

Oakville, Ontario

**Hyperspectral Imagery Analysis
for EAB Management**



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Agenda

- Project Overview
- Technology Overview
- Field Data Collection and Imagery
- Ash (*Fraxinus*) Mapping Status
- EAB Infestation Mapping Status
- Next Steps and Delivery

Project Overview

Purpose/Scope: aide Oakville in EAB management by collecting hyperspectral imagery, field spectra, and analyzing the data to produce GIS locations of ash (*Fraxinus*) and more

Deliverables:

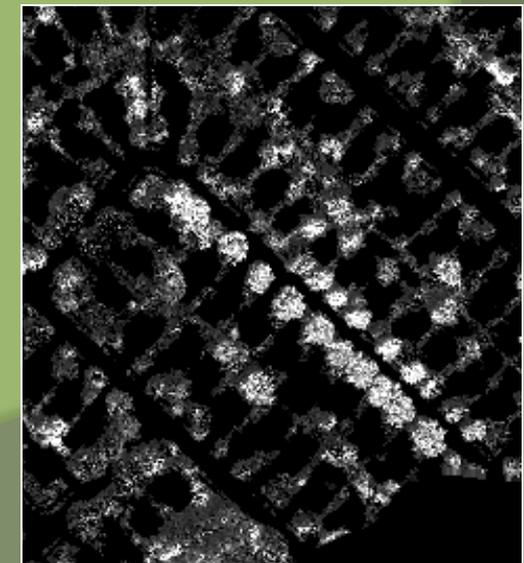
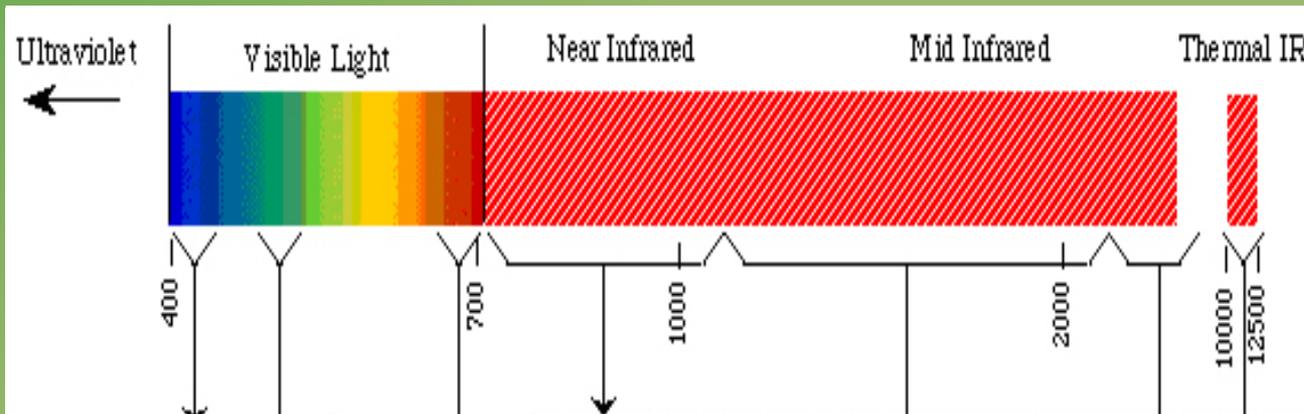
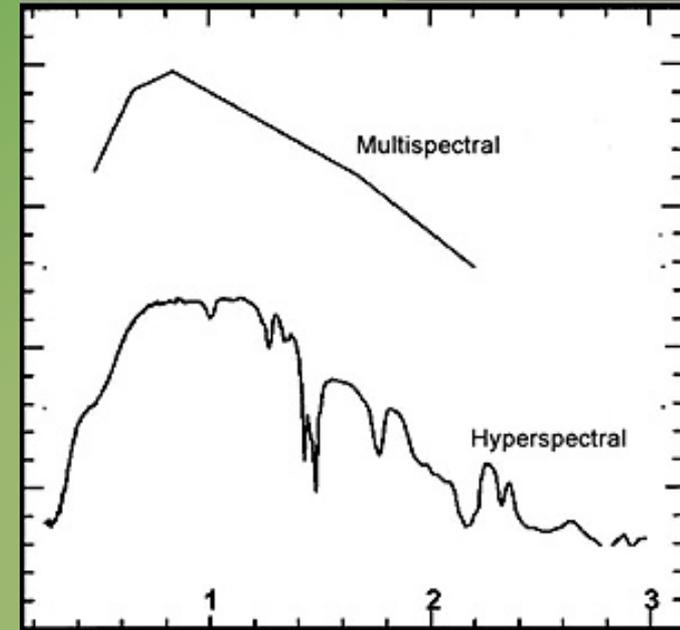
- Ash locations and EAB infestation hot spots in GIS format
- Imagery: hyperspectral and 4-band imagery
- 2010 Urban Tree Canopy (UTC) Assessment (compare w/2005)
- Report, metadata, accuracy assessment and PowerPoint

Status:

- Imagery, Field Work and Initial Classification are complete
- Initial Iterations of Ash and EAB Infestation
- Additional Training Samples and Accuracy Verification

HSI Technology Overview

- “Narrow band mapping”
- High Spectral Resolution: The measure of a remote sensing instrument’s power to resolve features in the electromagnetic spectrum.



