

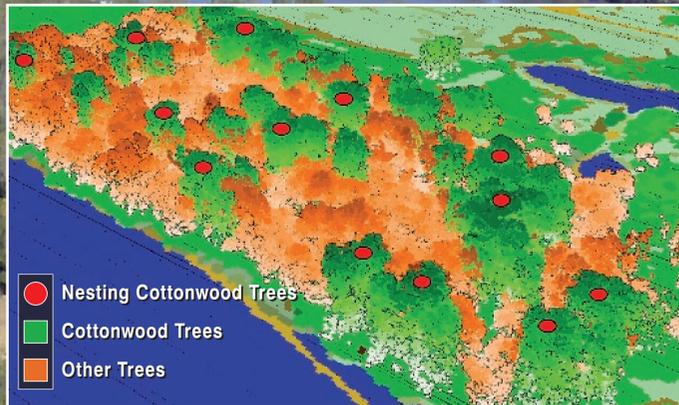
## Using Hyperspectral and LiDAR for Missouri River Mitigation Project Conservation



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**Project Location:** Hemmies Bend near Corning, Missouri  
**Client:** US Army Corps of Engineers; Omaha and Kansas City Districts



# Preserving Eagle Habitat



Classified Super-Canopy with Potential Nesting Cottonwood Trees

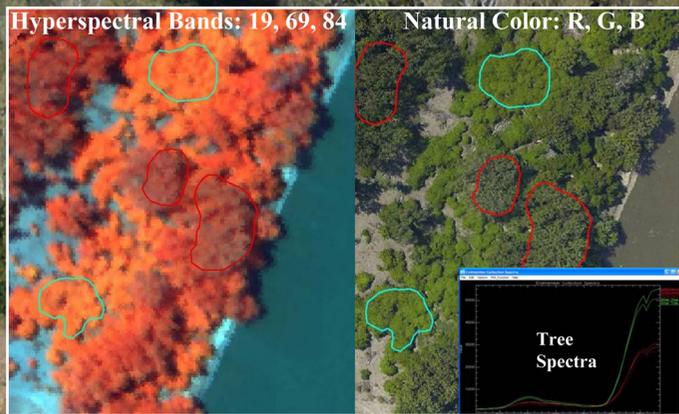


Image Ground Truthing and Tree Species Training/Classification

### INNOVATION

- Co-mounted LiDAR, color, and hyperspectral sensors in one aircraft saving multiple aircraft mobilization
- All three sensors integrated to one positioning and orientation system increases accuracy and reliability of the analysis
- Data fusion combines multiple data sources to dramatically improve habitat inventory reliability and scientific value

### FUTURE VALUE

- Scientific value of fused data from disparate sources provides more quantifiable results than if sources were analyzed individually
- Following prototype, the USACE is determining the cost benefit of using the manual and remote sensing approaches
- Fused data also used for soils, invasive plants, vegetation health, and endangered species inventories

### SOCIAL & ECONOMIC IMPACT

- Remote sensing and hyperspectral expedites congressional mandated mitigation and water resources planning
- Successful inventory of prime bald eagle habitat helps protect this once-endangered species
- Derived data provides critical information needed for "decision support" and adopting "best management practices"

### COMPLEXITY

- Assisting client to manage large volume of hyperspectral data cube and LiDAR using custom software programmed by Merrick
- Color photography used for ground truthing LiDAR and hyperspectral data to save money and time
- New data fusion technology and procedures are being created for the first time at the USACE

### CLIENT SATISFACTION

- Project flown during difficult summer "leaf-on" weather conditions to meet schedule
- Maintained fixed-price budget despite some R&D of new technology
- Completed prototype determined hyperspectral and LiDAR approach is technically feasible
- Located prime eagle nesting areas faster and more reliable than existing procedures

## Multi-Sensor Fusion Work Flow

### ACQUISITION

LIDAR, Digital Aerial Photo, Hyperspectral, AGPS/MU, Spectra Definition



Merrick's Cessna 402C



Three sensors co-mounted in aircraft

### PROCESSING

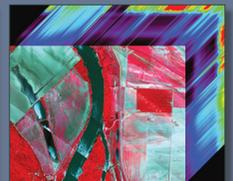
Digital Ortho, Co-Registration, Radiance Mosaic, LIDAR Classes, Spectral Training, Ground Truth



Color Digital Ortho



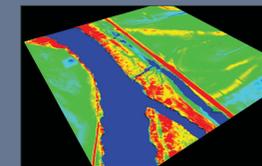
Hyperspectral Radiance Image



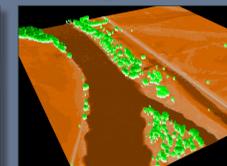
Data Cube

### DATA FUSION

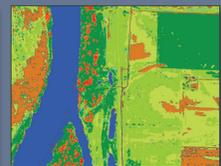
Cottonwood Class, Other Land Cover, Attributed LIDAR



Bare Earth LIDAR Shaded by Elevation



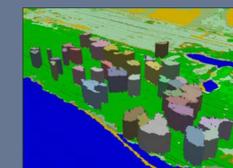
Bare Earth LIDAR with Classified Trees



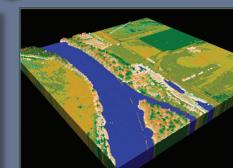
Hyperspectral-Derived Land Cover Classes

### PRODUCTS

ERDAS / ENVI Images, Suitable Habitat, 3D Tree Polygons Mapping, LIDAR



Individual Tree Polygon-Derived from Fused Hyper/LIDAR



Fused Cottonwood Trees Super Canopies