Upstream Environmental Project Review

Remote Sensing for Environmental Baselining and Monitoring

Oak Ridge National Laboratory

U. S. Geological Survey

Agricultural Research Service

Outline

- Background
- Objective
- Approach
- Osage County
- Data Analysis
- Conclusions

Background

Hyperspectral remote sensing can be used to rapidly assess present conditions and monitor environmental change at low cost.

Alternatives are: slow, expensive, and not comprehensive.

Field monitoring: $20,000/acre.
Hyperspectral remote sensing: $1/acre.

Objective

Develop hyperspectral remote sensing methods to identify areas impacted by oil production.

- **Collect airborne hyperspectral imagery.**
- **Identify distinct groups of similar spectra.**
- **Prepare geobotanical maps.**
- **Perform field validation.**

Approach

Paper: "A New Clustering Algorithm for Unsupervised Classification" submitted to IEEE Transactions on Geoscience and Remote Sensing.

	Number of Pixels
● Jornada field measurements:	211
● USGS Site B	12,740
● Zink Site 127	36,960
● TGP Site 122	49, 020
● Bluestem Site 134	104,160

Osage County, OK

Osage Indian Reservation.
38,500 oil wells since 1896.

1,480 (of 2,260) square miles are within a quarter mile of an oil well.
Many brine scars or weathered oil pits.

Tallgrass Prairie, USGS, John Zink Ranch, and Bluestem Ranch.

HyVista

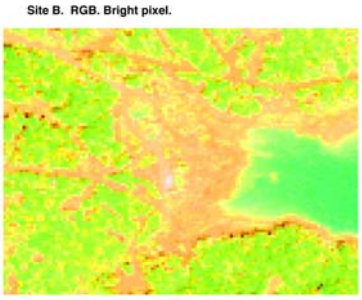
On Oct. 12, HyVista imaged three regions with overlapping strips of 126 band hyperspectral data.

Tall Grass Prairie	**18 km^2**
Bluestem	**61 km^2**
USGS + Zink	**106 km^2**

On Oct. 27 & 28, Field measurements by team.

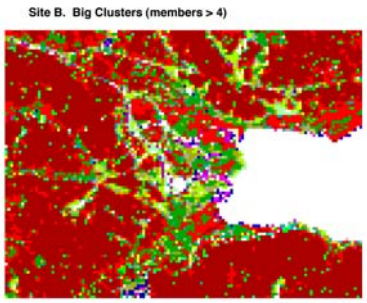
On Nov. 10, 5 DVD with 14.4 Gigabytes of data.

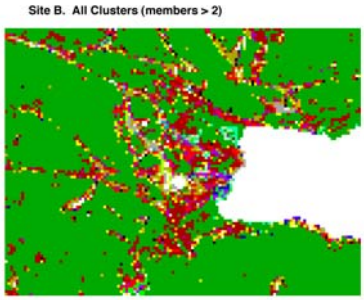
USGS Site B



Site 127 & Site B

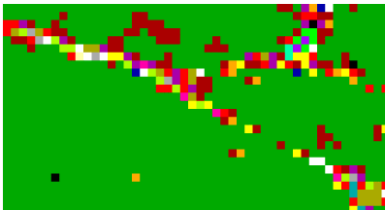
USGS Site B





38 Clusters

USGS Site B



Road: 2.

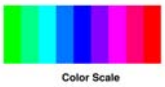
Both: 7.

Site B: 9.

Road different than brine scar.

