

MAPPING THE FUTURE FOR EMERALD ASH BORER READINESS AND RESPONSE PLANNING

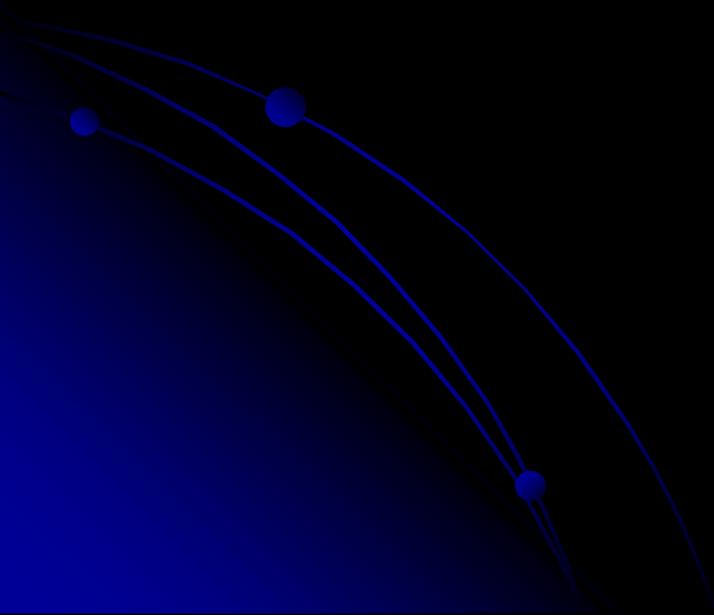


David Sivyer
City of Milwaukee



EAB READINESS & RESPONSE STRATEGIES

1. Risk Assessment
2. Risk Management



EAB READINESS & RESPONSE STRATEGIES

Risk Assessment

- **Host Assessment**
 - Structural
 - Functional
- **Public Safety**
 - Public trees
 - Private trees
- **Operations Impacts**
 - Resource allocation
 - Fiscal impacts

EAB RISK ASSESSMENT

Host Assessment

- **Structural Risk (How many trees?)**
 - Beetle Infested (100% Inventory)
 - Street Tree Inventory
 - i-Tree ECO (UFORE) Analysis (structure and function)
 - Remote Sensed
 - Hyperspectral derived ash classification
- **Functional Risk (Ecological services)**
 - i-Tree STREETS (STRATUM) Analysis (street tree structure and function)
 - i-Tree Eco (UFORE) Analysis (UTC structure and function)
 - CITYgreen Analysis
 - i-Tree HYDRO

EAB READINESS & RESPONSE STRATEGIES

Risk Management

- **Public Safety** (person and property)
 - Public and Private Trees
 - Street trees / Public open space
 - Threatening other property
 - Threatening public rights of way
 - Threatening public utilities
 - Preemptive Removals
 - Treatment (tree specific; canopy treatments?)
- **Community Outreach**

RISK ASSESSMENT

Host Assessment (structure and function)

1. Computerized Street Tree Inventory



MILWAUKEE'S STREET TREES

EAB Structural Impacts

- 193,000 street trees
- 33,000 ash street trees
- 17% Canopy Loss
- \$46 Million structural damage
- 27 Million removal and replacement cost (3" cal.)

EAB Functional Impacts

- STRATUM Analysis (2009)