Field Campaign Overview

Dates: 19-22 July 2010

Area: 5 sites, 40 trees

Equipment: ASD Spectrometer

Purpose: gather spectral signatures on ash, EAB and background features. Gain familiarity with area.



Field Campaign Overview

The screenshot displays the Intterra Situation Analyst interface. The main map shows a street grid in Oakville, Ontario, with several yellow circular markers indicating field campaign locations. The markers are located at various points, including one near the intersection of 8th Line and Trafalgar Rd, another near 3rd Line and Spicers Rd, and others in the northern and eastern parts of the map. Four inset windows provide aerial views of specific areas: the top-left inset shows a residential area with a cluster of markers; the top-right inset shows a residential area near a road intersection; the bottom-left inset shows a parking lot area with several markers; and the bottom-right inset shows a green field area with several markers. The software interface includes a menu bar (File, Edit, View, History, Bookmark), a toolbar with navigation and search icons, and a sidebar on the left with a 'layers' panel and a list of loaded files: 'New072110gps_kml.kml', 'New071910gps_kml.kml', and 'New072010gps_kml.kml'. The bottom status bar reads 'Read server: arcgisonline.com'. Navigation and tool buttons are visible on the right side of the map.

Field Spectra Signature Collection

Collection of spectral signatures using hand-held spectrometer.

BLUE – Construction Asphalt
SEA GREEN – Sage Brush
GREEN – Lawn Grass
ORANGE – Brown silty loamy soil
YELLOW – Pinyon Pine

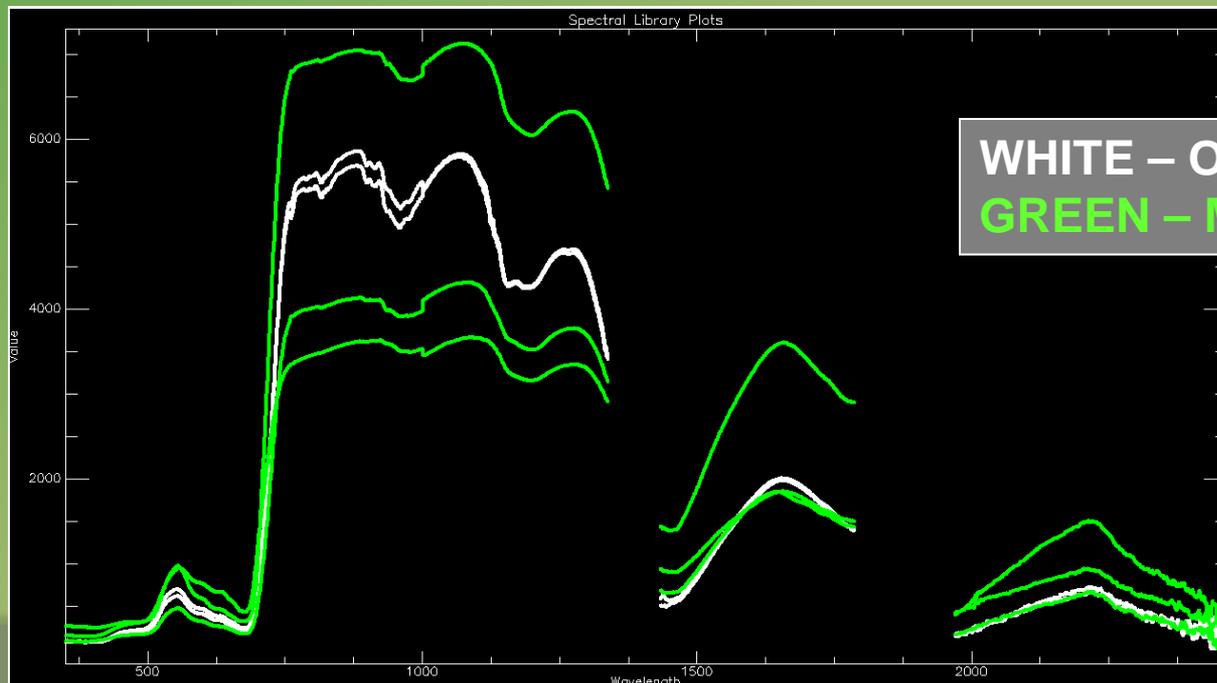
Reflectance
(amount of
light reflected
in each
wavelength)



Assessment of Spectra

Ash and background spectra similar to spectra observed in Milwaukee and Chicago.