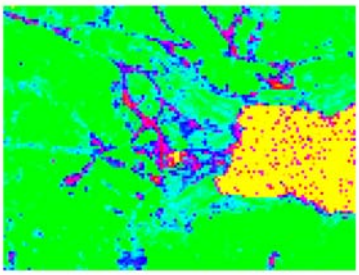
USGS Site B

Correlation with Root Vectors

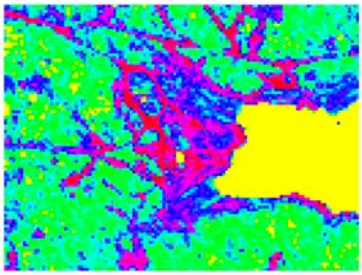


Color Scale

Site B. CC Row 0. Cut 0.40 Jan 9



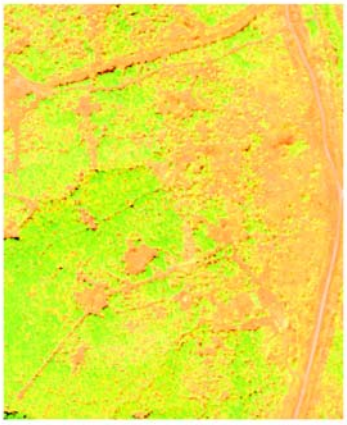
Site B. CC Row 22. Cut 0.35 Jan 9



Zink Site 131

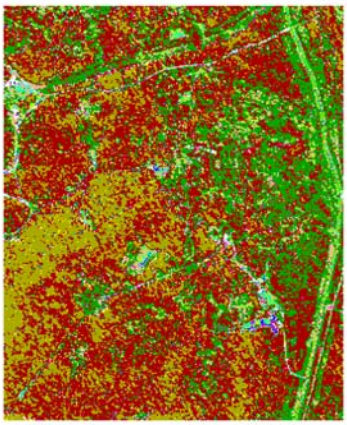
Zink Site 131

Zink 131. RGB. Bright pixel.



Zink Site 131

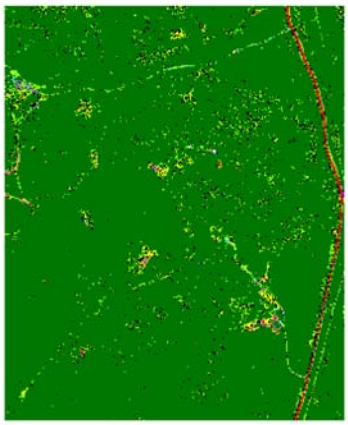
Zink 131. Big Clusters (members > 18)



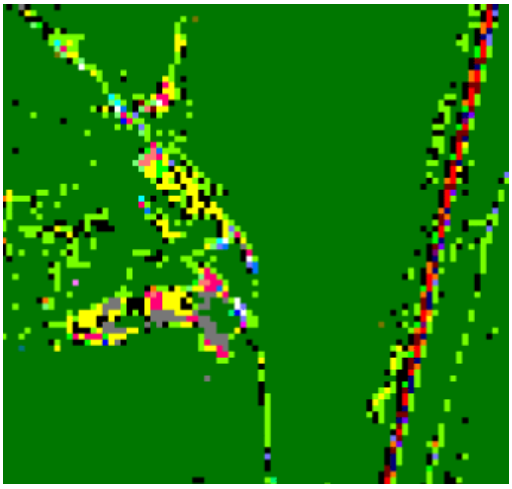
49

Clusters

Zink 131. All Brown Clusters (members > 2)



Zink Site 131



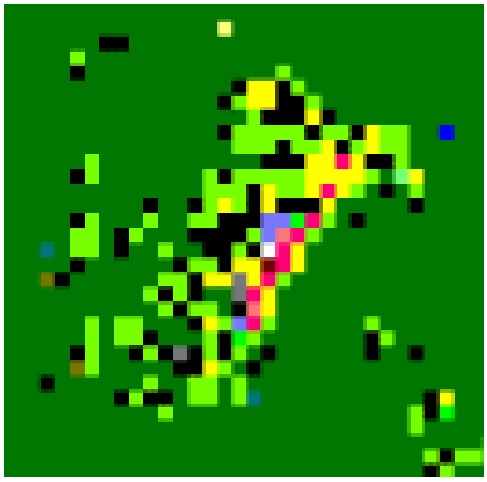
Production **Road**

Production: Magenta, Peach, Grey.

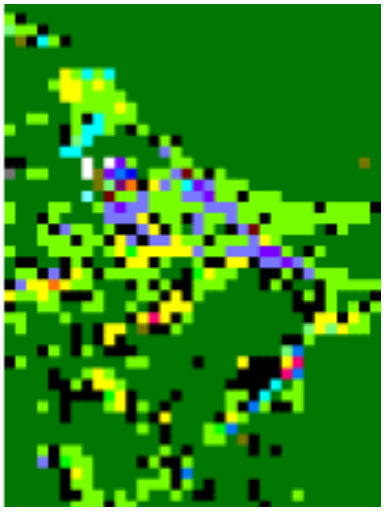
Road: Brown, Red, Orange, Blue.