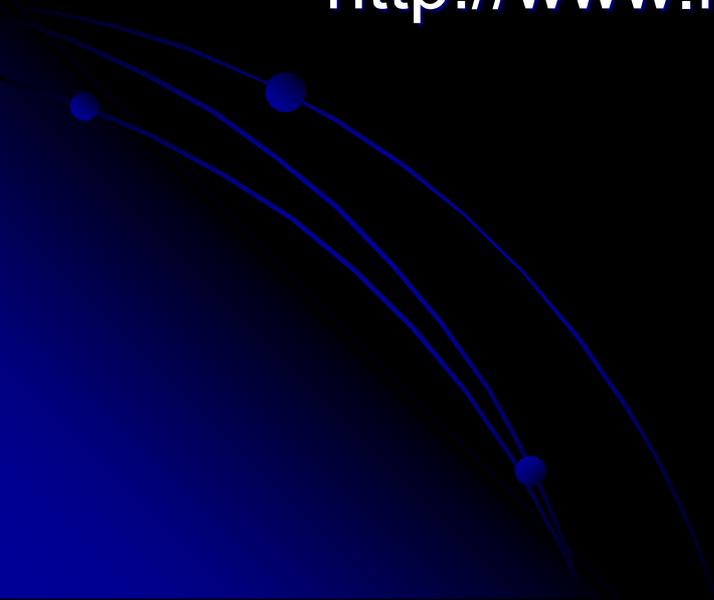


RISK ASSESSMENT

Host Assessment (Structure and Function)

1. Computerized Street Tree Inventory
2. **Urban Tree Canopy Assessment UFORE
(now i-Tree ECO)**

<http://www.itreetools.org>



MILWAUKEE'S URBAN FOREST

Forest Structure

- 3.4 Million Trees
- 21.5% Canopy Cover
- Estimated 587,000 ash trees (17.3%)



MILWAUKEE'S URBAN FOREST

Forest Valuation

Structural Value

- \$1.4 Billion Structural value
- \$9 Million Carbon storage

Functional Value (annual)

- \$321,000 Carbon sequestration
- \$2,590,000 Air Pollution removal
- \$903,000 Energy savings and carbon emission reductions

- \$3.8 Million Total Functional Value



EAB URBAN FOREST IMPACTS

EAB Structural Impacts

- 17.3% Canopy Loss
- \$221 Million structural damage (citywide)

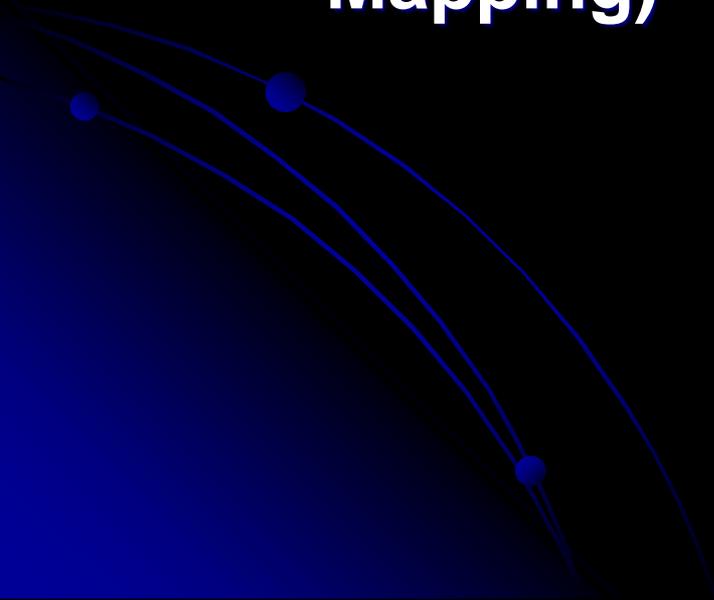
EAB Functional Impacts

- \$243,785 less pollutant removal annually
- \$138,000 less energy savings annually (cooling benefits)
- \$2.6 Million storm water reduction benefits



Risk Assessment

Host Inventory (Structural and Functional)