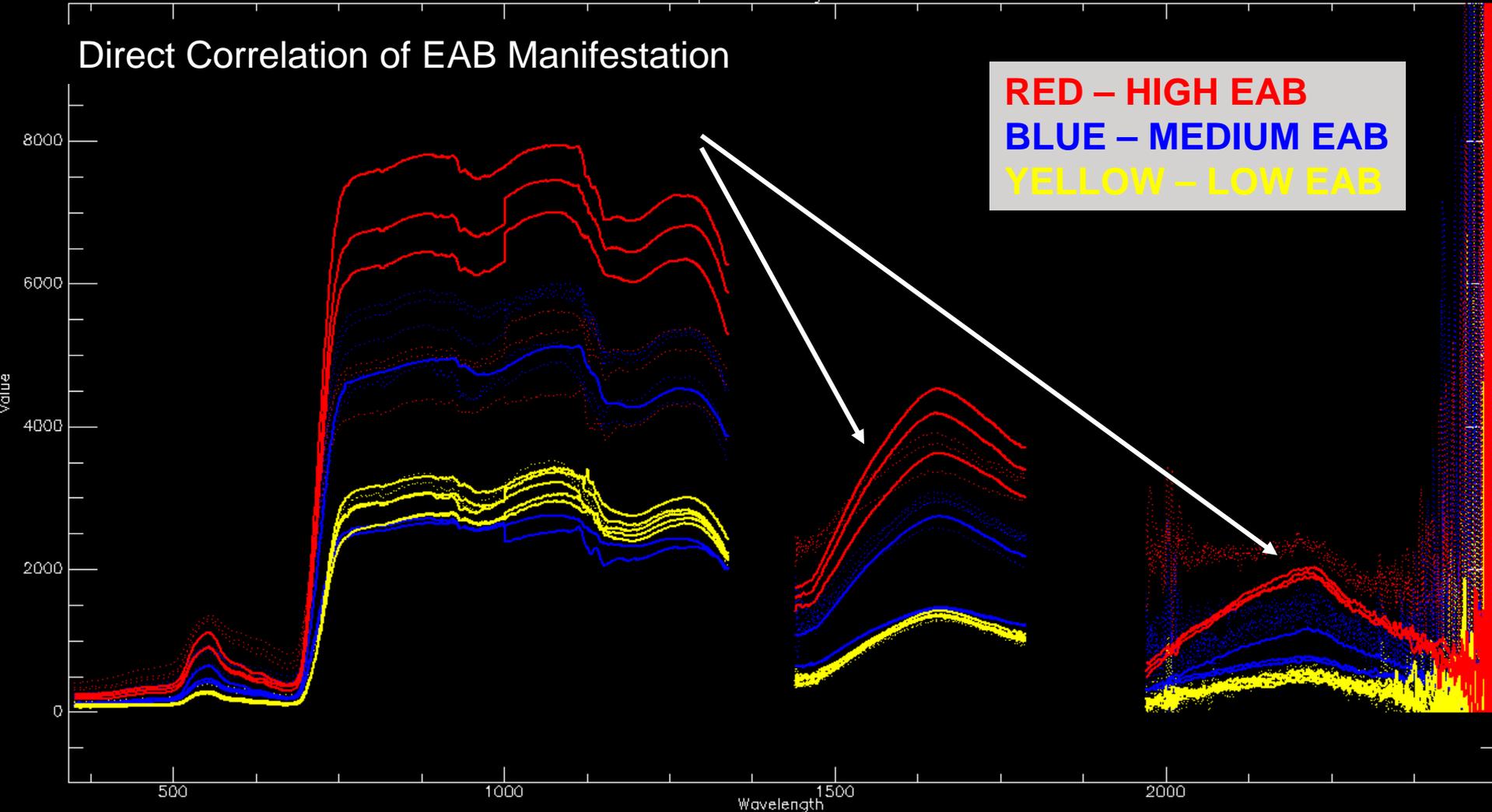
- Same latitude and conditions
- Similar background species



Assessment of Spectra - EAB

Spectral Library Plots

Direct Correlation of EAB Manifestation



Note - 'DOTTED' spectra are additional spectra collected during off-hours/rain. Included to demonstrate that overall trend still apparent

Field Collection Summary

Field campaign (hand-held spectrometer):

- Confirms spectral response of Ash vs Background as similar to projects in Wisconsin and Illinois
- Supports potential for correlation between SWIR spectral response and EAB infestation based on high vs. low

Next Step:

- Exploration of airborne spectral data to determine if separation and correlation are evident

