

VIS Spectral Unmixing

V- Very
I- Inconvenient
S- Stuff

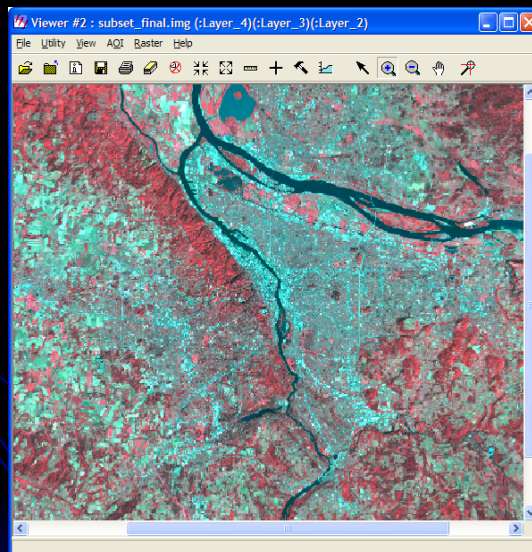
Introduction

- Purpose: To analyze urban biophysical surfaces through the use of spectral mixture analysis.
- Separate image into three classes:
Vegetation, Soil, and Impervious surface.

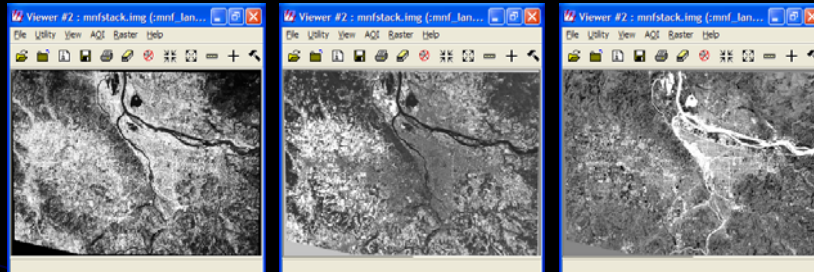
Processes

- Transformations:
 - PCA
 - MNF
 - Tasseled Cap
- Image Analysis:
 - What images will be useful in finding potential endmembers?
- Feature Space Analysis
 - Identifying Endmembers (Vegetation, Soil, High and Low Albedo)
- Fraction Image Calculation
 - Linear unmixing model.

