

Impacts of Land Use Changes Over Time on the Arbuckle – Simpson Aquifer in South – Central Oklahoma



Cesalea N. Osborne

Environmental Science

Haskell Indian Nations University

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Overview

Introduction and Background

- What is an aquifer?
- Where is the Arbuckle-Simpson Aquifer?
- Why is it important?

Sources

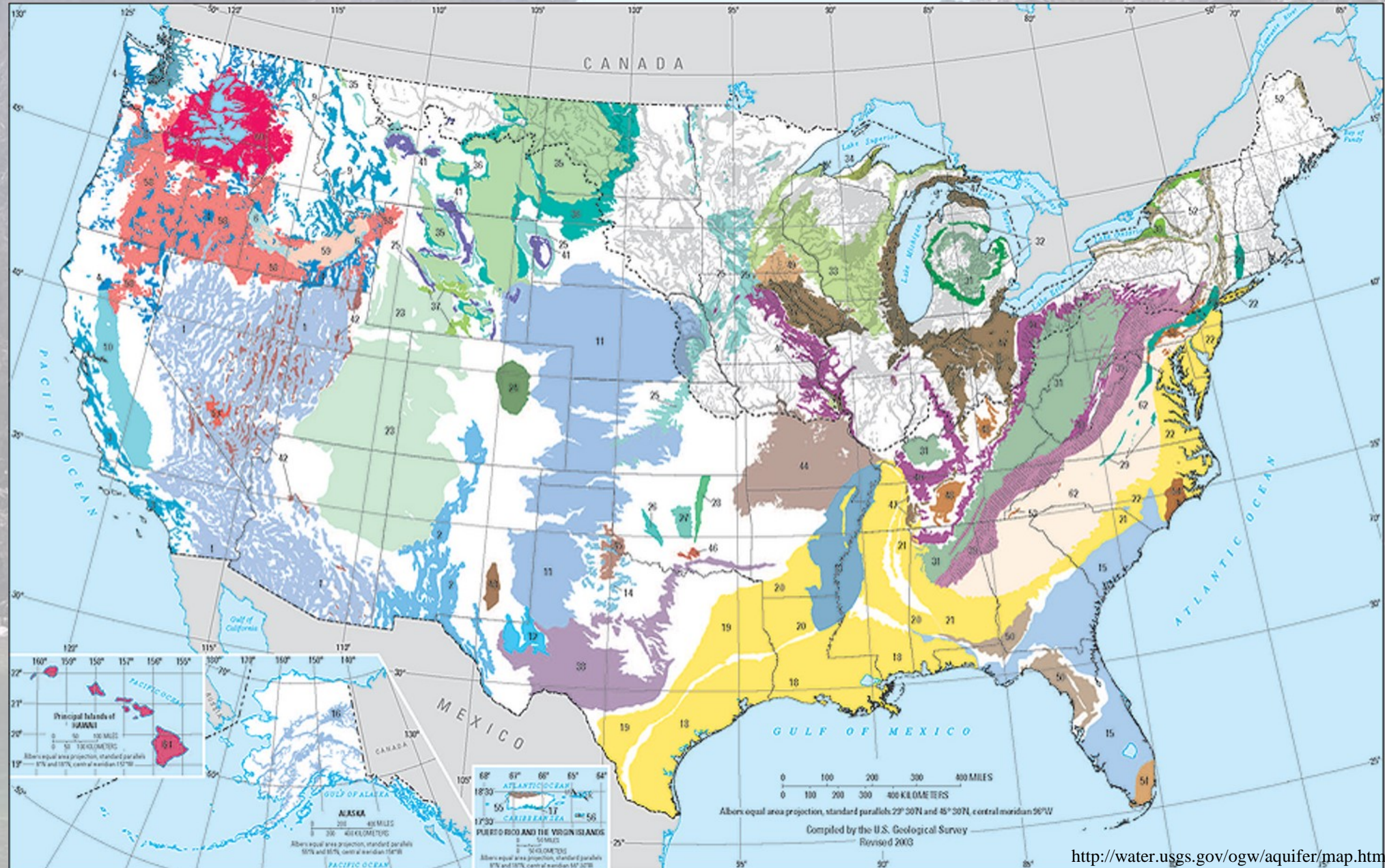
- Who's involved?