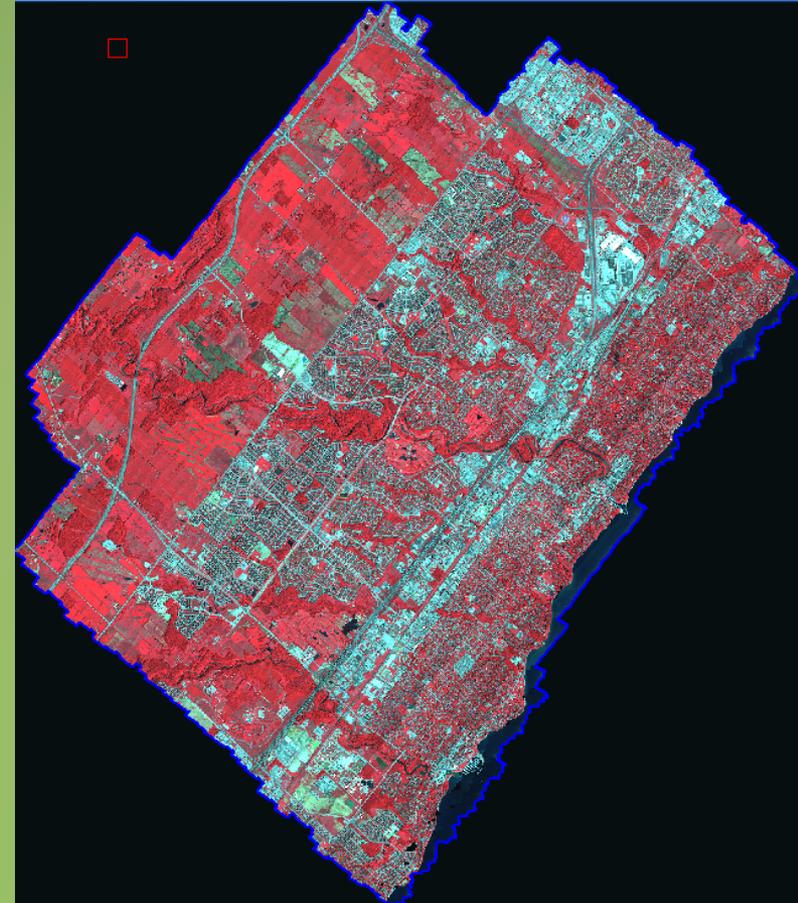
Hyperspectral Collection Specifics

Aerial Collection

- Collection days: 7/22, 7/26, 7/29, 8/1
- Flight Lines: 54
- Nominal Parameters: 1m GSD, 30% overlap, 360 spectral bands

Data Processing

- Radiance and Reflectance
- Georeferencing Information



Initial Ash Analysis

2nd Interim Data Results

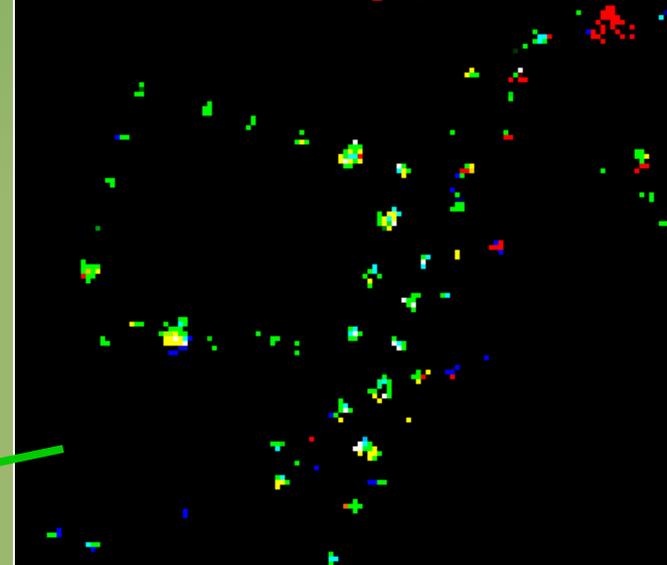
Flight Lines 06, 30, 31, 32, 41, 42, 43

Progress of Ash Detection:

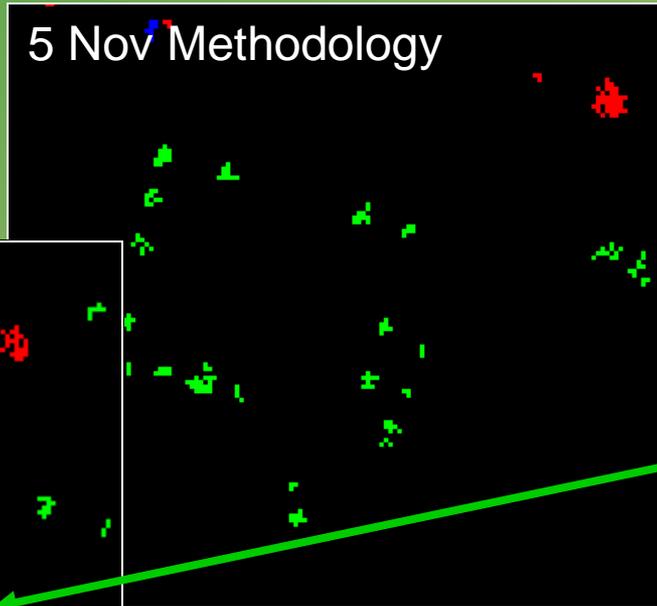
- 31 Oct Methodology: Reflectance
- 5 Nov Methodology: Spectral subset to discriminate Honey Locust and Silver Maple from Ash.
- 28 Nov Methodology: Switch from 3 Ash Signatures (generic, green, white) to single (combined green and white, no generic)