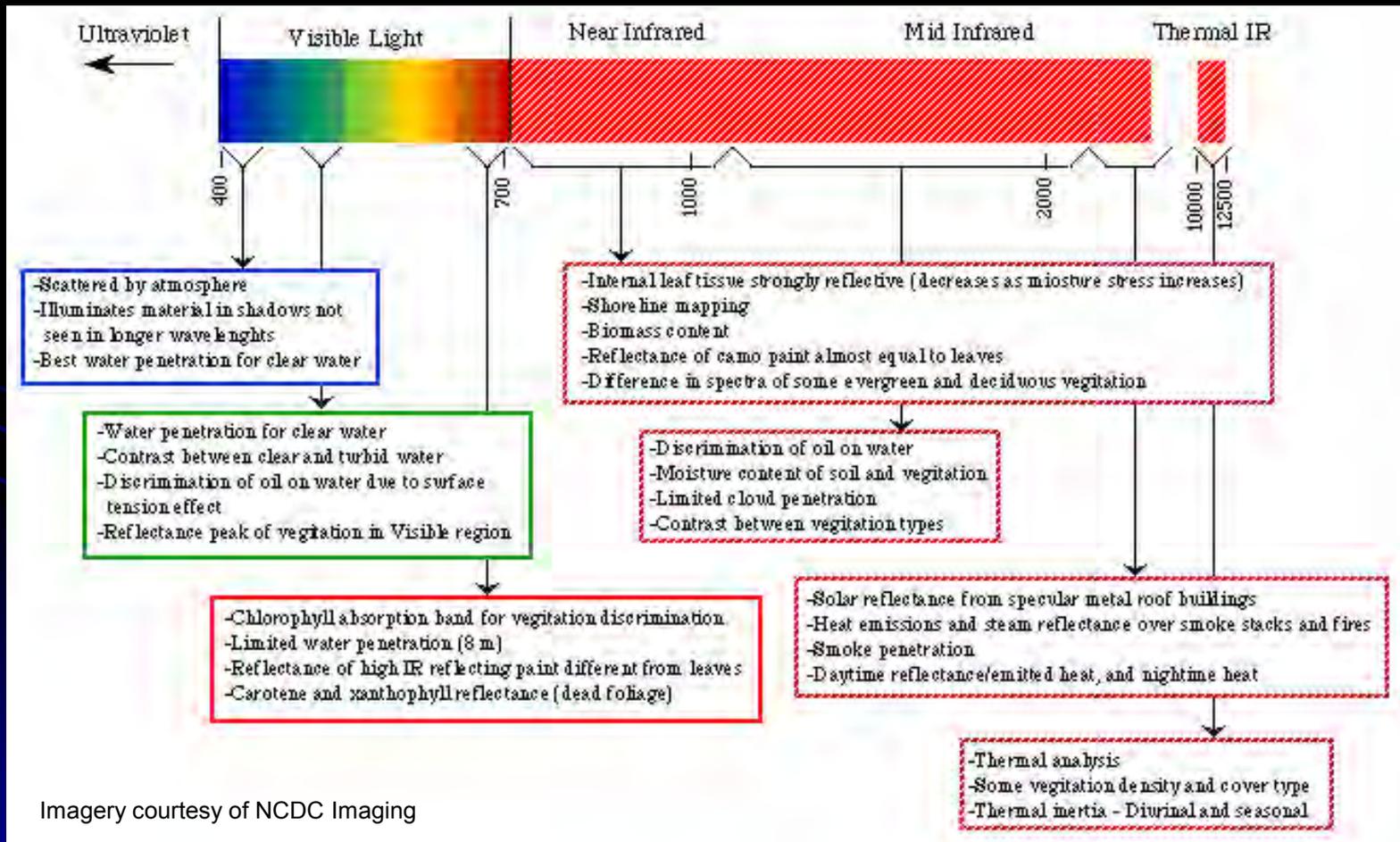
1. Computerized Street Tree Inventory
 2. Urban Tree Canopy Assessment (UFORE)
 3. **Hyperspectral Imagery (Ash Species Mapping)**
- 

HYPERSPPECTRAL IMAGING (HSI)