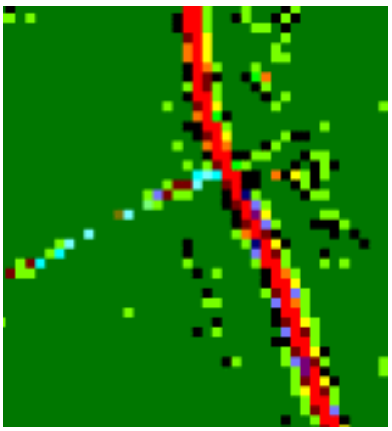
Both: Green, Black, Yellow.

Zink Site 131

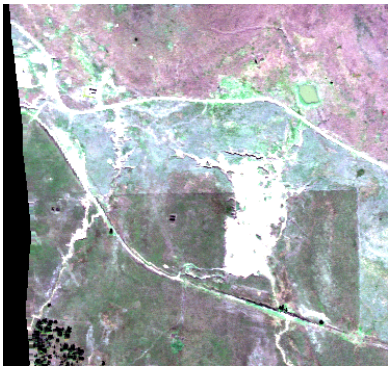


Zink Site 131



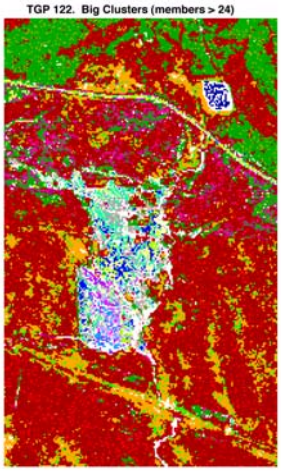


TGP Site 122

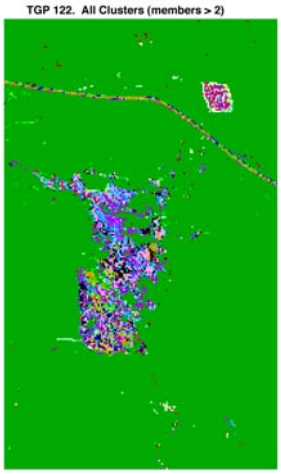


Site 122 & 120

TGP Site 122



74 Clusters



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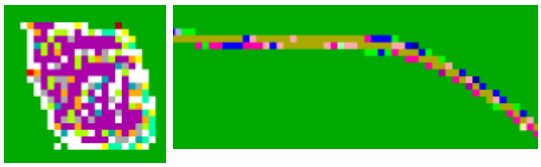
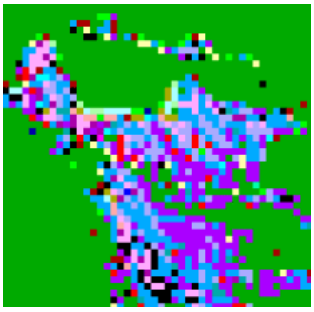


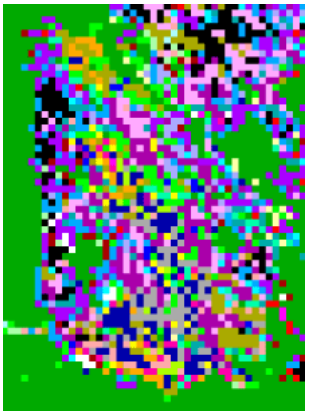


Pond

Road

Scar NW

Scar SW



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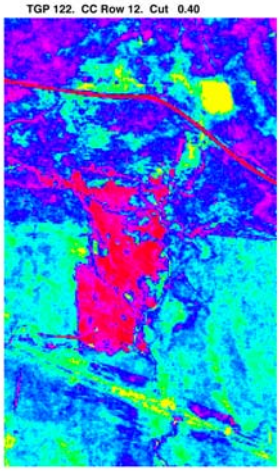
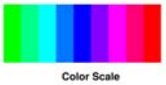
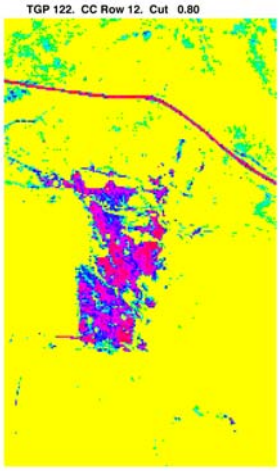


