# Dallas-Fort Worth Metroplex: Thirty Years of Urban Core Expansion Ms. Andi Hollier, Dr. Jennifer Jensen

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### BACKGROUND

Between 2010 and 2014, Austin, San Antonio, and Fort Worth were ranked among the fastest-growing large cities in the nation. Additionally, Houston, San Antonio, Dallas, Austin, and Fort Worth were ranked in the top 17 for most populous incorporated places in the United States; a 4-7 percent change for each city (Cohen 2015). With population growing at a steady incline, an evaluation of urban land use and land cover change for major metropolitan areas in Texas is paramount to understand how past growth may influence future projections. Currently, the US Geological Survey (USGS) provides a National Land Cover Dataset supplying urban land cover data and land use change information. This research will expand and improve on existing data by providing additional time steps and thematic map information, from Landsat imagery, to thoroughly document land cover change for the Dallas-Fort Worth metropolitan area within the last 30 years (1985-2015).

#### **DESCRIPTION AND JUSTIFICATION**

This study uses the Multi-Resolution Land Characteristics (MRLC) classification scheme with Landsat imagery (TM 5, ETM 7+, and L8 OLI) to classify land cover for the Dallas-Fort Worth Metroplex for four time steps between 1985 and 2015. A post-classification change detection analysis provides from-to information of land cover change.

Making this information available (published at

www.landchangesciene.txstate.edu) will benefit major businesses in making concise decisions for the Texas public that include: Land change science, urban planning, and water resources in the study area.

#### **METHODS**

- . Configure a study area prior to performing supervised classification: Extract Dallas-Fort Worth Metroplex polygon data from the US Census
- Bureau Geography Division shapefile of metropolitan areas, year 2014. Use the Feature Envelope to Polygon tool in Arc GIS 10.3.1 to create a
- bounding box around the metroplex. The new shapefile is projected to the coordinate system, WGS 1984, UTM Zone 14 North.
- Repeat steps 1-3 for all image dates (1985-2015).

2. Perform supervised classification with training data that includes five, level one, class codes: Water, Developed, Forest, Cultivated, Herbaceous. Training data is unique for each image.

- Spectral separability is determined using feature space plots for a graphical perspective and transformed divergence for a statistical method
- 3. Perform an Accuracy Assessment for each image.
- Search Count: 1024
- Number of Points: 150
- Distribution Parameters: Stratified Random
- Minimum Points: 30

\*Overall accuracy exceeds 80%

\*Kappa statistic > .71

4. Using the matrix union function, create a post-classification change detection map to provide a visualization of land cover change from 1985 to 2015.

RGB values from the National Land Cover Database 2011 are used as a template to produce the final change detection map.

5. Create a summary report of the matrix union that provides to and from class change statistics in ERDAS Imagine.

6. Interpret data provided in the summary report matrix.

## **RESULTS AND DISCUSSION**



Water To Developed To Forest To Herbaceous To Crops To Water Developed Forest Herbaceous Crops

• The series above are a product of the supervised classification learning algorithm. Each image is derived from unique training data and results in varying overall accuracies. Refer to Table 1. The 2015 image has the highest overall accuracy and kappa statistic.

• The 1985 image has very little urban development in contrast to the robust amount of developed pixels in 1990,1995 images. Although there was most likely an increase in growth within five years time, the intensity of growth shown here is due to the differences in training data. The 1985 image low intensity developed areas were classified as herbaceous or forest. In 1990, low intensity developed pixels are classified as urban. Using level two or three class codes would mitigate this matter.

Figure 3. Post-classification change detection from 1985 to 2015. Focus on the deep red and light pink color to see the advance in urban growth in the last 30 years.



REFERENCES Cohen, D.T. 2015. Population Trends in Incorporated Places: 2000-2013. U.S. Census Bureau. P25-1142.

NLCD 2011 citation: Homer, C.G., Dewitz, J.A., Yang, L., Jin, S., Danielson, P., Xian, G., Coulston, J., Herold, N.D., Wickham, J.D., and Megown, K., 2015, Completion of the 2011 National Land Cover Database for the conterminous United States-Representing a decade of land cover change information. Photogrammetric Engineering and Remote Sensing, v. 81, no. 5, p. 345-354



Figure 2. Results of performing an accuracy assessment for each image date using Google Earth and the original Landsat Surface Reflectance products as a reference.

| 2015 "to" class  |                  |                   |                |                  |                  |                |
|--|------------------|-------------------|----------------|------------------|------------------|----------------|
|  |                  | Developed         | Open Water     | Herbaceous       | Forest           | Cultivated     |
|  |                  | Hectares (%)      | Hectares (%)   | Hectares (%)     | Hectares (%)     | Hectares (%)   |
| Unchanged  |                  |                   |                |                  |                  |                |
| 1985 "from" class  | Hectares         | 88834.60          | 32555.61       | 306442.17        | 69908.76         | 5213.60        |
|  | <mark>(%)</mark> | (71.42)           | (97.04)        | (58.41)          | (66.70)          | (4.06)         |
|  | Changed          |                   |                |                  |                  |                |
|  | Developed        |                   | 1608.93 (1.29) | 28730.61 (23.10) | 4410.09 (3.55)   | 794.34 (0.64)  |
|  | Open Water       | 415.35 (1.24)     |                | 215.46 (0.64)    | 341.19 (1.02)    | 22.32 (0.07)   |
|  | Herbaceous       | 145949.13 (27.82) | 5107.86 (0.97) |                  | 65135.88 (12.42) | 1989.72 (0.38) |
|  | Forest           | 10917.36 (10.42)  | 3522.96 (3.36) | 20074.86 (19.15) |                  | 379.26 (0.36)  |
|  | Cultivated       | 52217.82 (40.65)  | 948.24 (0.74)  | 66273.93 (51.59) | 3797.91 (2.96)   |                |
| Table 1. To and from class change statistics. Percentages refer to the change from one class in 1985 |                  |                   |                |                  |                  |                |









2010

2015

to another class in 2015. The same concept is applied to hectares of land cover change.