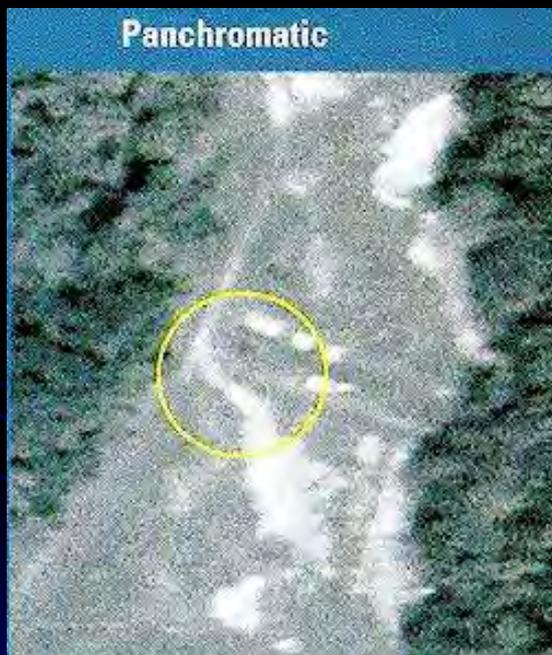
- Airborne HSI is an advanced digital imaging process that utilizes high-powered sensors to record hundreds of contiguous narrow bands of electromagnetic energy reflected from objects or materials on the Earth's surface. Each substance, such as green and white ash, yields a unique reflectance or "spectral signature" based on the molecular and electromagnetic properties of the substance that can be targeted and extracted from the hyperspectral data.

SPECTRAL IMAGERY ATTRIBUTES

Spectral Range: The range of electromagnetic spectrum recorded or measured by remote sensing instrument.



IMAGERY COMPARISON



VEGETATION SPECIES MAPPING

Counter Narcotics



Identification of Poppy Fields

HYPERSPPECTRAL IMAGING ASH MAPPING

- August 2008 Data Collection
- RFP Mapping & NCDC Imaging
- Ash target species
- 1.0 -1.2 meter Spatial Resolution
- Simultaneous collection of LIDAR (Light Detection and Ranging) - improves positional accuracy and output



FIELD SURVEY OF TARGET TREES



Field Spectral Data Collection

25-29 August 2008

Field Spectral Data Collection: ASD Field Spectrometer

Target Species: Spectra collected from target tree species as well as predominant background vegetation and environment

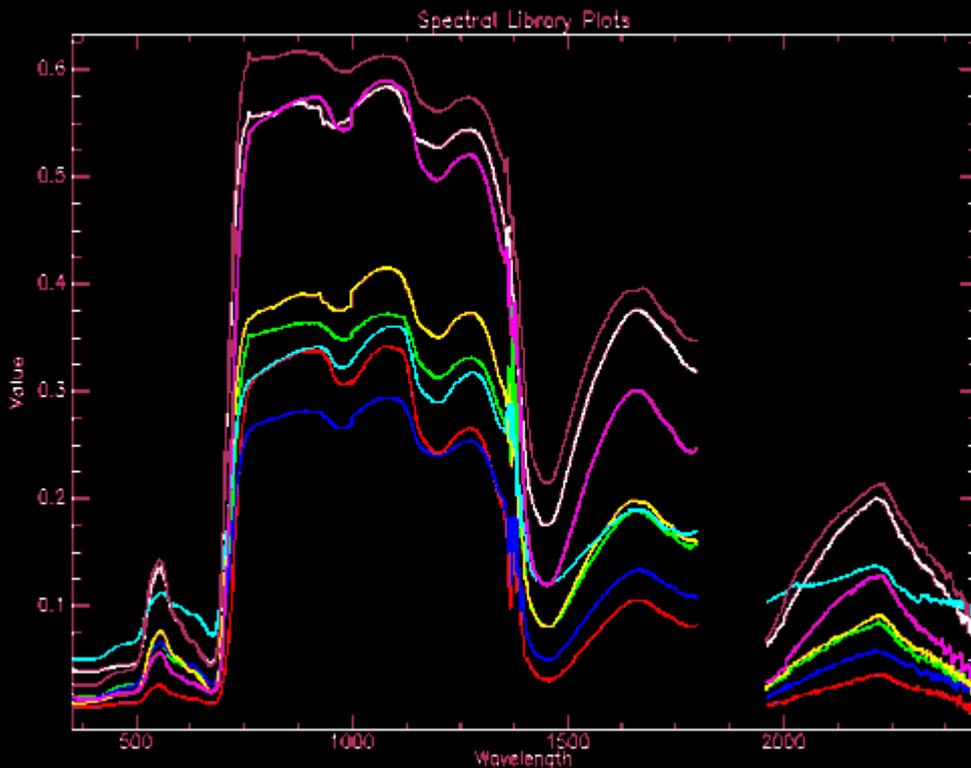
Collection Method: 'Sensor-view' from top of canopy

Analysis: Spectral separability assessed by analysis of optimal bands required to identify each target.

