

Remote Sensing Applications Center

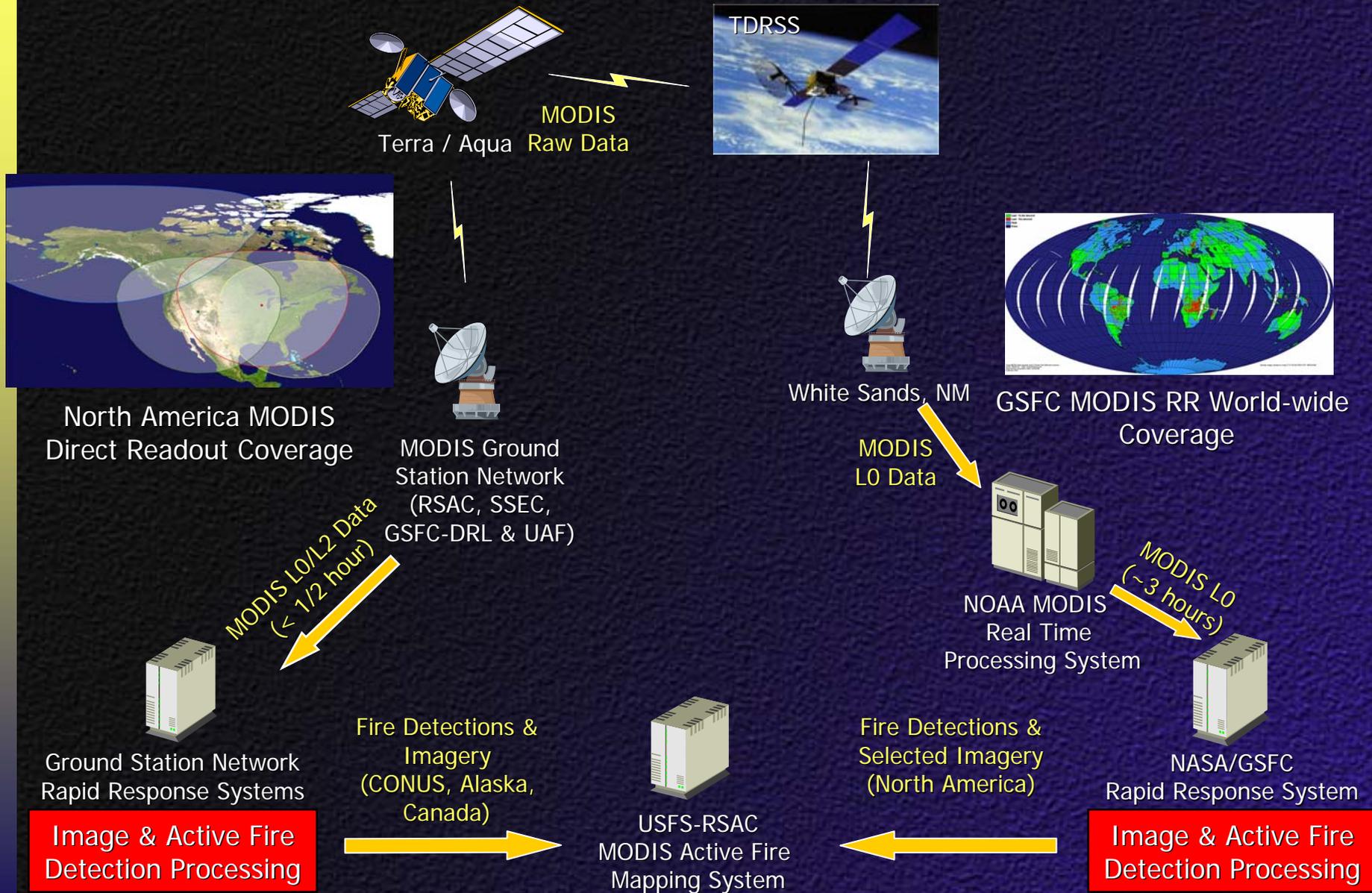
USDA Forest Service
Salt Lake City, Utah