Landsat TM image 2000



MNF Transformation

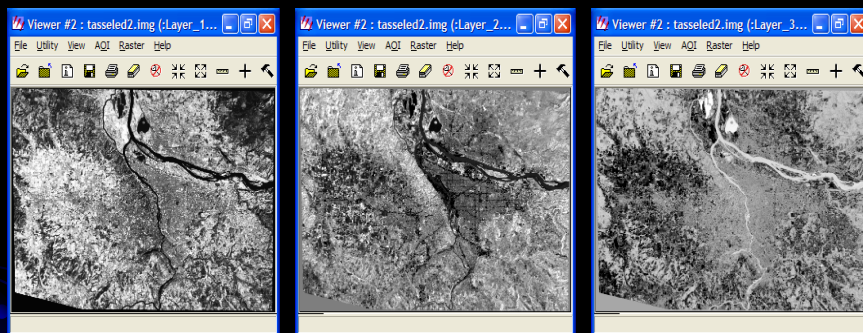


MNF Component 1

MNF Component 2

MNF Component 3

Tasseled Cap Transformation

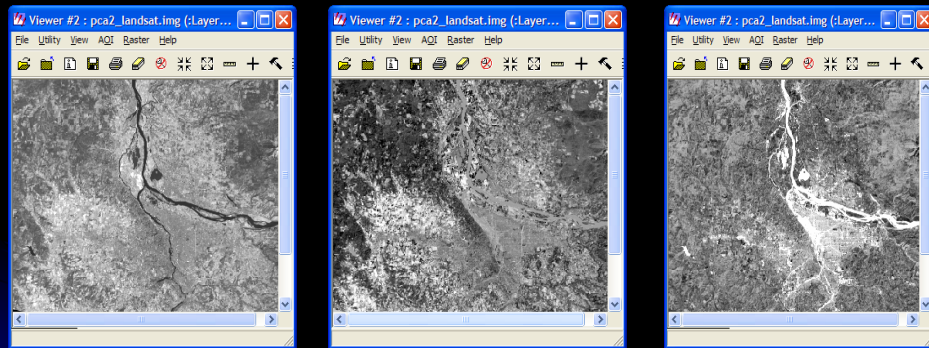


Brightness

Green

Moisture

PCA Analysis

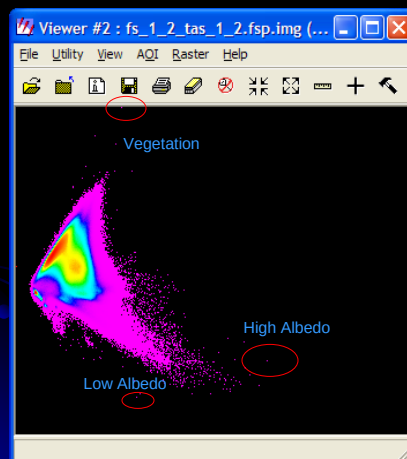


Component 1

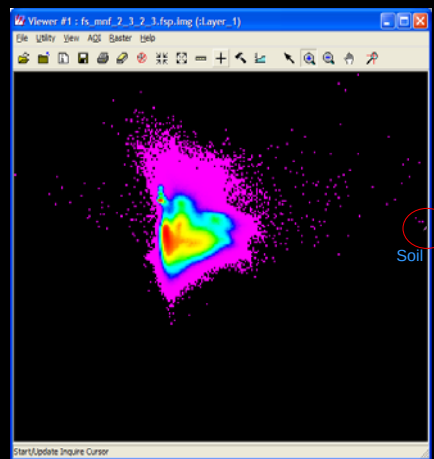
Component 2

Component 3

Endmember Selection

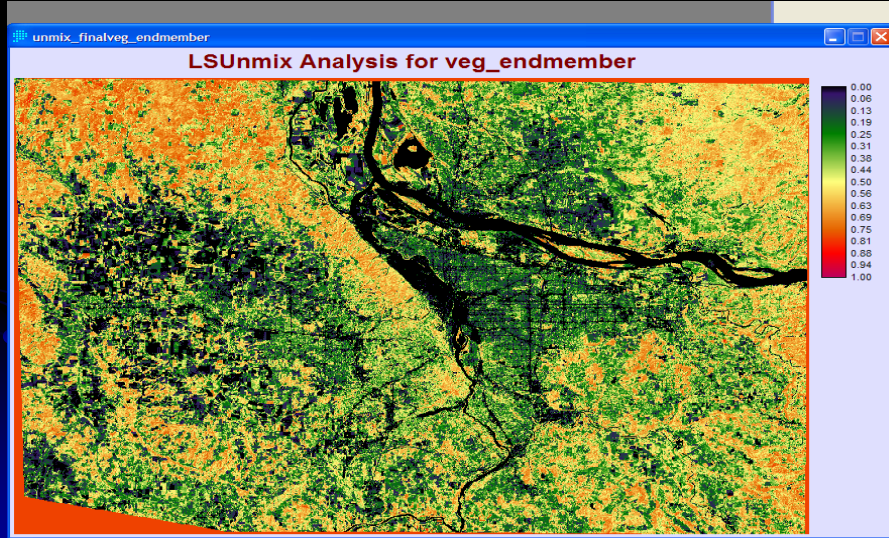


Tasseled Cap bands 1 and 2 FS



MNF Bands 2 and 3 FS

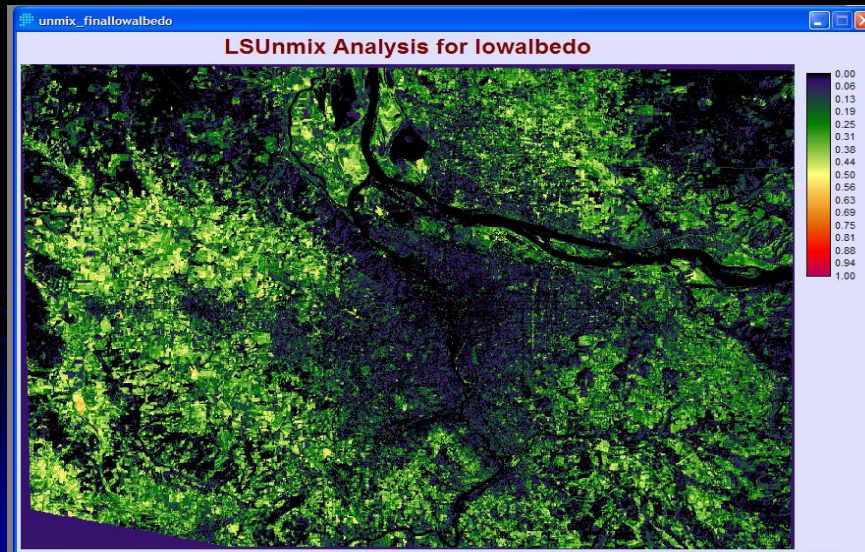
Vegetation Fraction Image



Observations

