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A Multi-angular and Multi-temporal Study using CHRIS Hyperspectral Imagery

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Objective

A multi-angular and multi-temporal study of vegetation and soils using CHRIS hyperspectral data

Goals:

1. To examine the variations in spectral directional reflectance of vegetation (cotton)
2. To study spatial variability of soil spectra.
3. To correlate a selection of indices from different times and different angular measurements

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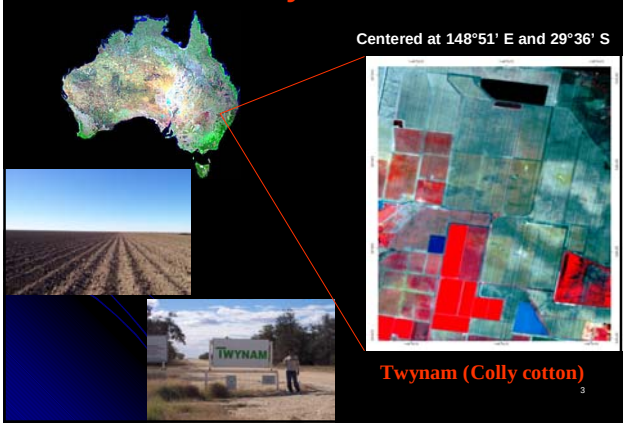
Field Study Site



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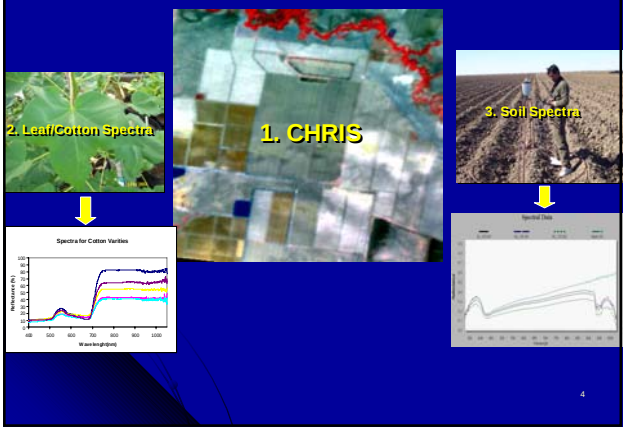
Images and Spectral Data Collection



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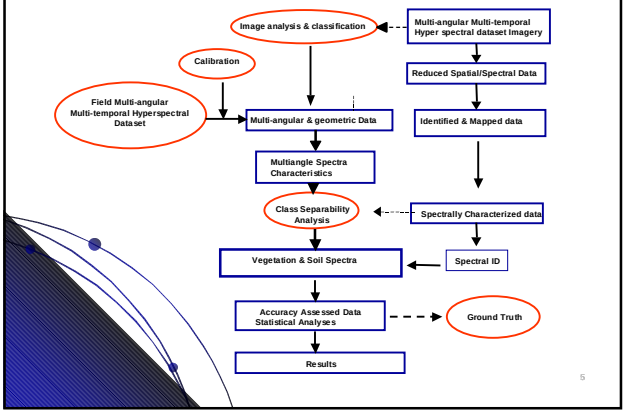
METHODOLOGY



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CHRIS Multi-Angle Image Data Analysis

- ❑ Statistical analysis of image data (surface reflectance)
- ❑ Spatial analysis
  - Registration/geo-correction, ROI
- ❑ Spectral Analysis
  - End-member collection
  - Spectral library creation
  - Classification/spectral Mapping – e.g MNF, SAM, PPI, Conti. Removed,
  - Index calculations
- ❑ Multi-temporal analysis
- ❑ Functional Data Analysis (FDA)

5 images

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Assumption of using Multi-angular CHRIS

- Different angle of acquisition has the different response and illumination.
- Multi-angular image can effect the spectral analysis results.
- CHRIS can be treated as Functional Data
- How BRDF effect on vegetation and soil.