Topics

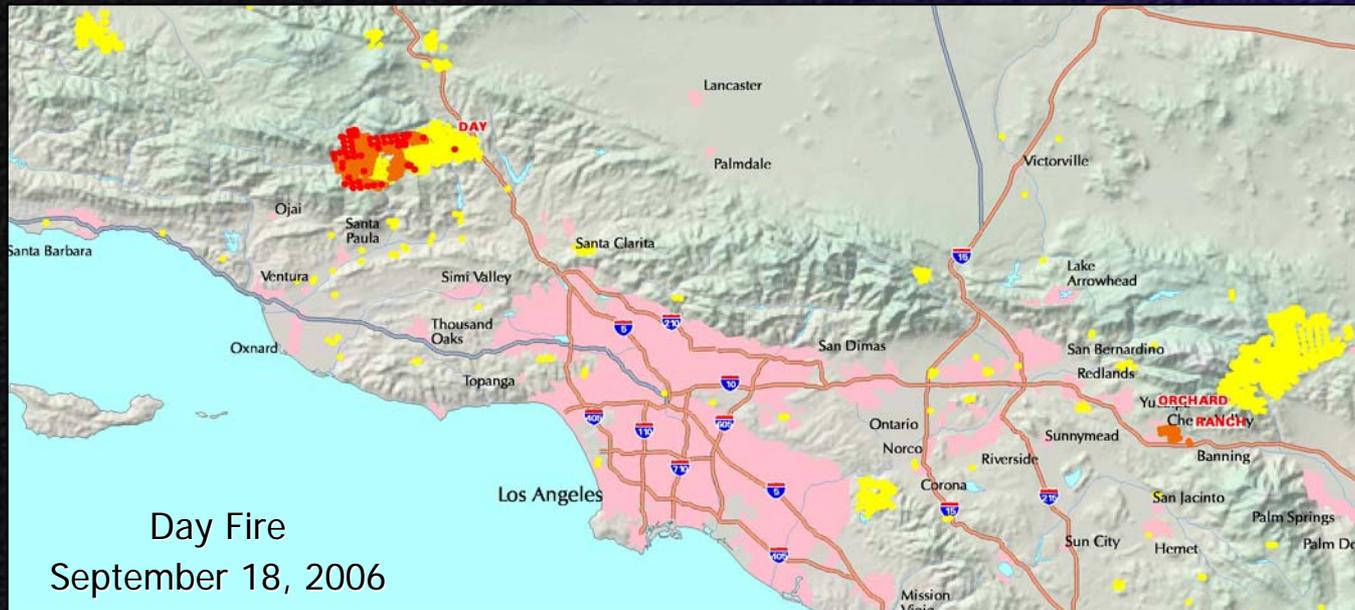
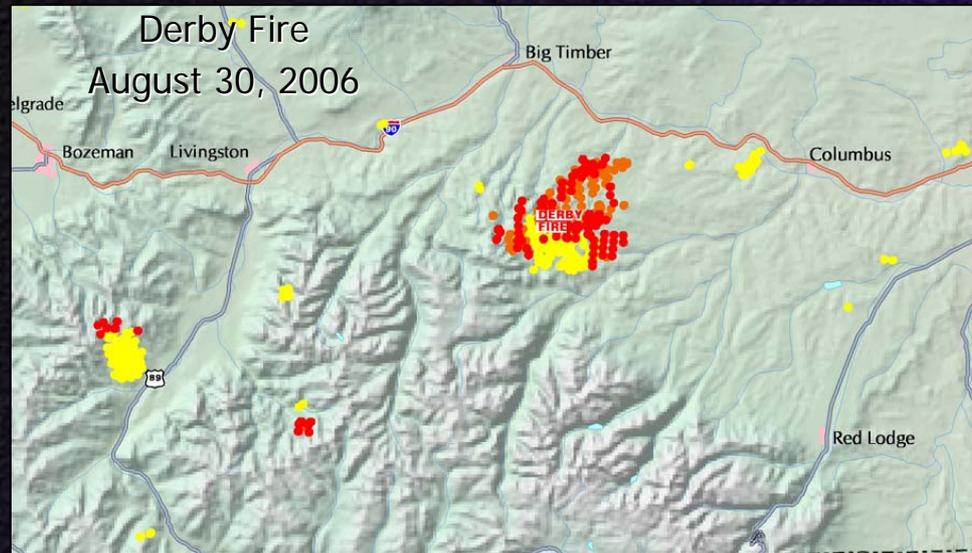
- MODIS Active Fire Mapping
- NASA Forest Service UAS
- Post-Fire Rehabilitation Mapping
 - ◆ Burn Area Emergency Response (BAER)
 - ◆ Rapid Assessment of Vegetation Condition after Wildfire (RAVG)
 - ◆ Monitoring Trends in Burn Severity (MTBS)
- ESRI Image Server
- Virtual Globe evaluations
- Salt Lake City Data Center - status