Ash Detection (FL31)

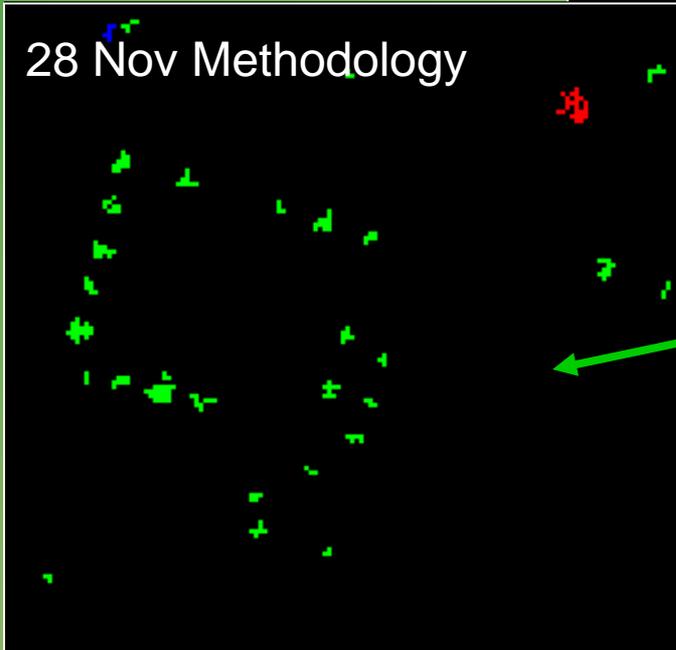
31 Oct Methodology



5 Nov Methodology



28 Nov Methodology



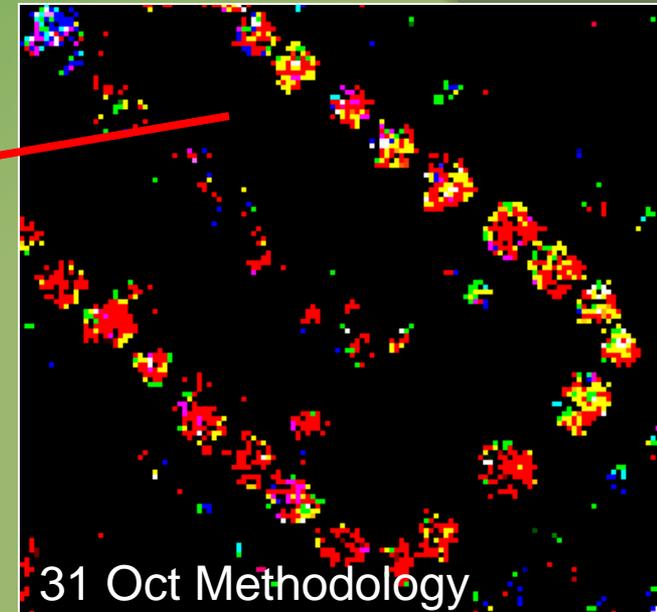
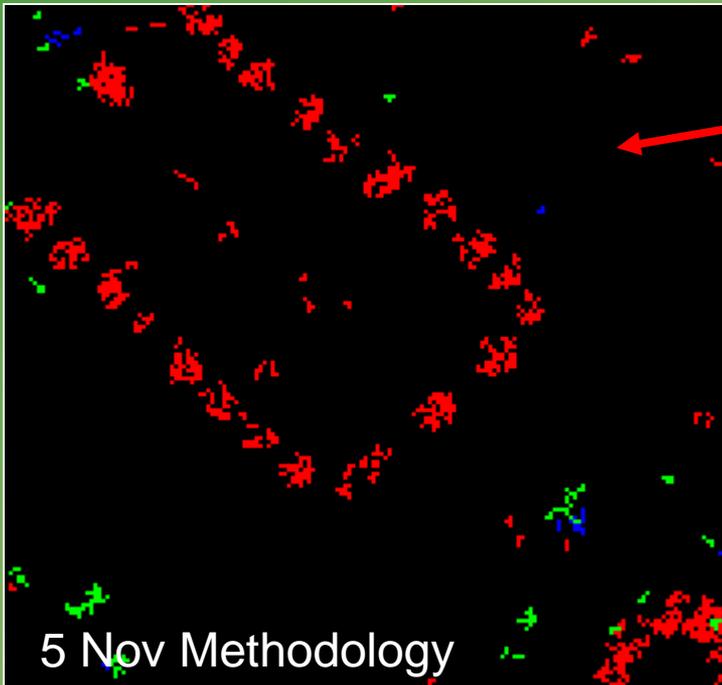
Improved
Separation of Ash
Trees