? How this effect, let we explore early findings the dataset analysis results.

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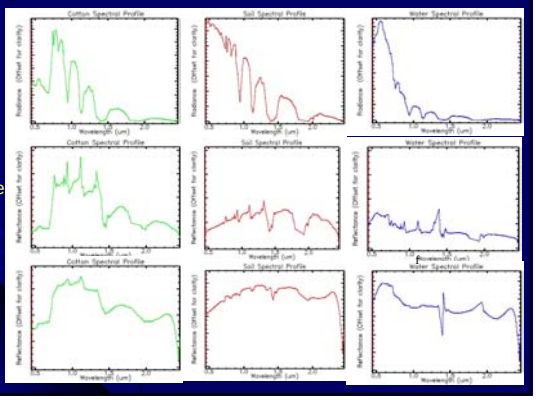
INITIAL RESULTS

- Atmospheric correction

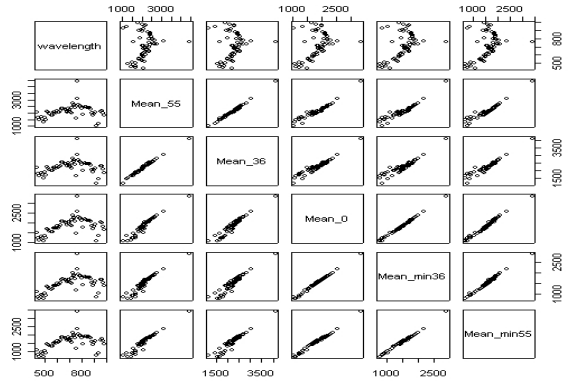
Radiance

Reflectance

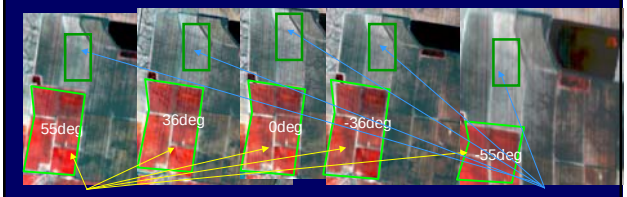
Reflec. +EFFORT

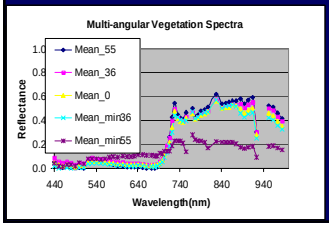


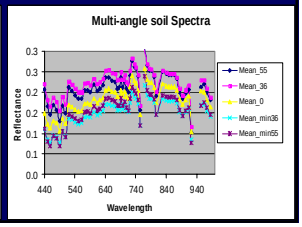
- Multi-angular Data Plot (soil)



- Multi-angular Spectral Signature







- Spectral Endmember Mapping

- Minimum Noise Fraction (MNF) to determine inherent image data
- Pixel Purity Index (PPI) to determine “pure spectra pixels”
- Spectral Angle Mapper (SAM) to classify spectra to match reference
- Mixture Tuned Matched Filtering (MTMF) to performs matched filtering to add “infeasibility image result”

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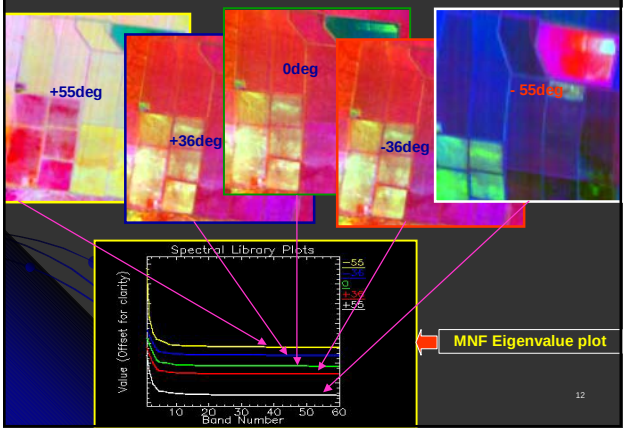
- Minimum Noise Fraction (MNF) for first 3 bands



