. in land cover and the sprawl of urbanization over a set period. I realized that the changes in West Columbia spanned back farther. than what the satellites were able to map. To counter this, I interviewed a resident of West Columbia who had lived in the area of interest from 1952 to 1965. Her testimony of the changes she witnessed in this area provided the last missing details I needed for my research. This unique form of data collection is why I am a data scientist.

I am a stem professional because of my interactions with the mentors in the SEES program. While working on my project, they were extremely helpful in providing resources or reading over a section of my work that I was skeptical about. I also met with one of the mentors and planned to continue my research outside of the internship with their guidance.

**Data Availability**

GLOBE Observer data were obtained from NASA and the GLOBE Program and are freely available for use in research, publications, and commercial applications. GLOBE Observer data analyzed in this project are publicly available at globe.gov/globe-data

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**Appendix**

My name is Roseanne Smith. I grew up in West Columbia, Texas, on a ranch located next to the Brazos River. The river flooded many times and every time it flooded, you could see a difference in the banks due to the sloughing of the sand from 1965 to 1973, while I lived in Houston, Texas, an extravagant multi-million-dollar community was developed right across the highway from the little ranch house I grew up in. Over 2000 people now populate the community that was once swampland. After all the development in 2023, my childhood home was bull bulldozed. I have many memories with my sister in the front yard of our home catching lightning bugs and watching the stars. The sky's not as bright as it once was because of the growth that West Columbia has seen. We had many, many. Con trees and oak trees. There was also moss in all the trees, and because of all the development, a lot of the trees and moss are gone.