

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

Kashton McCracken

Columbia High School
West Columbia, Texas

Mentors Rusty Low, Peder Nelson, and Cassie Soeffing.



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 of one of the original residents of the home was 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.

Research Question

The world is constantly changing around us, with the regions we once knew to be empty turning into populated areas. This urbanization happens gradually over time. Are the effects of urbanization recognizable from land cover data?

Introduction

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 near centuries are being torn down in front of the original owners. It is important for people in communities to recognize the effect that urbanization has 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

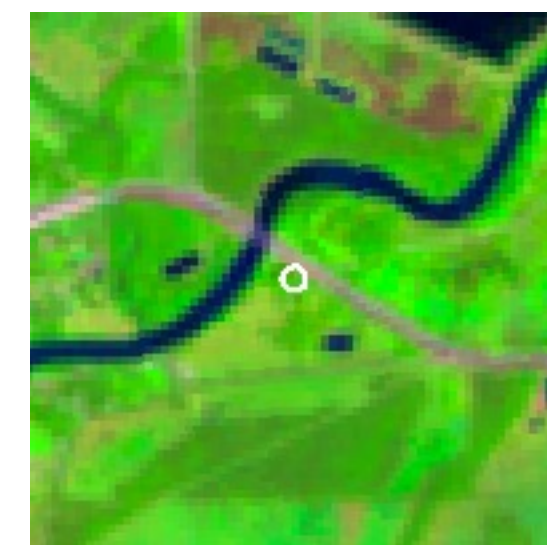
I selected a ranch house on the outskirts of West Columbia, Texas, which is adjacent to the Brazos River and the Jimmy Phillips Highway. This small farmhouse that was used to ranch cattle was next to major land cover facilities that would be noticeable from ground and satellite images.

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 the area experienced droughts were splotted 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.

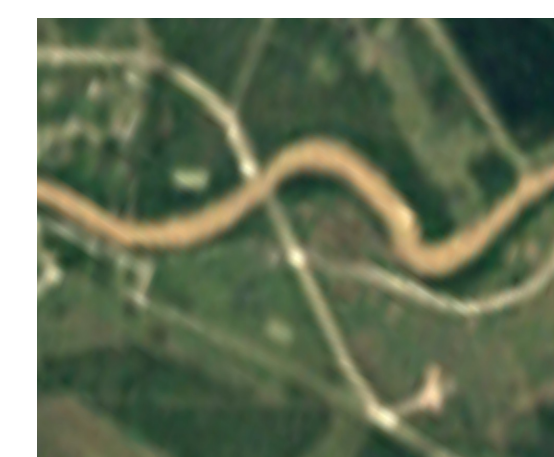
Personal testimonies from a previous resident of the ranch house was conducted to gain a further understanding of the changes that happened before LandSat satellites were around, and to learn of things that the satellite's are unable to pickup or have not picked up yet. Rose Anne Smith, a native of West 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.



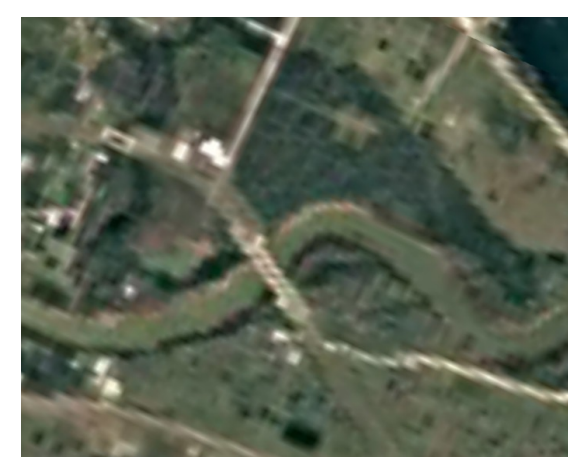
2000



2006



1984



2022

Results

The programs used to identify the different types of urbanization 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 the satellite imaging.



Although the 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).

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 the satellite imagery and the ground imagery provide 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 had 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

This project was possible thanks to the combined efforts of Ms. Cassie Soeffing, Dr Erika Podest, Andrew Clark, and the continuous support of Mr. Peder Nelson and Dr. Rusty Low.

A special thanks to Rose-Anne Smith for supporting me through this project.

The material contained in this poster is based upon work supported by the National Aeronautics and Space Administration (NASA) cooperative agreements NNX16AE28A to the Institute for Global Environmental Strategies (IGES) for the NASA Earth Science Education Collaborative (NESEC) and NNX16AB89A to the University of Texas Austin for the STEM Enhancement in Earth Science (SEES). Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of NASA.