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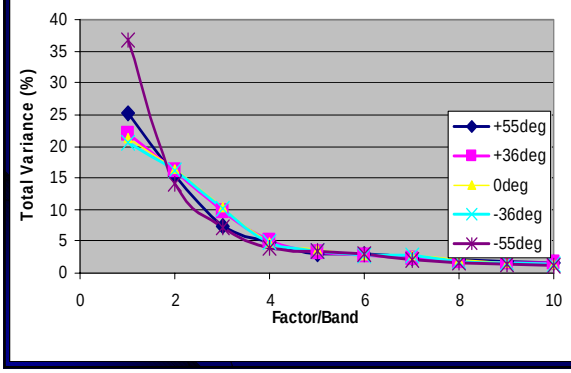
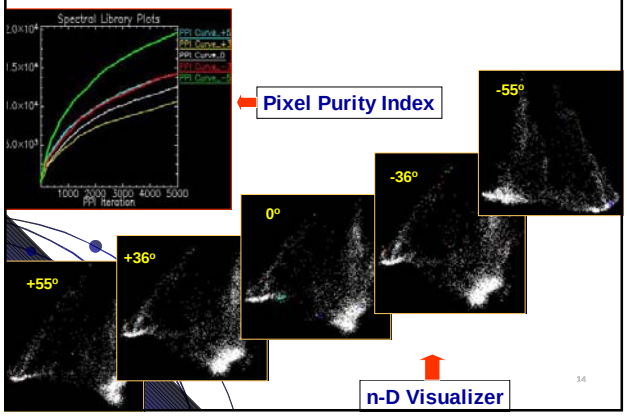
- MNF continued…