GREEN – Ash
RED – Honey Locust
BLUE – Silver Maple

Small ash trees, park background



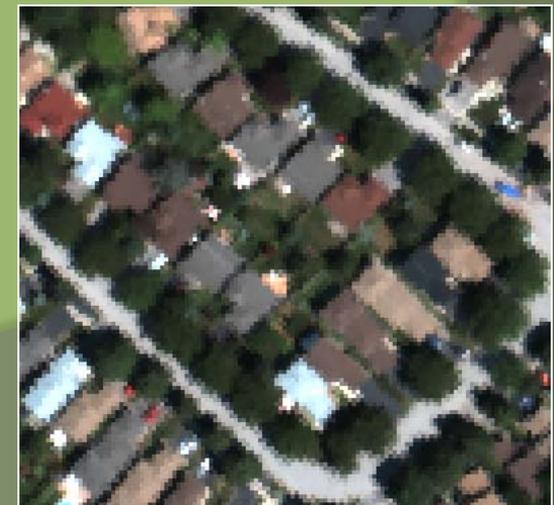
Ash Detection (FL31)



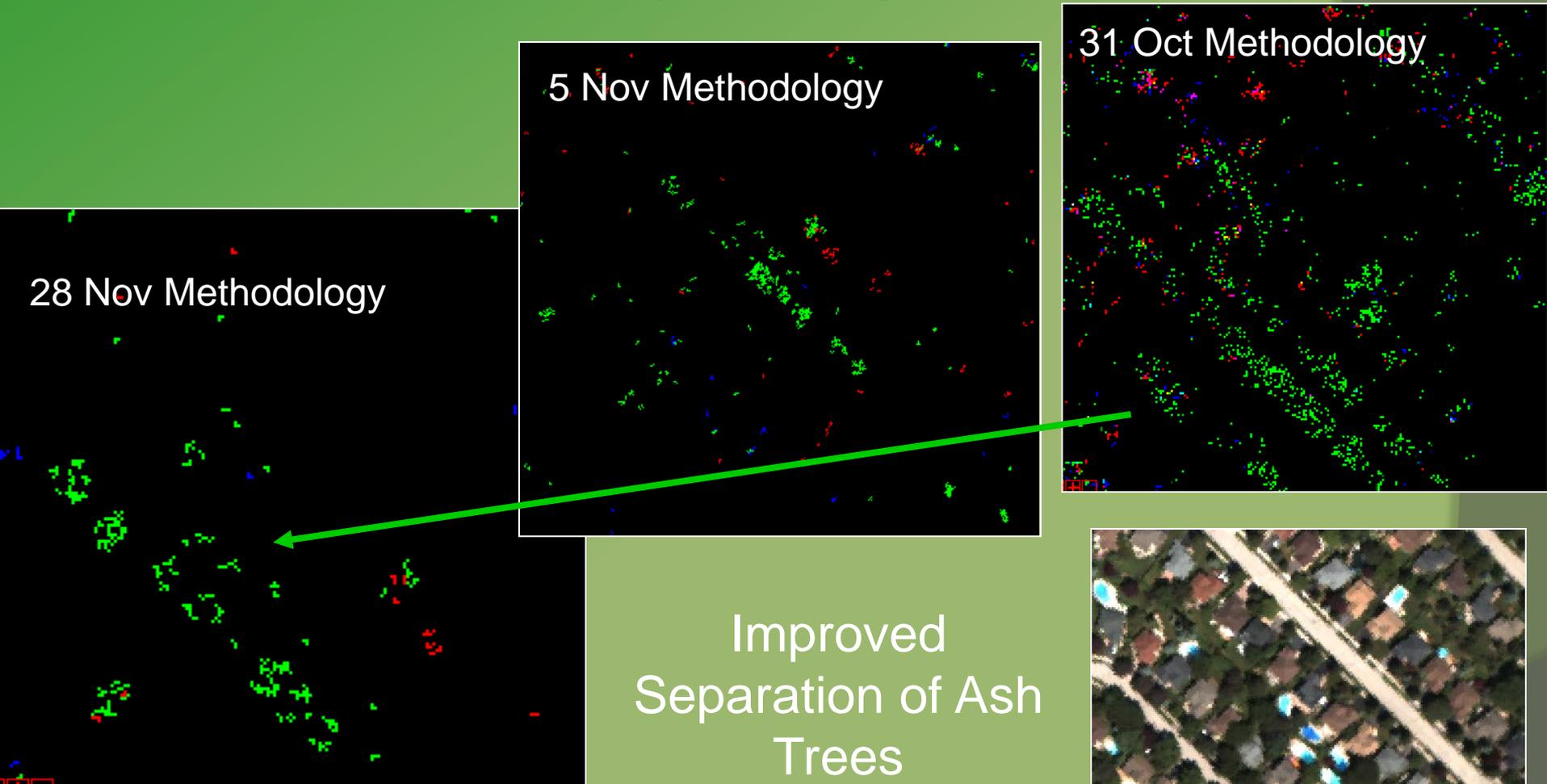
Improved
Separation
of Honey