Methodology & Results

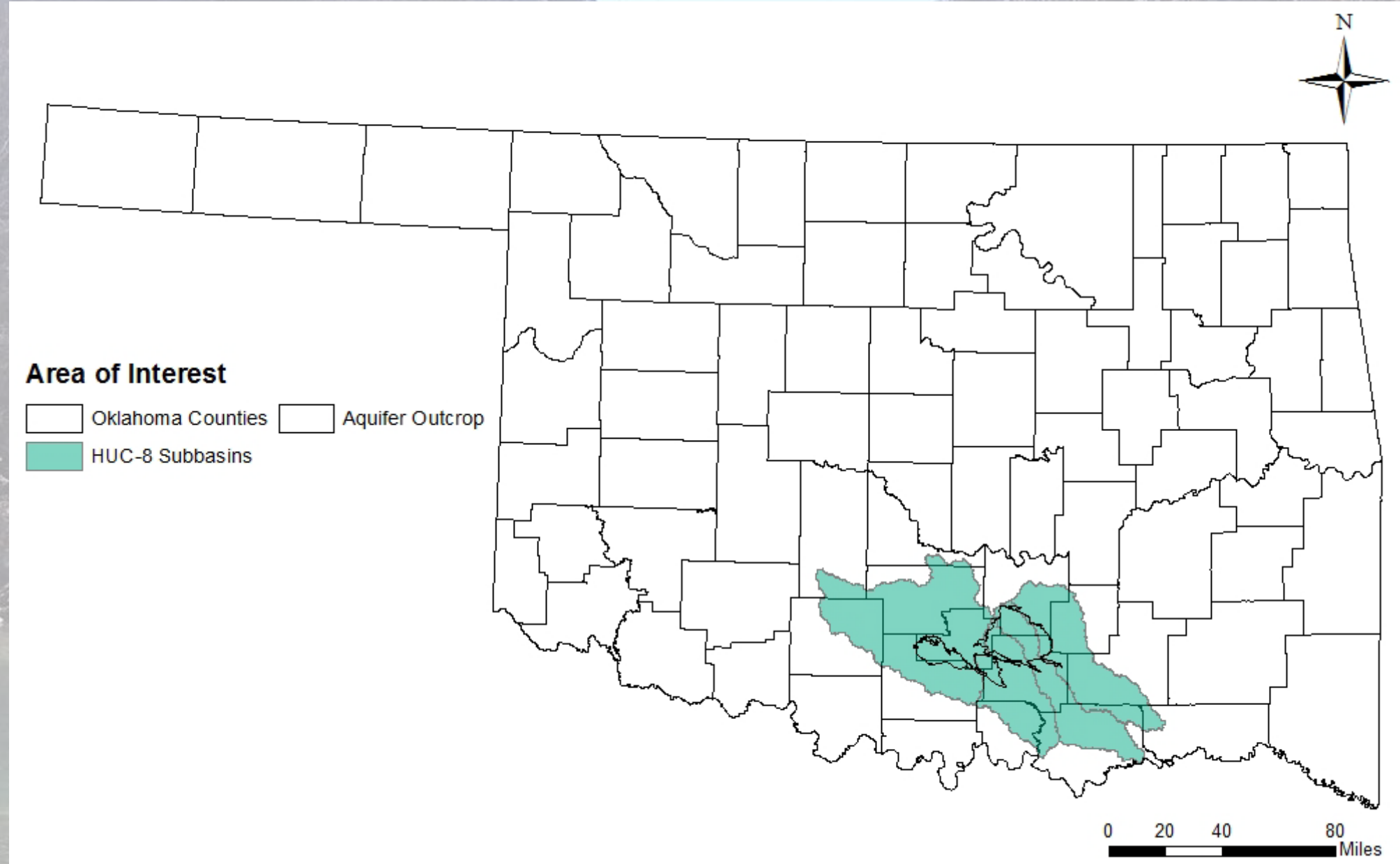
- Spatial data
- Satellite imagery
- Difference maps



Aquifers = Water Storehouses



The Arbuckle-Simpson Aquifer spans **five counties** in south-central Oklahoma.





The objective of my research is to **characterize** the change in **demand** on the Arbuckle – Simpson Aquifer using **land use** and **land cover change** over time.