- Vegetation: Appears to have been successful.
- City has fairly low percentage
- Forest has the highest percentage
- Water shows up darkest along with patches of bare soil
- Residential areas are highly mixed

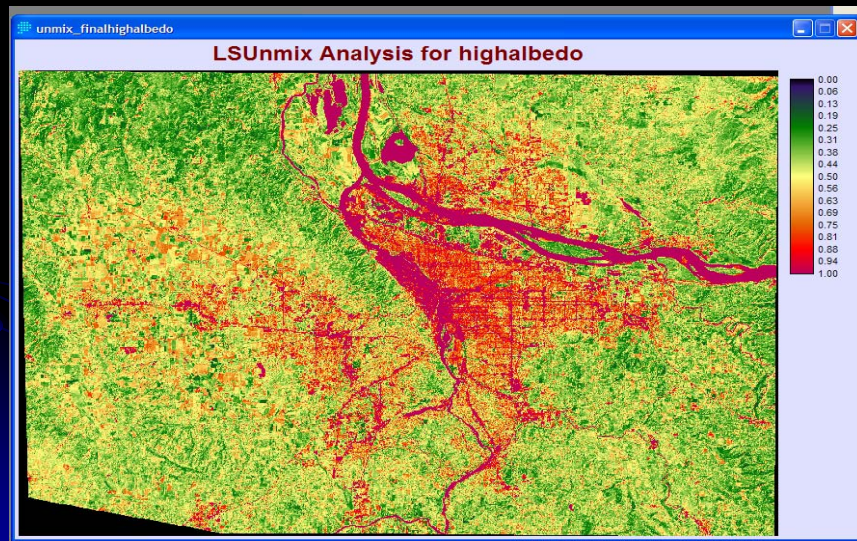
Low Albedo Fraction Image



Observations cont.

- Low Albedo: City and Residential show up as expected with low reflectance.
- Water shows up dark which is contrasting to what one would expect.
- Crop and Soil show up in the mid-range.
- Vegetation shows up as a low percentage which contradicts what is expected.

