Change Detection in a Post Industrial Environment

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Introduction

The city of Youngstown, Ohio has seen a dramatic decrease in population since its heyday in the early 20th century. From 1950 to 2010 Youngstown's population dropped by 60%. This decrease in population has resulted in urban decay and subsequent changes to the city's planning strategy. Beginning in 2005, the city of Youngstown enacted a new planning strategy to deliberately deurbanized and depopulate. A major component of the "Youngstown 2010" plan aims demolish vacant buildings, alleys and roads, in an effort to create more parks and green spaces. This gray to green initiative would seemingly have to altered land use and land cover within the city. Information on the gains and losses of certain land cover types may be required to assess the effectiveness of the city of Youngstown's planning strategies. These land cover changes can be detected with remote sensing techniques with the use of time series satellite images. This study attempted to explore the influence of de-industrialization and population decline on the city of Youngstown using remote sensing.

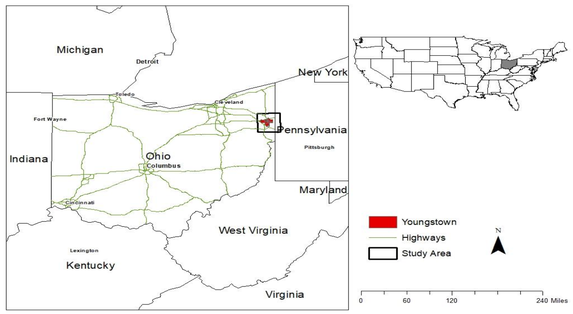
Research Questions and Objectives

What digital change detection techniques are most useful for monitoring shrinking urban environments?

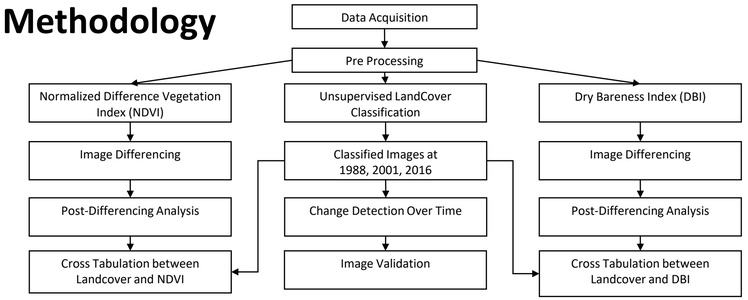
What can these techniques tell us about how deindustrialization has altered the landscape in Youngstown?

The objective of this study is to compare the effectiveness of advances in environmental characterization that have been applied to explain urban change. The second objective is to quantify the land cover change that has occurred in Youngstown as a result of urban decline.

Study Area



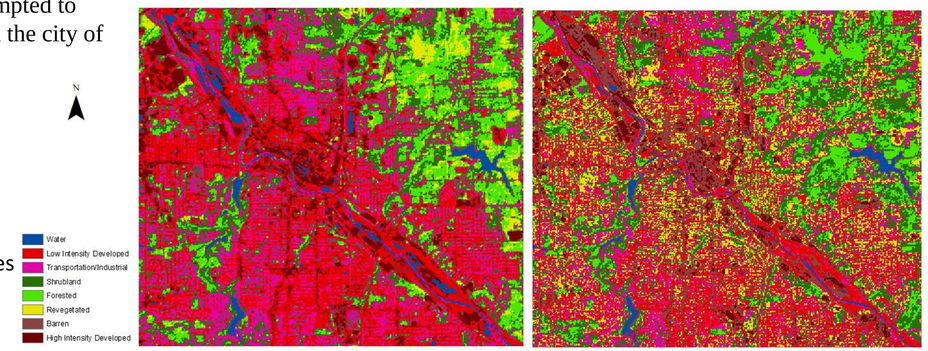
Methodology



Workflow of Analysis

Results

Land Cover Classification in Youngstown

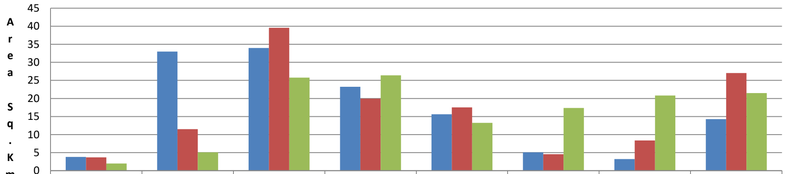


Unsupervised classification of Youngstown 2001 (left) 2016 (right)

NDVI Image Differencing

NDVI images of Youngstown from 2001(left) 2016 (middle) and difference image (right) The green corresponds to high NDVI values that indicate healthy vegetation while the red indicates low NDVI values and areas of no vegetation

Area of Land Cover 1988, 2001, 2016



	Water	High Intensity Developed	Low Intensity Developed	Shrubland	Forested	Revegetated	Barren	Industrial
1988	3.82	33.00	33.96	23.22	15.62	5.08	3.23	14.27
2001	3.69	11.51	39.57	19.96	17.51	4.57	8.35	27.02
2016	1.99	5.09	25.78	26.40	13.23	17.38	20.83	21.48

Total area of land cover categories over time

Conclusion

The results of this study demonstrate the land cover changes brought on by de-industrialization and de-urbanization in Youngstown, Ohio. From 2001 to 2016 roughly 13km^2 of previously developed land was converted to green space. The revegetated surface increased nearly 10% from 2001 to 2016. The green and developed transition thematic maps show a clear pattern of greening occurring in Youngstown since 1988. The NDVI analysis shows that in 2016 Youngstown was a more photosynthetically active surface, with a 5% increase of the total NDVI surface area from previous years. Cross tabulating NDVI with land cover identified land cover types that contributed to urban greening. Intuitively forested, shrubland, and revegetated areas contributed the most NDVI surface coverage. Industrial developed land had a high proportion of area in the highest NDVI Class in 2016 than 1988 suggesting that some developed areas are becoming greener and improving over time. The remote sensing techniques used in this study proved to be effective at providing a synoptic view of intricate land surface patterns. These techniques are capable of aiding in the detection of land cover change patterns as a result of the shifting urban environment.

References

City of Youngstown, 2005, Youngstown 2010 Citywide Plan. Youngstown, OH: City of Youngstown.

Rhodes, J., & Russo, J. (2013). Shrinking 'Smart'?: Urban Redevelopment and Shrinkage in Youngstown, Ohio. Urban Geography, 34(3), 305–326.

Acknowledgements

-Dr. J. Lein for all his guidance and feedback throughout this entire process.