Operational Use of Landsat in the Intermountain West

Current Examples of Resource Agency Applications
RSAC Mission:

• **Technical support** - evaluating and developing remote sensing, image processing, GIS, GPS, and related geospatial technologies.

• **Project support** and assistance using remote sensing technologies.

• **Technology transfer** and training to field users.
Operational Applications of Landsat are Extensive, Diverse & Critical

- Mid-level vegetation mapping applications
- Landfire refresh
- TEUI – basis for natural breaks and classification
- Whitebark pine change detection
- Aspen decline
- Forest health - risk maps
- Great lakes change detection
- National all-lands disturbance mapping - MTLC
- FAO Land cover change
- Groundwater Dependent Ecosystem (GDE) Inventory
- Strata for inventory - bare earth on WCU
- Imputation using FIA plots
- Disaster assessment - hurricanes, tornadoes, etc
- Post-fire mapping & monitoring applications
Representative Landsat-based Applications Significant to ID and the IW

• Disturbance Mapping - Fire
  – Monitoring Trends in Burn Severity

• Existing Vegetation Mapping
  – Intermountain Region Forests

• Forest Health Monitoring
  – Whitebark Pine Mortality
Monitoring Trends in Burn Severity (MTBS)

http://www.mtbs.gov

Consistently map the burned areas and associated severity of large fires on all lands in the United States from 1984 to 2010

Jointly implemented by USFS and USGS

• Geospatial data distributed through web-based portals
Data Processing Overview

- Compile a single MTBS fire occurrence database (FOD) from existing data sources
- Based on FOD and prescribed assessment strategy, select pre and post-fire Landsat scenes
- Landsat TM/ETM+ data ordered and acquired from EROS
- Analysts perform necessary image pre-processing, image differencing, burned scar delineation and threshold dNBR images into burn severity classes
- Metadata, map products, burn severity data analysis and summary, and reporting

Pre-fire

Post-fire

\[ \text{Normalized Burn Ratio (NBR)} \]
\[ NBR = \frac{\text{NIR} - \text{SWIR}}{\text{NIR} + \text{SWIR}} \]

\[ \text{Differenced Normalized Burn Ratio (dNBR)} \]
\[ dNBR = \text{Pre NBR} - \text{Post NBR} \]
MTBS Assessment Strategy

• Based on fire type
  - Extended Assessment (EA)
    • Severity based on post-fire assessment at peak of green of next growing season
    • Forests/shrublands
  - Initial Assessment (IA)
    • Severity based on immediate post-fire assessment
    • Grasslands/shrublands
  - “Single Scene” Assessment
    • Lack of suitable pre-fire imagery or other factors; use post-fire NBR
    • Conducted on a limited basis (EAs and IAs)
Existing Vegetation Mid-Level Mapping

Current projects include:

- Boise/Payette:
  - 5 million acres
  - 5 Landsat path/rows x 3 dates
- Caribou Targhee:
  - 3 million acres
  - 6 Landsat path/rows x 3 dates
- Sawtooth:
  - 1 million acres
  - 5 Landsat path/rows x 3 dates
- Salmon Challis:
  - 4.3 million acres
  - 5 Landsat path/rows x 3 dates
Existing Vegetation Mid-Level Mapping

- Process relies on Landsat imagery
- Develop information based on national standards for mid-level mapping
- Dominance type, canopy cover, size

Input image-cube + Field & PI training sites = Data mining develops decision-trees to classify veg

Applied to image-cube to classify & label segments

Map Updates for Mid-Level Mapping

- Updating mid-level maps
  - Humboldt-Toiyabe NF, NV
    - ~150 Landsat images used (1998-2009)
  - Bridger-Teton NF, WY
    - 10 Landsat images used (2001-2009)

1. Disturbance maps derived from Landsat – fire, conifer mortality, harvest, etc.
2. Develop vegetation crosswalk to reflect disturbance class
3. Integrate updates into existing vegetation map
Whitebark Pine Mortality Assessment

- Developed whitebark pine mortality map for Greater Yellowstone Area 2000-2008:
  - Used in risk assessment models
  - Aids in prioritizing restoration efforts
  - Assessing impacts of whitebark mortality on ecosystem components

Study Area - ~14 million acres

6 national forests:
- Shoshone
- Bridger-Teton
- Caribou-Targhee
- Gallatin
- Custer
- Beaverhead-Deerlodge

2 national parks:
- Yellowstone
- Grand Teton
Whitebark Pine Mortality Assessment

- Landsat imagery
  - 5 path/rows
- Landfire
  - Existing vegetation type
  - Canopy closure
- USGS Whitebark pine map (S. Podruzny, C. Schwartz, R. Lawrence, L. Landenburger)
- 425 1-Hectare field plots
Whitebark Pine Mortality Assessment

• Products

Conifer mortality for GYA

Whitebark pine relative damage (2000-2008)
Parting Thought

Without LDCM & the NLIP, Agencies cannot continue to assess, monitor & manage at an adequate level of scientific validity.