Overview: MODIS Data Acquisition and Processing



MODIS Active Fire Map Examples

-  Actively Burning Area (Last 12 hours)
-  Actively Burning Area (Last 24 hours)
-  Previously Burned Area (Since January 1st)
-  VISTA NIFC Situation Report Fire
-  Interstate Highways
-  U. S. Highways



User Community Depends On MODIS Active Fire Mapping

USDA MODIS Active Fire Mapping Program Website Stats 2001-2007

| | 2001* | 2002 | 2003 | 2004 | 2005 | 2006 | 2007# |
|----------------------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Hits | 1.5 Million | 3.3 Million | 24.9 Million | 18.7 Million | 25.8 Million | 35.9 Million | 43.9 Million |
| Users | 42,000 | 502,000 | 1.5 Million | 817,200 | 960,000 | 1.54 Million | 2.7 Million |
| Data Volume Transferred | 12 GB | 215 GB | 750 GB+ | 1 TB+ | 4 TB | 2 TB | 4.6 TB |

* - complete statistics not available for entire year

- through October 25, 2007

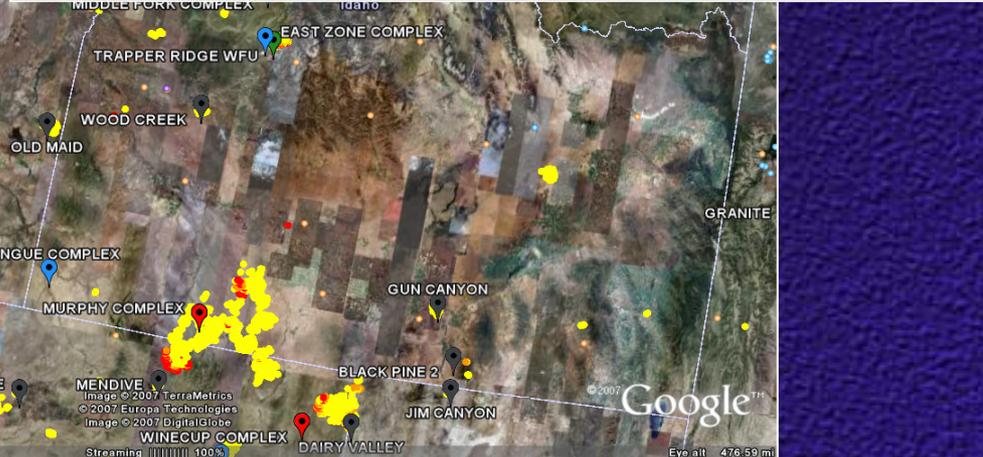
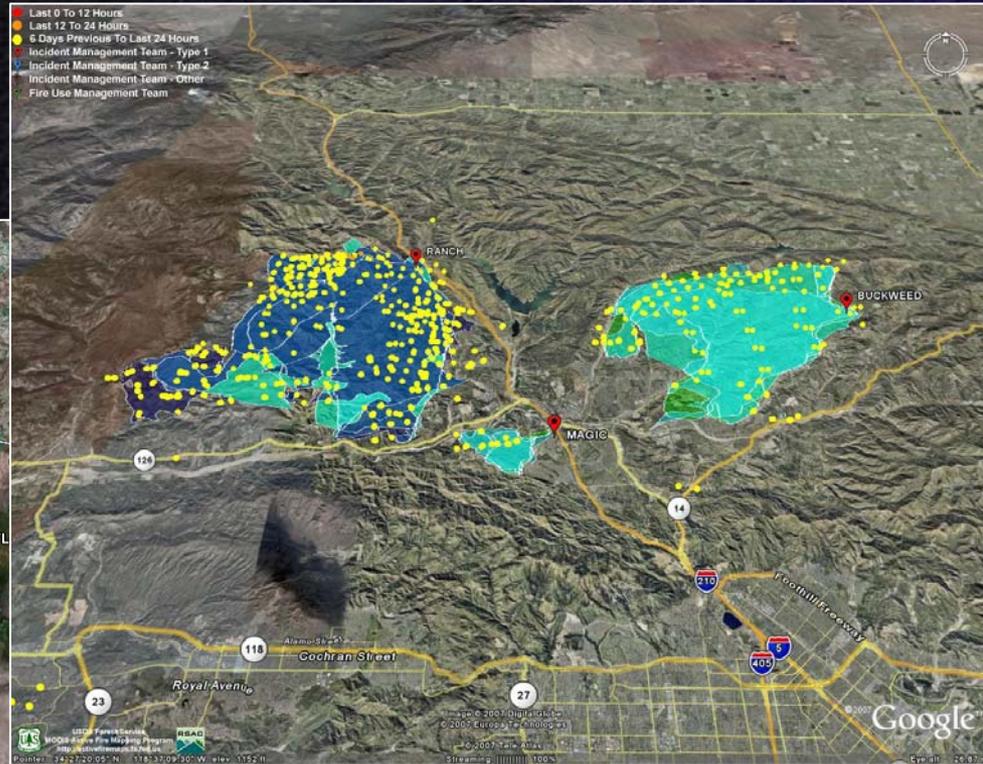
Critical source of timely wildfire geospatial data...

Data provided by MODIS Active Fire Mapping Program is also relayed to other fire support websites and data portals

GIS Data Access – KMLs/KMZs

Available KMLs

- Current Large Incidents (w/ICS209)