- Field data collection used to confirm capability to detect and identify target tree species prior to aerial data collection
- Field spectra will be used to tailor analysis methodology for large-scale analysis of aerial data (>1Terrabyte)

MILWAUKEE HSI DATA

Comparison of spectral signatures from 7 different species results in 240 significant bands.



Green Ash

Crab Apple

White Ash

Hackberry

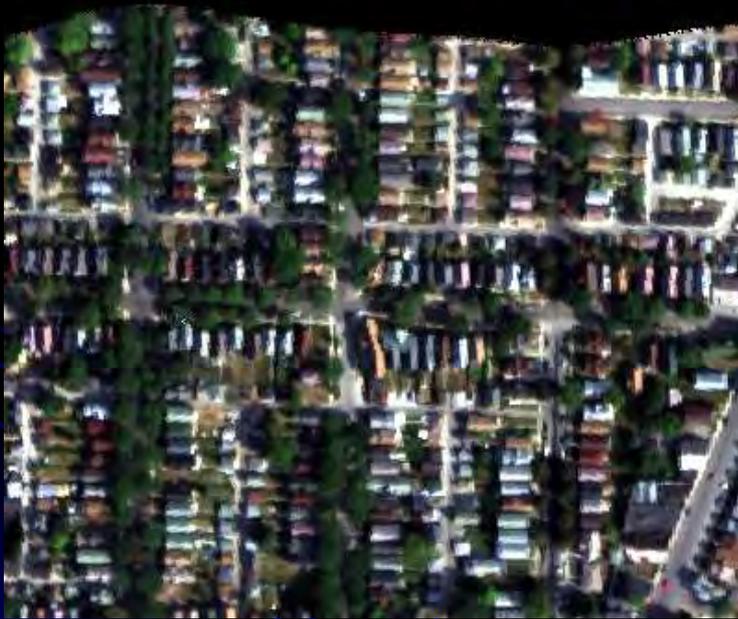
Honey Locust

Spruce

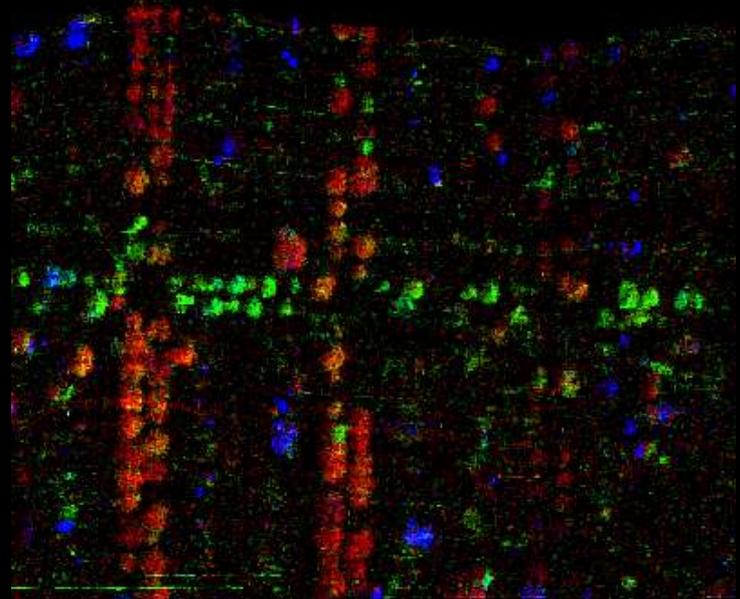
Norway Maple

Red Sunset Maple

HYPERSENSPECTRAL IMAGERY MILWAUKEE URBAN FOREST



Hyperspectral
Imagery



Hyperspectral
Exploitation

LIDAR IMAGERY MILWAUKEE URBAN FOREST



Field Inventoried Ash Trees, Shown in Blue, Provided by City of Milwaukee Forestry