CC Row 12

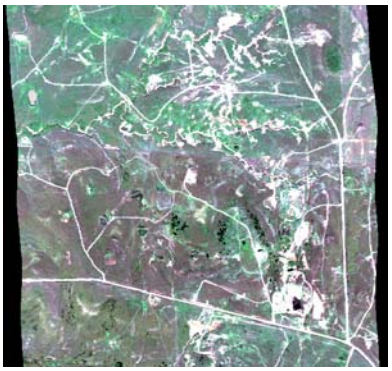
Cut 0.40

Cut 0.80





Bluestem 134



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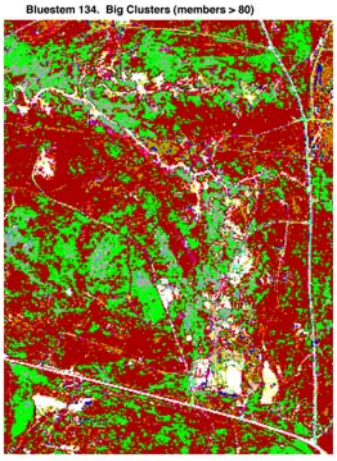
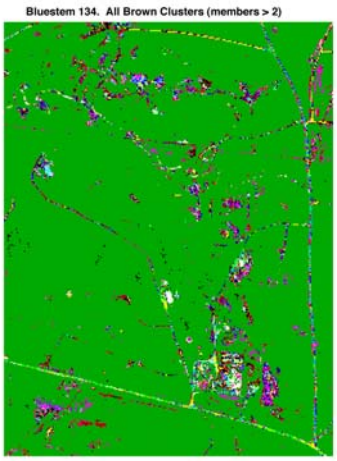
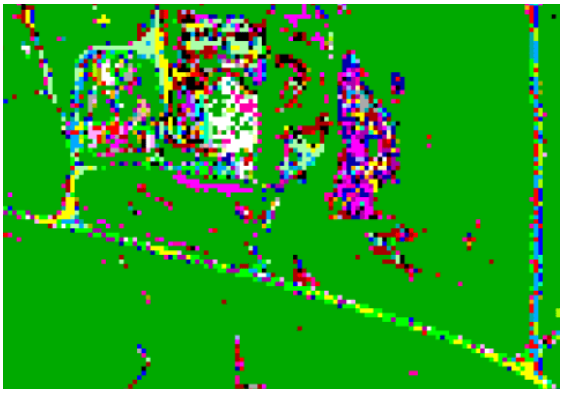


124 Clusters



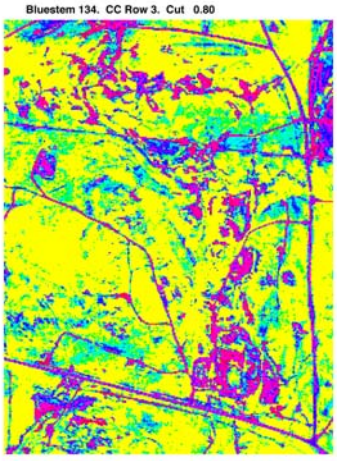
BlueStem 134

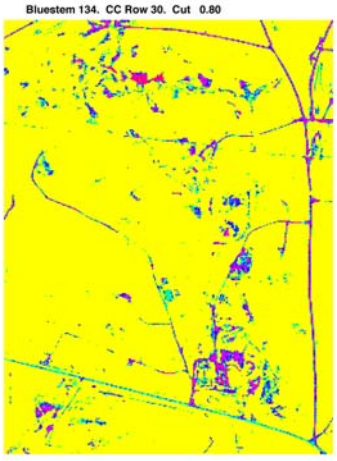
Site 133



Site 134 Pit

Bluestem 134





Conclusions

- Collected airborne hyperspectral imagery.
- Identified distinct groups of similar spectra.
- Prepared geobotanical maps.
- Can distinguish brine scars from roads.
- Next: Perform field validation.