- MODIS Fire Detections (w/attributes)
- Current Fire Perimeters (Prototype; w/attributes)
- NWS Imagery & Warnings
- 7-day Fire Potential Product



NASA - Forest Service Ikhana UAS Flights



2007 Western States Fire Mission

Results:

- 8 missions
- 35+ fires mapped
- Traversed 8 western states
- Over 90 hours operational hours in the National Airspace



Unmanned Aerial Vehicles

- Tactical scale fire mapping with small UAVs



Post-Fire Rehabilitation Mapping

- "Burn Severity" has different meanings...
- **B**urn **A**rea **E**mergency **R**esponse (BAER)
 - ◆ Focus on soil and water quality effects
- **R**apid **A**ssessment of **V**egetation Condition after Wildfire (RAVG)
 - ◆ Focus on reforestation needs
- **M**onitoring **T**rends in **B**urn **S**everity (MTBS)
 - ◆ Focus on long term vegetation

Burn Area Emergency Response (BAER) Support

- Objective is to prepare Burn Area Emergency Response plan within 7 days of fire containment
- Remotely sensed imagery - use best available
 - Landsat 5,7
 - AWiFS
 - ASTER
 - SPOT 4,5
 - Ikonos, OrbView, GeoEye
 - Airborne MS scanners
 - Airborne CIR Digital cameras
- Critical factors:
 - Acquisition timing
 - Delivery from provider
 - Spectral properties - SWIR band