Ash Tree Classification (Green), Ash Street Inventory (Blue) & Tree Points (Ash <Yellow> vs. Other <Green>)



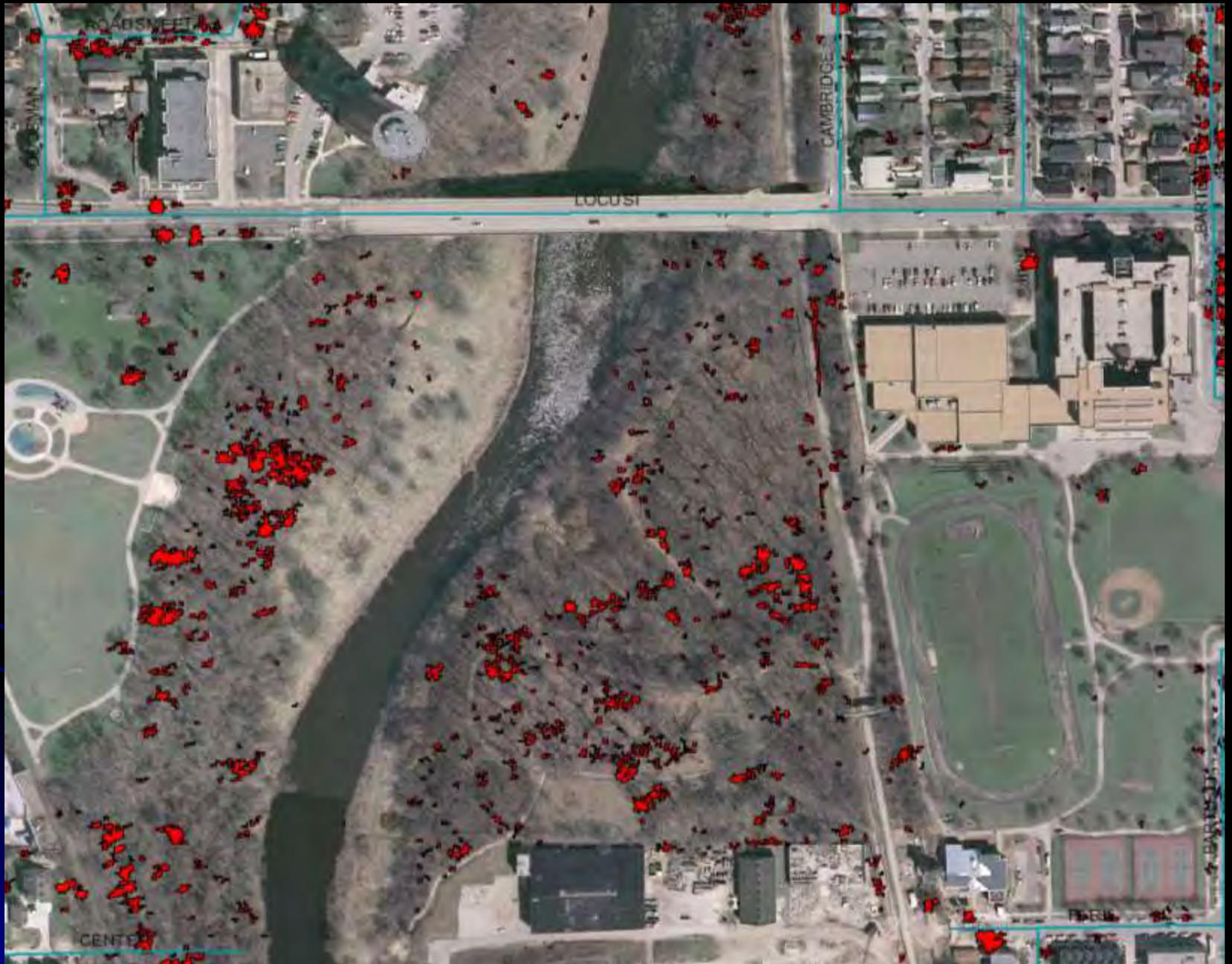
Ash Tree Points (Yellow) and Parcels w/Ash Tree Present Selected











