Using Hyperspectral and LiDAR for Missouri River Mitigation Project Conservation

Preserving Eagle Habitat

Authors: Jason Sheeley; Kansas City Army Corps of Engineers
Brian Rabor and Raul Campos-Marquetti; Merrick & Company

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

INNOVATION
- Co-mounted LiDAR, color, and hyperspectral sensors in one aircraft saves 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
- 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”

SOCIAL & ECONOMIC IMPACT
- Remote sensing and hyperspectral expedites congressional mandated mitigation and water resources planning
- Digital ortho, co-registration, radiance mosaic, LiDAR classes, spectral training and ground truthing
- US Army Corps of Engineers

COMPLEXITY
- Assisting client to manage large volume of hyperspectral data cube and LiDAR using existing 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 needed for new technology
- Completed prototype determined hyperspectral and LiDAR approach is technically feasible
- Located prime eagle nesting areas faster and more reliable than existing procedures

DATA FUSION
- ERDAS / ENVI Images, Suitable Habitat, 3D Tree Polygons Mapping, LiDAR

PRODUCTS
- Individual Tree Polygon-Derived from Fused Hyper/LiDAR
- Bare Earth LiDAR Shaded by Elevation
- Bare Earth LiDAR with Classified Trees
- Hyperspectral-Derived Land Cover Classes
- Cottonwood Class, Other Land Cover, Attributed LiDAR

Multi-Sensor Fusion Work Flow

ACQUISITION
- LiDAR, Digital Aerial Photo, Hyperspectral, AGPS/MU, manual calibration

PROCESSING
- Three sensors co-mounted in aircraft
- Digital Ortho, Co-Registration (Digital Ortho, LiDAR, Digital Aerial Photo, Hyperspectral Training Band)

DATA FUSION
- Hyperspectral, Radiance Image
- Light Color

PRODUCTS
- Individual Tree Polygon-Derived from Fused Hyper/LiDAR
- Bare Earth LiDAR with Classified Trees
- Hyperspectral-Derived Land Cover Classes
- Cottonwood Class, Other Land Cover, Attributed LiDAR

Classified Super-Canopy with Potential Nesting Cottonwood Trees

Image Ground Truthing and Training/Classification

Tree Spectra

Using Hyperspectral and LiDAR for Missouri River Mitigation Project Conservation

Preserving Eagle Habitat

Authors: Jason Sheeley; Kansas City Army Corps of Engineers
Brian Rabor and Raul Campos-Marquetti; Merrick & Company

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