Data Needs & Sources

Spatial Data

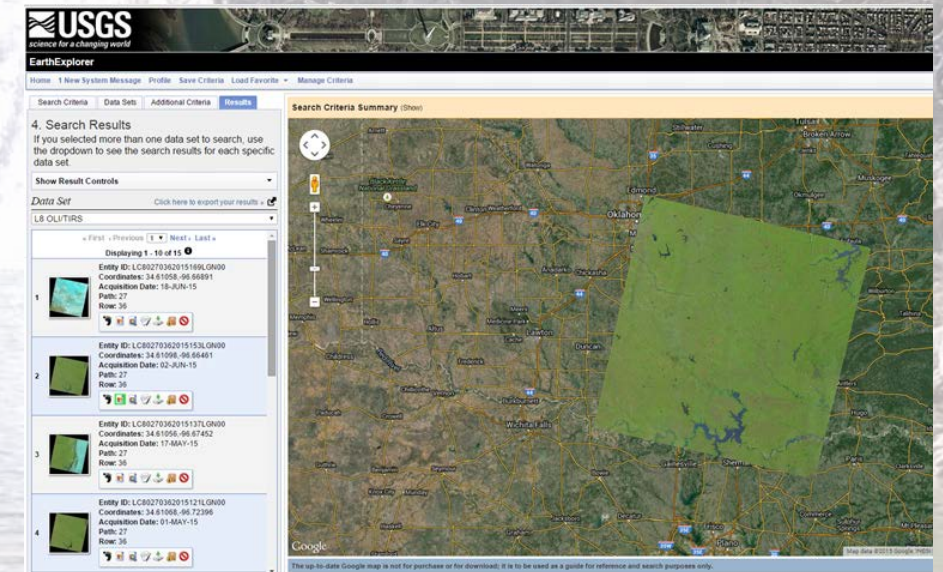
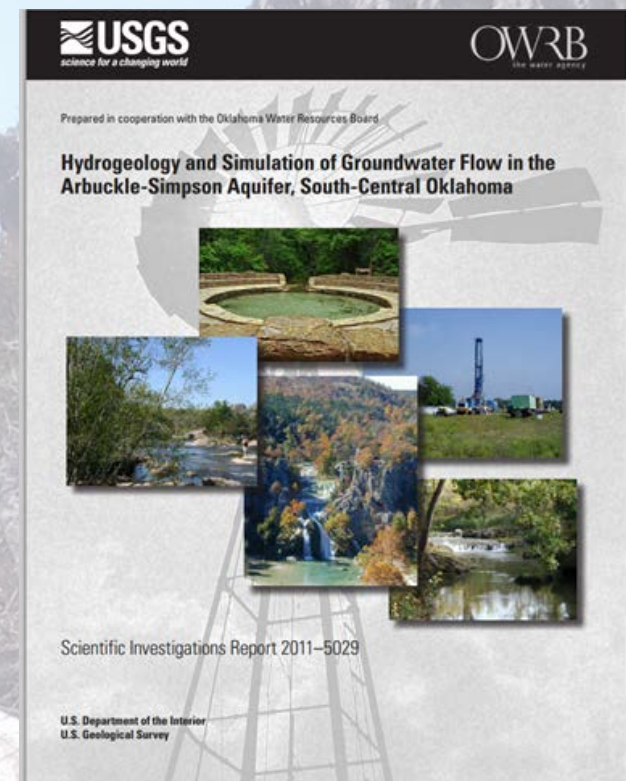
- Arbuckle-Simpson Aquifer outcrop – **Oklahoma Water Resources Board (OWRB)**
- State/county boundaries – **Oklahoma Geographic Information Council**

Surficial Hydrology Data

- HUC – 8 subbasins – OWRB

Landsat Data

- Landsat L8 OLI/TIRS and L4-5 TM– Earth Explorer – **United States Geological Survey (USGS)**



Methodology

- Researched current water demand on the Arbuckle – Simpson Aquifer
- Determined study area based on HUC-8 watersheds (4) that impact the Arbuckle-Simpson Aquifer
- Acquired spatial base data and Landsat images from L8 OLI/TIRS and L4-5 TM sensors for the years of 2015, 2005, 1995, and 1985
- Characterized land use and land cover change over time using an ISO unsupervised classification (15 classes) on Landsat imagery
- Created difference maps for each 10 year time step
- Classified the difference maps into three classes
 - No Change
 - Undetermined change
 - Development
- Analyzed results to determine impacts of demand over time