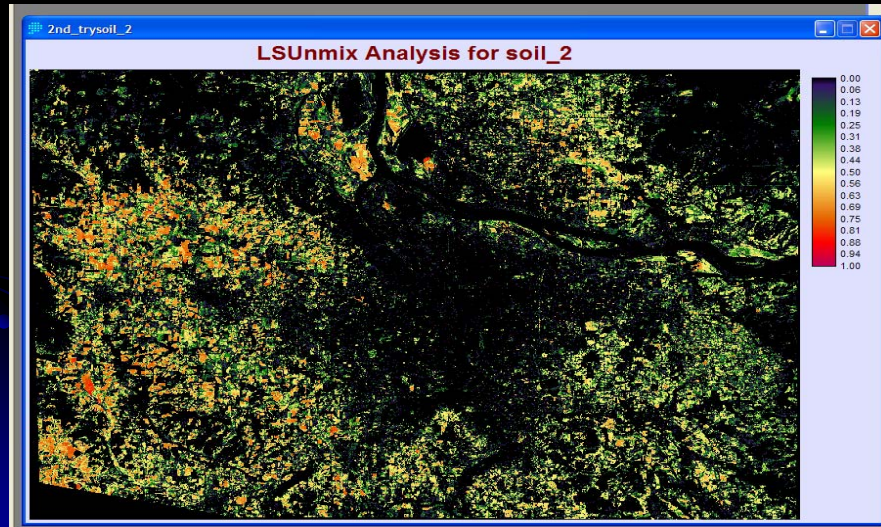
High Albedo Fraction Image



Observations cont.

- High Albedo: Roads and Urban areas showed up with the highest percentage
- Vegetation showed in general lower percentage.
- Bare Soil showed up in the higher range
- Water unexpectedly showed up as the highest values contradicting expected result

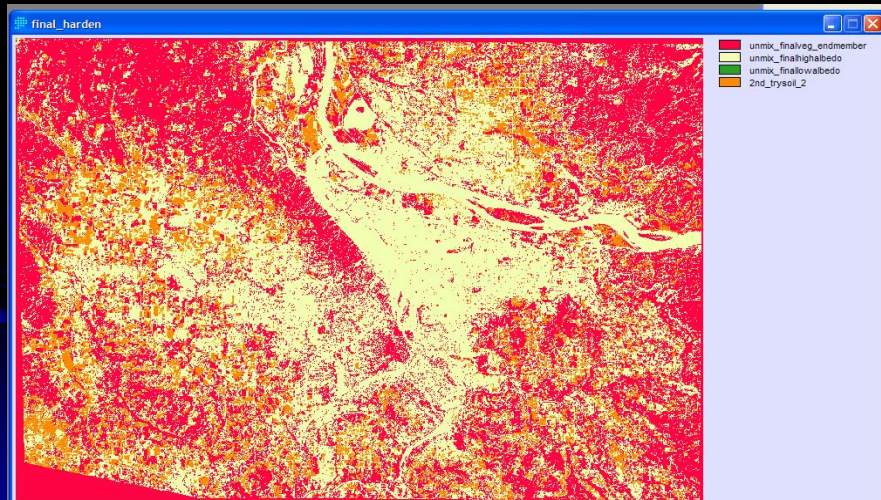
Soil Fraction Image



Observations Cont.

- Soil: The original endmember used showed no data on image.
- 2nd endmember image displayed was taken from using aerial photograph to pinpoint bare soil.
- Enmember chosen seemed to reflect fairly accurate representation of soil

Hardened Image



Limitations

- Unable to find adequate soil endmember
- Enmembers selected are questionably accurate.
- No final classified image could be obtained to perform accuracy assessment
- Water seemed to pose a problem in certain endmember classes.

Conclusions

- Results show a lot of potential in using this method to classify an image
- Choosing endmembers are the most crucial part in getting an accurate output
- One must spend a lot of time analyzing components feature space to determine best band combinations to bring out endmembers

Sources

- Weng Q, Lu D, Liang B. Urban Surface Biophysical Descriptors and Land Surface Temperature Variations. Photogrammetric Engineering & Remote Sensing. Vol. 72, No. 11, November 2006, pp 1275-1286.
- Wu C, Murray A. Estimating Impervious Surface Distribution by Spectral Mixture Analysis. Remote Sensing of Environment. Vol. 84, 2003, pp 493-505.