

Background - Where?

- Northwestern North Dakota
 - McKenzie, Williams, Mountrail Counties
 - Primarily rural, agricultural area





Background - Where?

• Bakken & Three Forks Formations

• Estimated up to 4.3 Billion barrels of oil



Background - When & Why?

- Began in 2006 with Parshall Oil Field
 - Hydraulic Fracturing ("fracing") and Horizontal Drilling just became feasible
 - U.S. seeking independence from unstable foreign oil
 - North Dakota with lowest unemployment rate during Great Recession
- Peaked in 2012
 - Has since declined
- Population growth of Williston, ND
 - 2010 = 14,716
 - 2015 = 26, 977

Bakken Drilling – 2008 & 2013



Infrastructure Rapidly Increases

- Primarily rural and sparsely populated area
- Construction of "Drill Pads"
 - Need roads to access them
- Construction of "Man Camps"
 - Housing for oil workers



Drill Pads



Data for Analysis

- Landsat 5 August 12, 2000 (Before)
 - Path 34, Row 27
 - 0% cloud cover
- Chose August for contrast of green, healthy vegetation to dirt/bare roads





Data for Analysis

- Landsat 8 August 19, 2014 (After)
 - Path 34, Row 27
 - 0% cloud cover
- Chose August for contrast of green, healthy vegetation to dirt/bare roads

Landsat 8



Multi-date Composite Change: Drilling AOI



2000

2014

Multi-date Composite Change: Drilling AOI



2000

Change

Multi-date Composite Change: Drilling AOI



2014

Change

Multi-date Composite Change: Williston AOI



2000

Multi-date Composite Change: Williston AOI



2000

Change

Multi-date Composite Change: Williston AOI



2014

Change

Unsupervised Classification: Issues?

- Not 100% accurate
 - Some of the change indicates agricultural changes, unrelated to oil drilling
 - Farmed vs. Fallow
 - Color of soil?
 - Brown vs. Red



Results: Proof of Concept

- Yes, Multi-date composite change analysis is able to detect infrastructure growth, due to drilling industry
 - But not perfect
- Worked better for Williston AOI as opposed to Drilling AOI
 - Williston had more physical infrastructure
 - Drilling area had mainly dirt roads and pads cleared
 - **Very similar process to farmed vs. fallow agriculture practice
- Perhaps other methods for final report
 - Spectral Enhancement for illustrating vegetation change?
 - NDVI, Tasseled-Cap, Principle Component Analysis

Tasseled Cap: Williston AOI 2000/TC 2014



The End...for now