Results

- ISO unsupervised classification did not accurately distinguish
 - exposed rock/soil from urbanization and development
 - transitions from grasslands to rangeland
- Could not determine if large portions of change were natural change or man-made due to lack of knowledge of the land
- ISO may have worked better using more classes
- Went through final processes to determine difference maps, and to validate that the Landsat based unsupervised classifications were inadequate to map the change in development

Results Continued

Original Classification

- Water
- Forest
- Agriculture
- Grass/Pasture
- Bare rock/soil
- Development

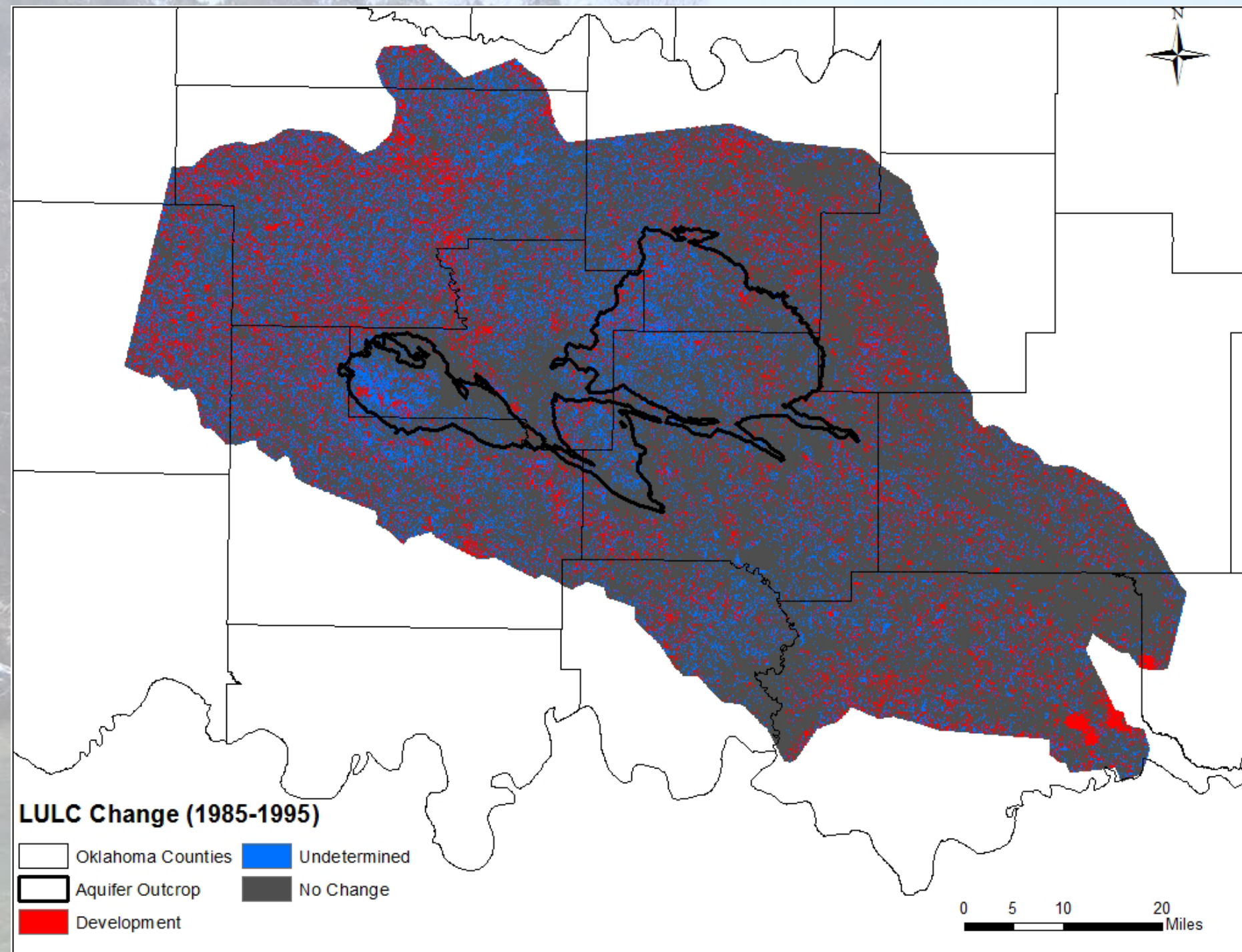
Changed original 6 classes to 4 classes

- Water
- Agriculture/Forest/Pasture
- Exposed rock/soil
- Development

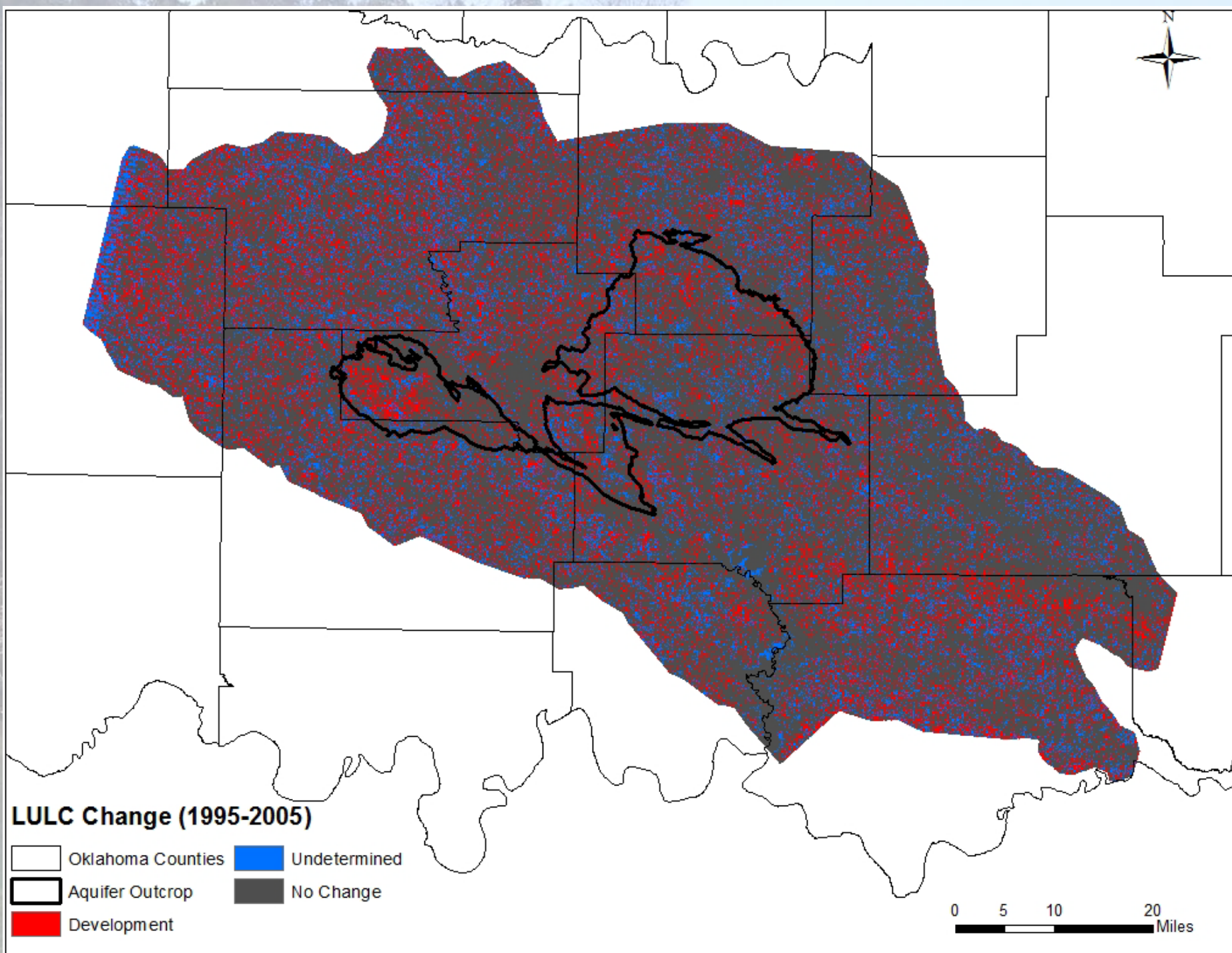
	Water	Agriculture/Forest/Pasture	Exposed Rock/Soil	Development
	1	8	26	54
1	No Change	Undetermined	Undetermined	Undetermined
8	Undetermined	No Change	Development	Undetermined
26	Undetermined	Undetermined	No Change	Development
54	Development	Development	Development	No Change