Locust

GREEN – Ash
RED – Honey Locust
BLUE – Silver Maple

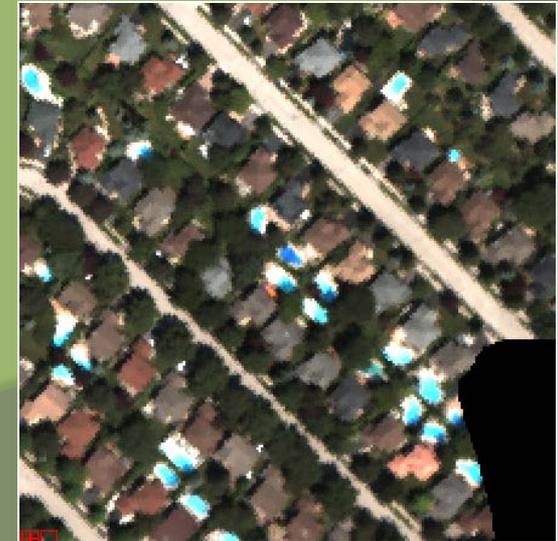
Honey Locust,
most likely 'false
alarm' species



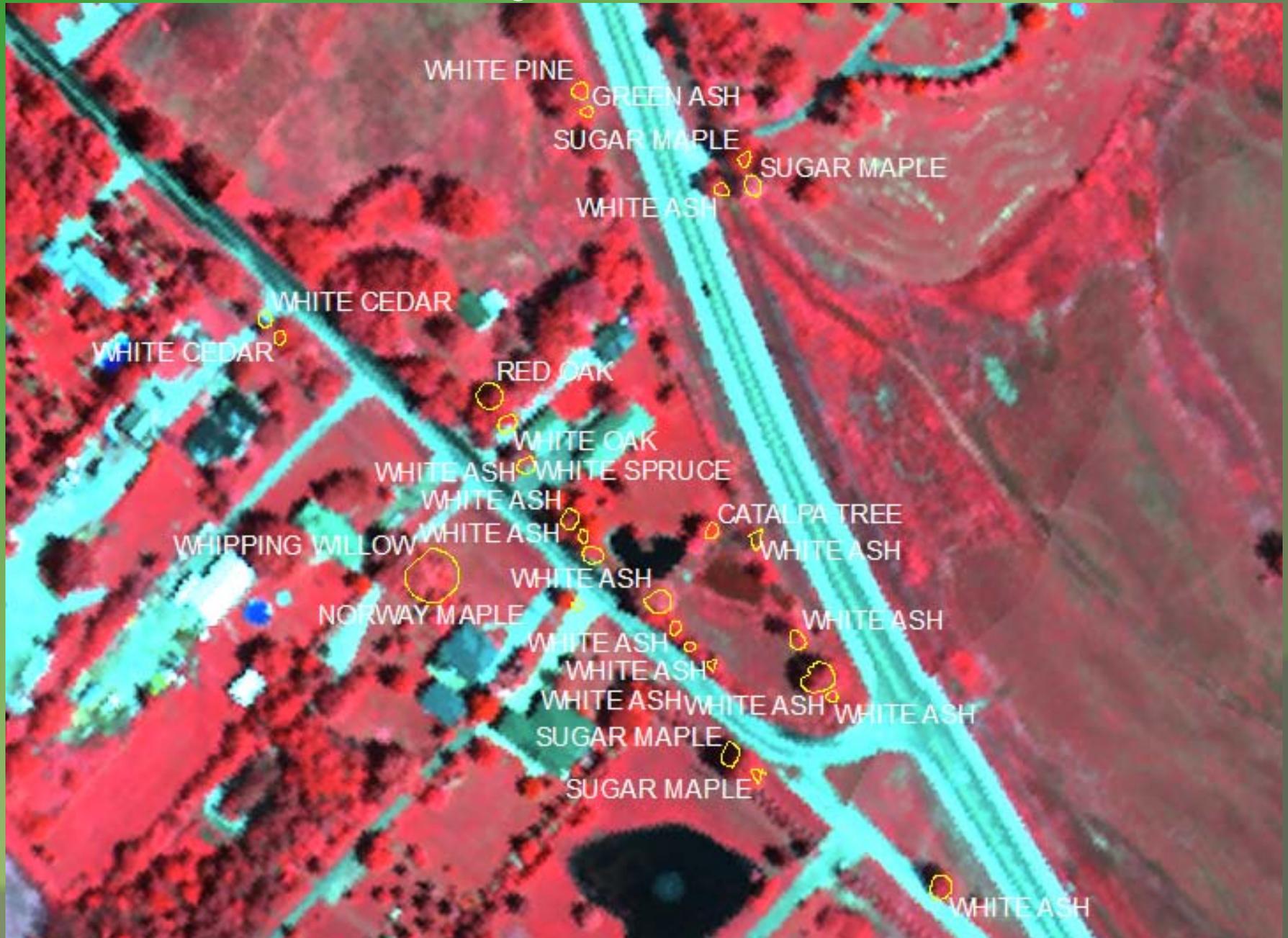
Ash Detection (FL41)