EAB RISK MANAGEMENT COMMUNITY AWARENESS



EAB RISK MANAGEMENT COMMUNITY AWARENESS



EAB RISK MANAGEMENT COMMUNITY AWARENESS

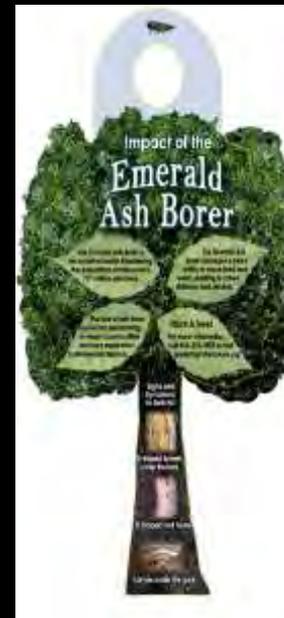


EAB RISK MANAGEMENT COMMUNITY AWARENESS



EAB RISK MANAGEMENT COMMUNITY AWARENESS

- Door to Door Outreach to 26,000 households
- Confirm presence of ash tree
- Communicate risk and options



ASH STREET TREE INJECTIONS

- Manages risk while transitioning to resistant species
- Allows ash to be removed on our schedule, not EAB
- Least disruptive to other forestry operations
- Prevents catastrophic loss of street tree canopy and associated benefits
- Eliminates crisis management



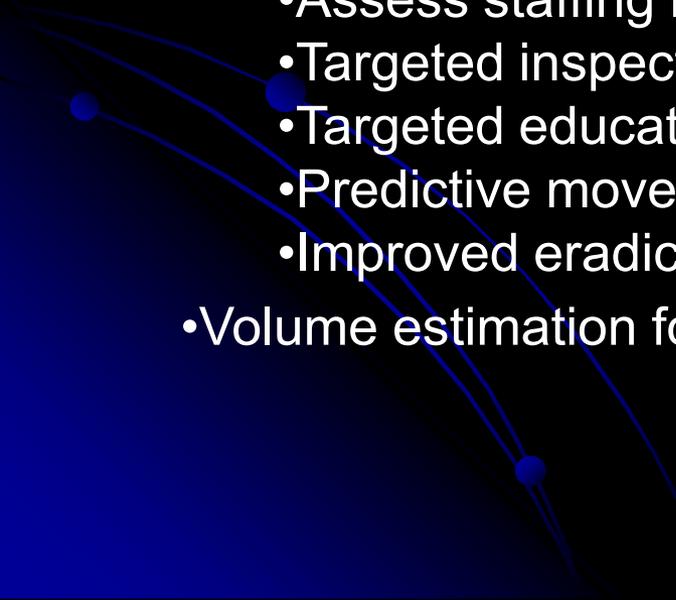
ASH STREET TREE INJECTIONS

- Provides 2 years protection
- Environmentally safe delivery system
- Self contained within tree
- Precise chemical delivery
- \$48.49/tree (16" average DBH)



HYPERSPPECTRAL IMAGING & EAB

Benefits

- Cost-effective method for EAB host inventory
 - Spatially map the location of all ash trees (85% or greater accuracy)
 - Integration with existing planning resources, i.e. orthophotos, GIS map layers (parcel, watershed, storm water, etc.)
 - Enhanced EAB management
 - Assess staffing needs based on quantifiable host
 - Targeted inspections
 - Targeted educational outreach
 - Predictive movement of EAB based on host distribution
 - Improved eradication and chemical treatment management
 - Volume estimation for wood waste projections
- 

CONTACT INFO

David Sivyer

Forestry Services Manager

City of Milwaukee

841 N Broadway, Room 619

Milwaukee, WI 53202

(414) 286-3729

david.sivyer@milwaukee.gov