Difference Map showing areas of development from 1985 to 1995

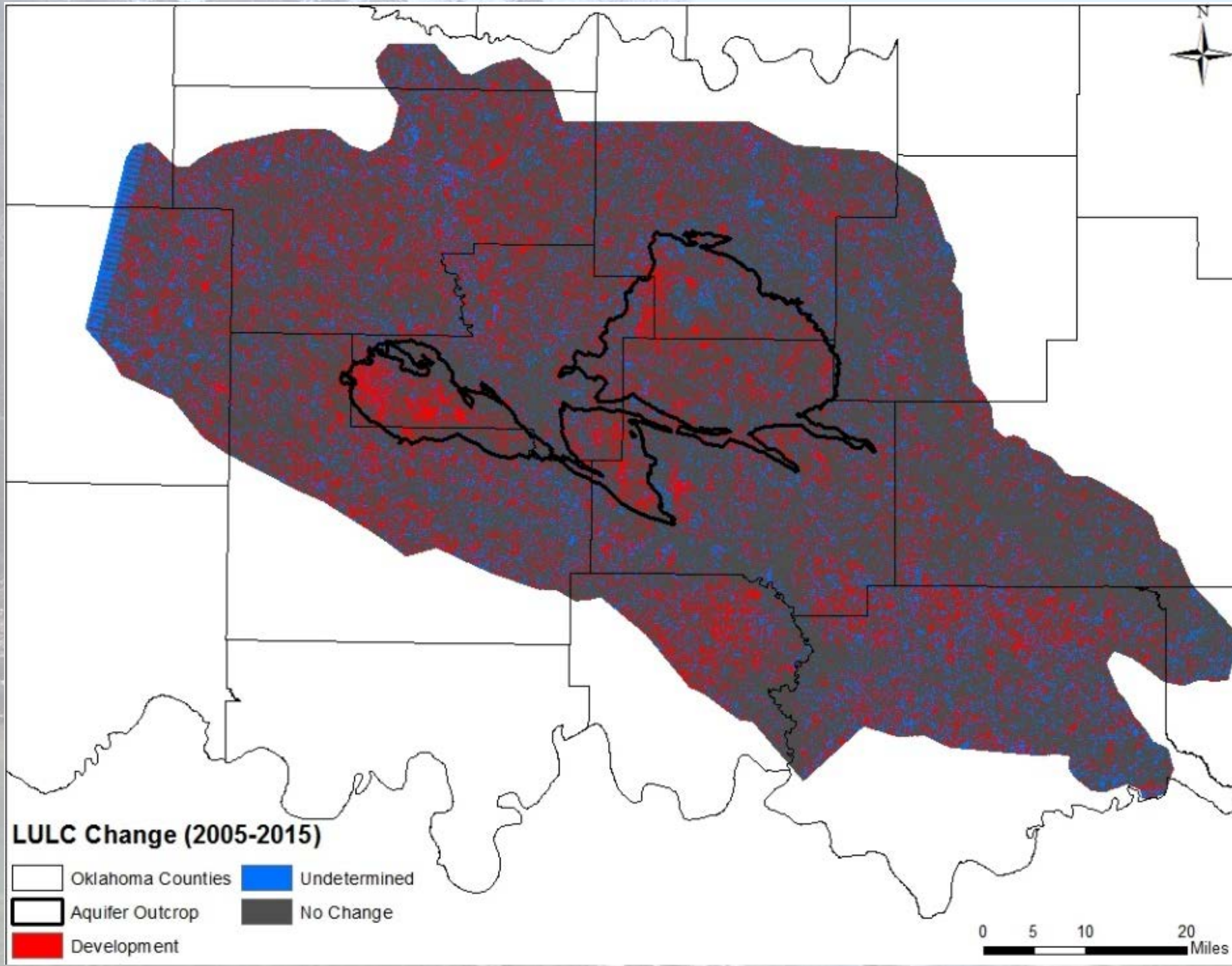
- Notice large areas showing change based on classification
- Areas were **misclassified** or misidentified using unsupervised classification



