LANDSAT IMAGE-BASED LULC CHANGES OF SAN ANTONIO, TEXAS USING ADVANCED ATMOSPHERIC CORRECTION AND OBJECT-ORIENTED IMAGE ANALYSIS APPROACHES.

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Specific Objectives

- to produce accurate and reliable results regarding LULC changes in the San Antonio area between 1985 and 2003 using Landsat TM images,

- to examine the advances of radiative transfer model based atmospheric correction and object-oriented classification method.
Study area & dataset

Bexar County
Study area & dataset

- **San Antonio**
  - 8th most populous city in the US
  - Population growth is 2% per year in the last decade.

- **Landsat TM images**
  - 10-05-1985 & 10-23-2003
  - Path27/Row40
  - 0% Cloud cover
  - Long 98.82, 98.21W
  - Lat 29.68, 29.17N.
Methodology

Input image → Pre-processing → FLAASH™ → Image segmentation, Object-based Classification → Accuracy assessment → Change detection → eCognition™
Atmospheric Correction - FLAASH

- FLAASH – Fast Line-of-sight Atmospheric Analysis of Spectral Hypercubes
- Retrieves spectral reflectance
- Incorporates the MODTRAN4 radiation transfer code
- Can compensate for atmospheric effects more accurately
- Module input includes: elevation, scene coordinates, sensor type, flight date & time, aerosol distribution, water vapor conditions, etc.
Image Classification (eCognition™)

- Multiresolution Segmentation
  - Subdivision of an image into separated regions
  - Based on adjustable criteria of homogeneity (shape, texture, etc.)
- Object-based Classification
  - Standard nearest neighbor approach
  - 7 classes: Fallow land, Cropland, Forest, Grass, Road/Pavement, Residential, and Water.
Multiresolution Segmentation

Multiresolution segmentation (Level 1)
Scale parameter = 25
Shape factor = 0.8
Compactness = 0.7
Smoothness = 0.3
Accuracy Assessment

- Error matrix based on samples

<table>
<thead>
<tr>
<th>Year</th>
<th>1985</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Accuracy</td>
<td>0.9382</td>
<td>0.9169</td>
</tr>
<tr>
<td>KIA</td>
<td>0.9237</td>
<td>0.8984</td>
</tr>
</tbody>
</table>

Results of accuracy assessment
## Results

<table>
<thead>
<tr>
<th></th>
<th>Fallow land</th>
<th>Forest</th>
<th>Grass</th>
<th>Roads/Pavement</th>
<th>Residential</th>
<th>Water</th>
<th>Cropland (Active crops)</th>
<th>Row Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified</td>
<td>0.015</td>
<td>0.017</td>
<td>0.000</td>
<td>0.031</td>
<td>0.007</td>
<td>0.000</td>
<td>0.000</td>
<td>99.329</td>
</tr>
<tr>
<td>Water</td>
<td>0.229</td>
<td>0.847</td>
<td>0.192</td>
<td>0.390</td>
<td>0.244</td>
<td>74.438</td>
<td>0.211</td>
<td>99.964</td>
</tr>
<tr>
<td>Cropland (Active crops)</td>
<td>8.934</td>
<td>2.981</td>
<td>11.080</td>
<td>2.990</td>
<td>1.753</td>
<td>0.559</td>
<td>14.728</td>
<td>99.999</td>
</tr>
<tr>
<td><strong>Class Total</strong></td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
</tr>
<tr>
<td><strong>Class Changes</strong></td>
<td>60.165</td>
<td>41.011</td>
<td>69.402</td>
<td>59.263</td>
<td>35.765</td>
<td>25.562</td>
<td>85.272</td>
<td></td>
</tr>
<tr>
<td><strong>Image Difference</strong></td>
<td>-18.556</td>
<td>-22.891</td>
<td>90.650</td>
<td>6.916</td>
<td>24.925</td>
<td>27.838</td>
<td>130.895</td>
<td></td>
</tr>
</tbody>
</table>

Change detection statistics (area in percentage)
Results (contd.)

- Reduction in forest cover (-23%) with corresponding increases in residential land cover (25%), roads and pavements (7%) between 1985 and 2003).
- Reduction in fallow land (-18%) and increased farming (131%) in the same period.
- Surface water coverage increased (28%) probably due to a heavy rain episode.
Results (contd.)

Conclusions

- Results demonstrated the potential for accurate LULC change assessment with advanced atmospheric correction and object-oriented image analysis using moderate resolution satellite data.
- Pollution in Mitchell lake needs to be confirmed using current data.
- Increasing impervious surface coupled with reduction in forest cover in the San Antonio area, portends significant economic and ecological implications in the near future such as:
  - Increased stormwater flow
  - Increased atmospheric moisture
  - Urban heat island effect
Thank you!