GREEN – Ash
RED – Honey Locust
BLUE – Silver Maple



Additional Field Data: Training and Validation



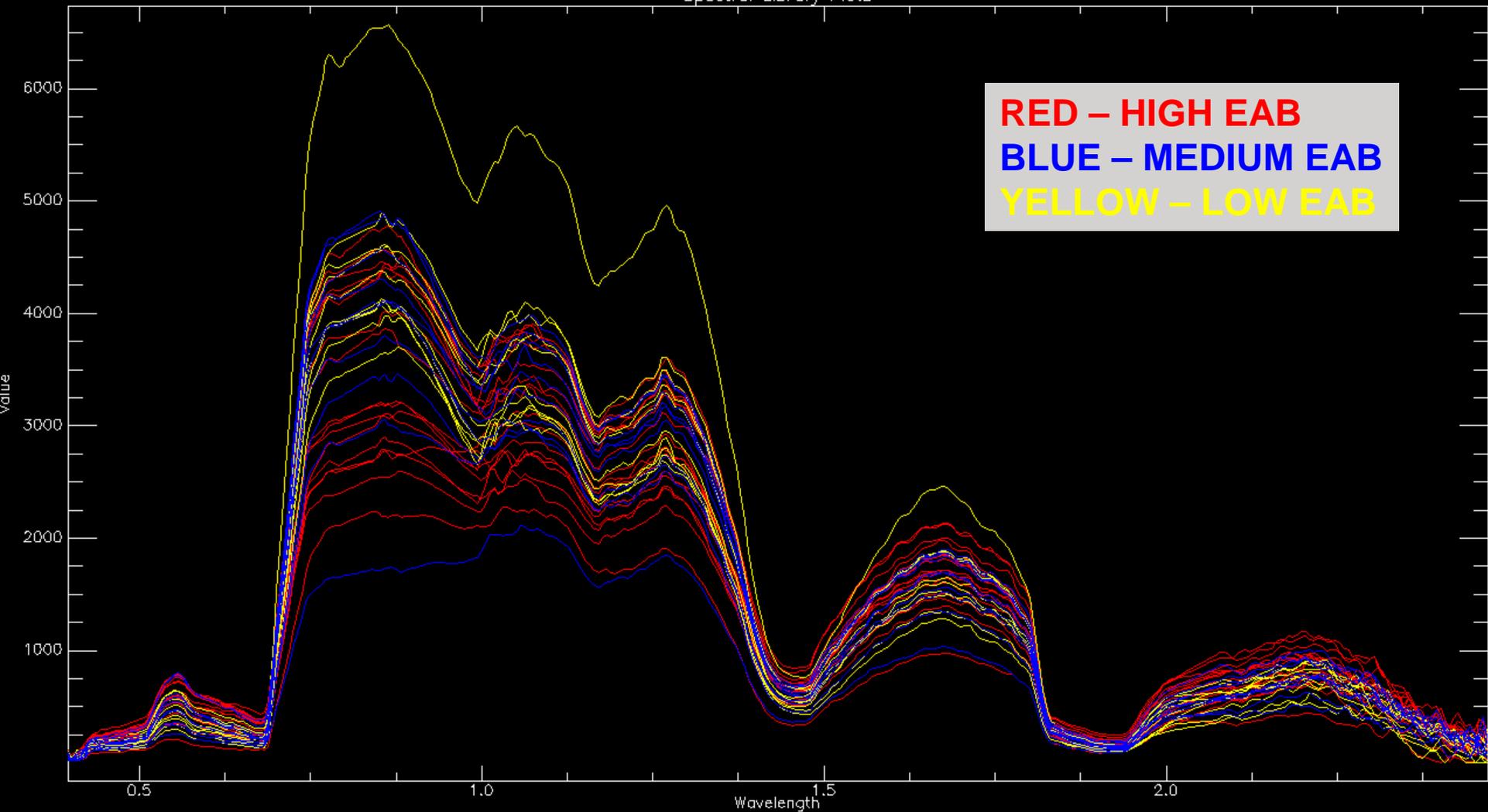
Comparison of EAB Infestation Spectra

ENVI Plot Window

File Edit Options Plot_Function Help



Spectral Library Plots



Initial EAB Infestation Conclusions

- Good correlation between high and low gallery counts (# per square meter)
 - Some outliers (mainly in trees which did not have good ash detection results due to thin/small canopy)
 - Effect is not linear and only represents broad differences
- Results based on assessment of Ash Trees detected with initial HSI detection (FL 30/31/41/42)
- Correlation is based on a subjective assessment of high vs low

Next Steps

- Perform 2nd accuracy assessment on ash mapping
- Modify ash detection algorithms as needed
- Request 2nd verification data from the field
- Continue iterative process, goal of 80% accuracy
- Refine/discuss EAB infestation levels
 - Request field checks
 - No specific accuracy assessment
- Confirm ash and UTC deliverables meet specification
 - Conversions/QC for GIS format delivery
- Reporting and Final Delivery

Thank You

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