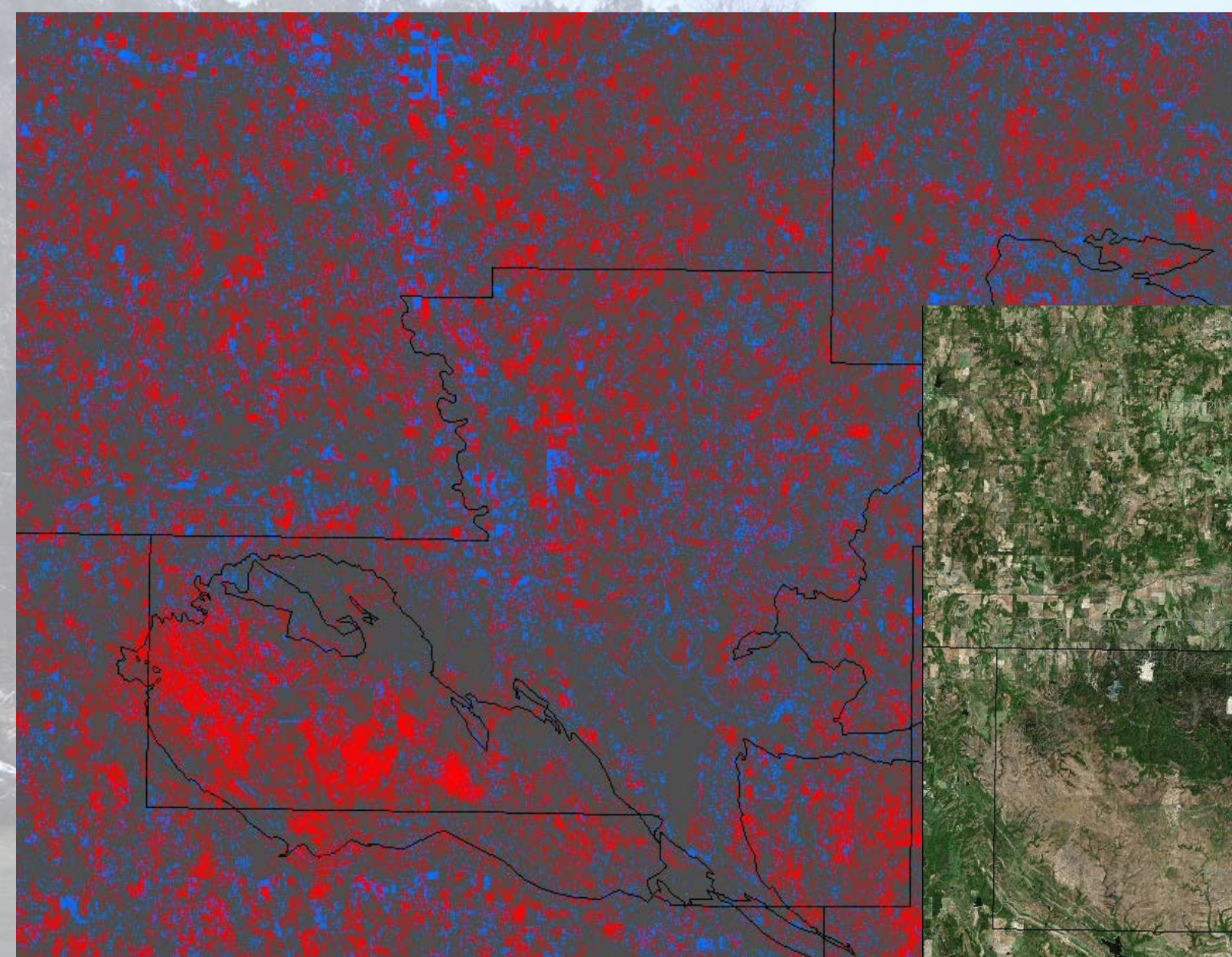
Difference Map showing areas of development from 1995 to 2005



Difference Map showing areas of development from 2005 to 2015



Close up of aquifer outcrop showing areas of misclassification



Future Recommendations

- Obtain higher **spatial/spectral** resolution imagery
- Create a **supervised** classification
 - Possible to use training data collected in field
 - Look at other supervised methods outside of ArcGIS
- Determine other methods to analyze potential detrimental impacts to aquifer and recharge area
 - Meeting with water CPASA, OWRB