Percentage of Total Variance of First 10 factors of 60 MNF Bands

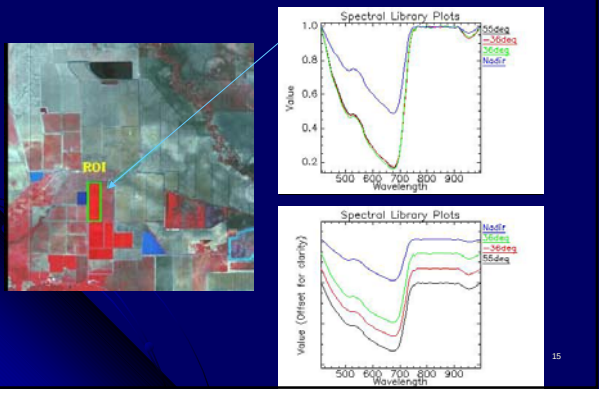


- PPI & n-D Visualizer

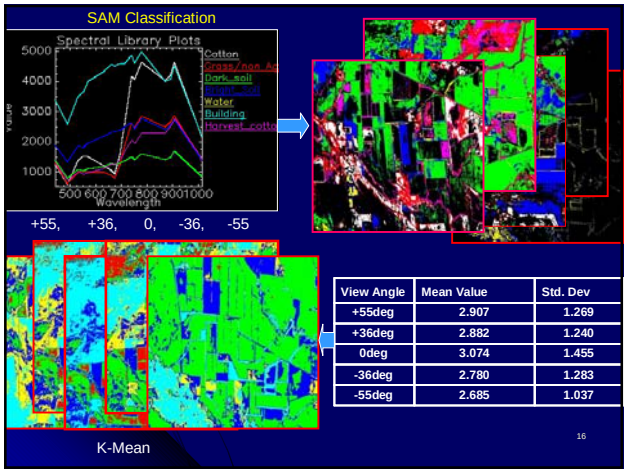
Multi-angle CHRIS Dataset



- Continuum Removal of Multi-angle dataset

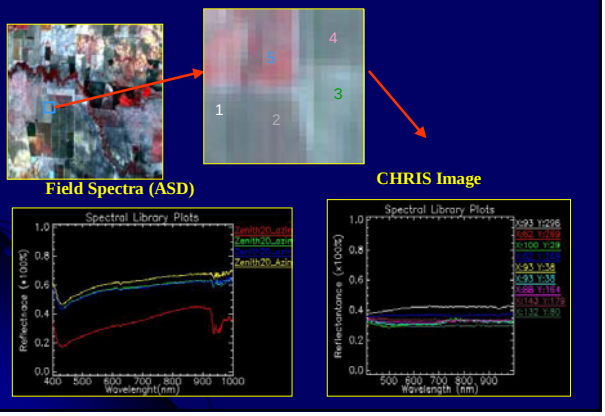


SAM Classification

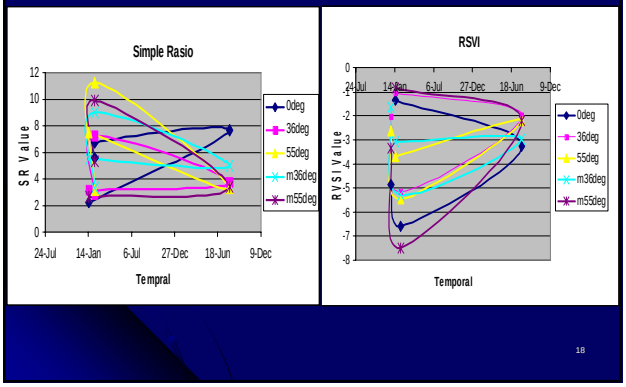


View Angle	Mean Value	Std. Dev
+55deg	2.907	1.269
+36deg	2.882	1.240
0deg	3.074	1.455
-36deg	2.780	1.283
-55deg	2.685	1.037

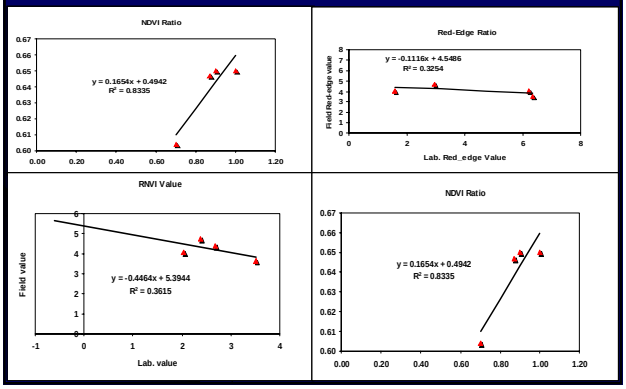
- Spectral Variation Within Paddocks (Soil)



-Multi-temporal Selected Index Value



Correlation of Vegetation Indexes for field spectra, laboratory spectra



CONCLUSION

CHRIS Multi-angle dataset:

- The initial investigation has shown the 'angular-signature' variation and well explored.
- Provide alternative classifications
- Could provide better classification results
- Can be used for BRDF studies
- Data function analysis possible

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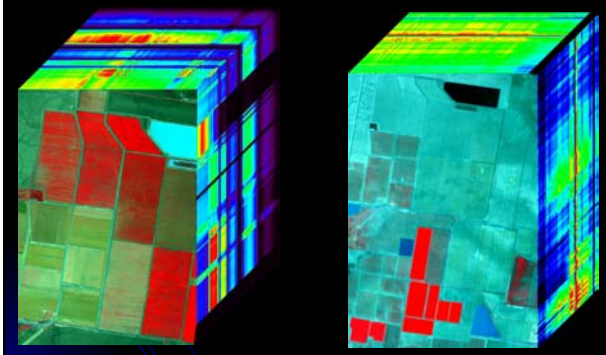
The "Hyperspectral Cube" of Colly Cotton Site



HyMap (126 channels)
Airborne Hyperspectral

"CHRIS" (62 Channels)
Space-borne Hyperspectral

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