Sources

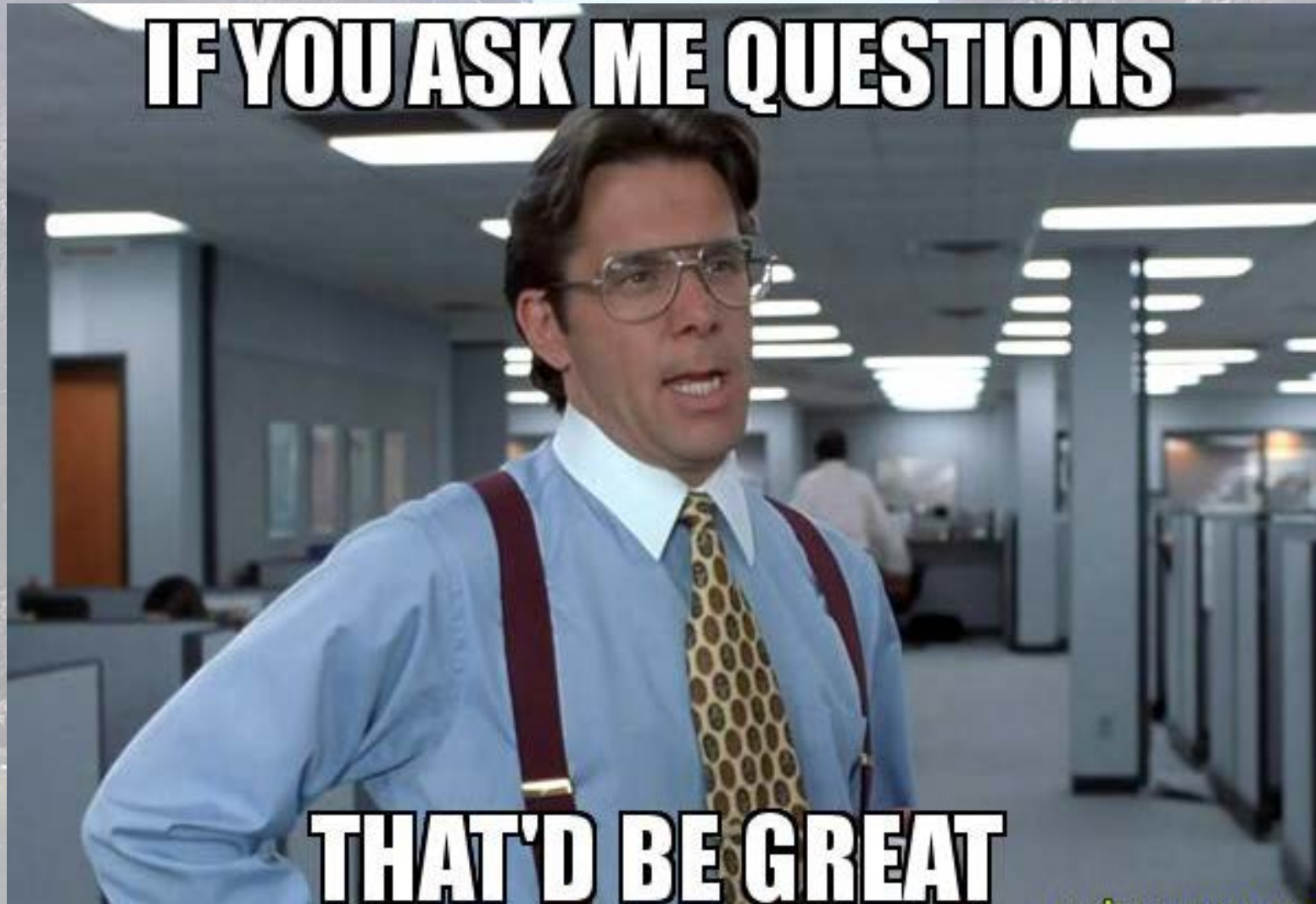
Blome, C. D., Christenson, S., Faith, J. R., Neel, C. R., Osborn, N. I., Pantea, M. P., & Puckette, J. (2011). *Hydrogeology and Simulation of Groundwater Flow in the Arbuckle-Simpson Aquifer, South-Central Oklahoma*. U.S. Department of the Interior; U.S. Geological Survey.

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U.S. Geological Survey . (2015). Retrieved from Earth Explorer : <http://earthexplorer.usgs.gov/>

IF YOU ASK ME QUESTIONS



THAT'D BE GREAT