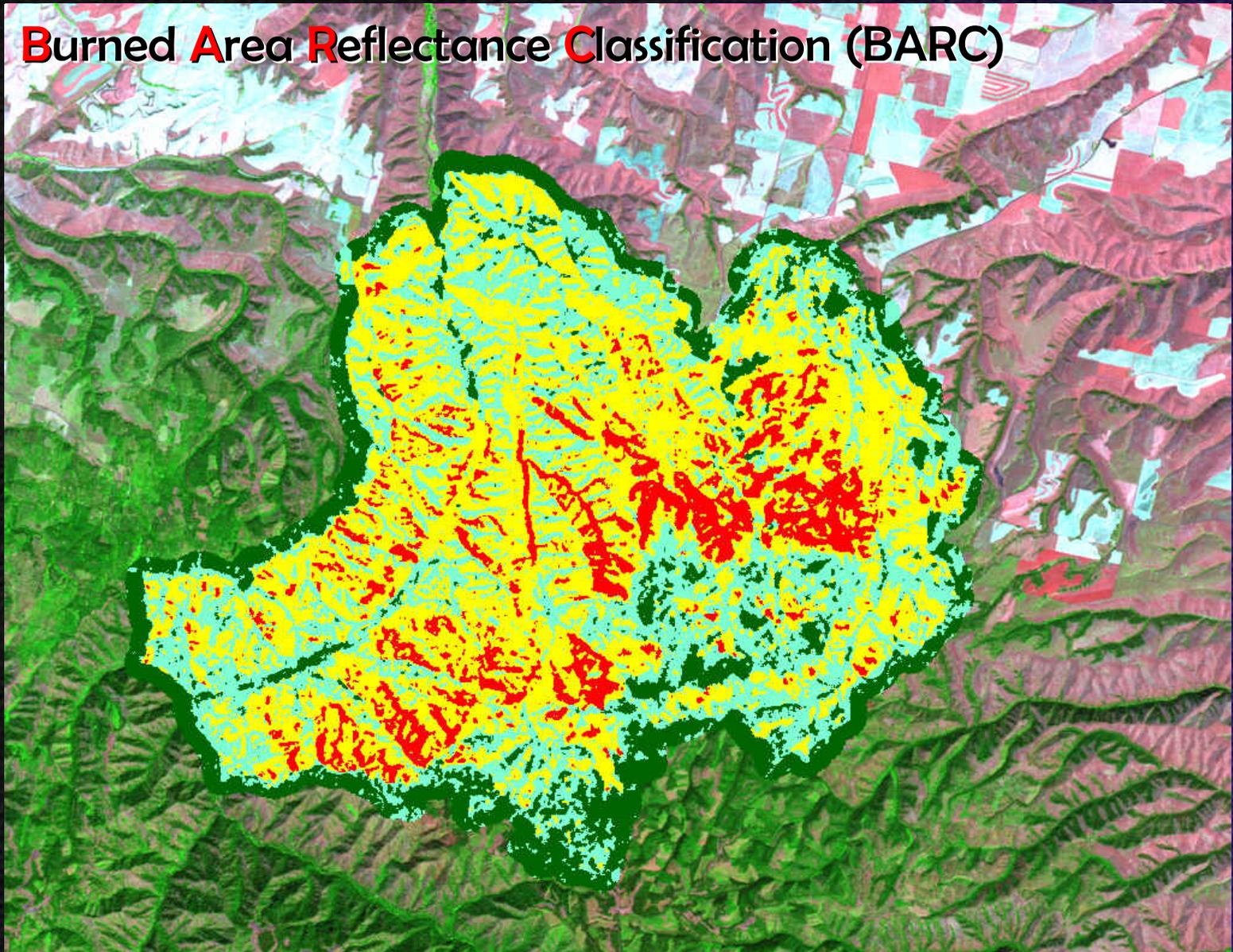


BAER Requirements

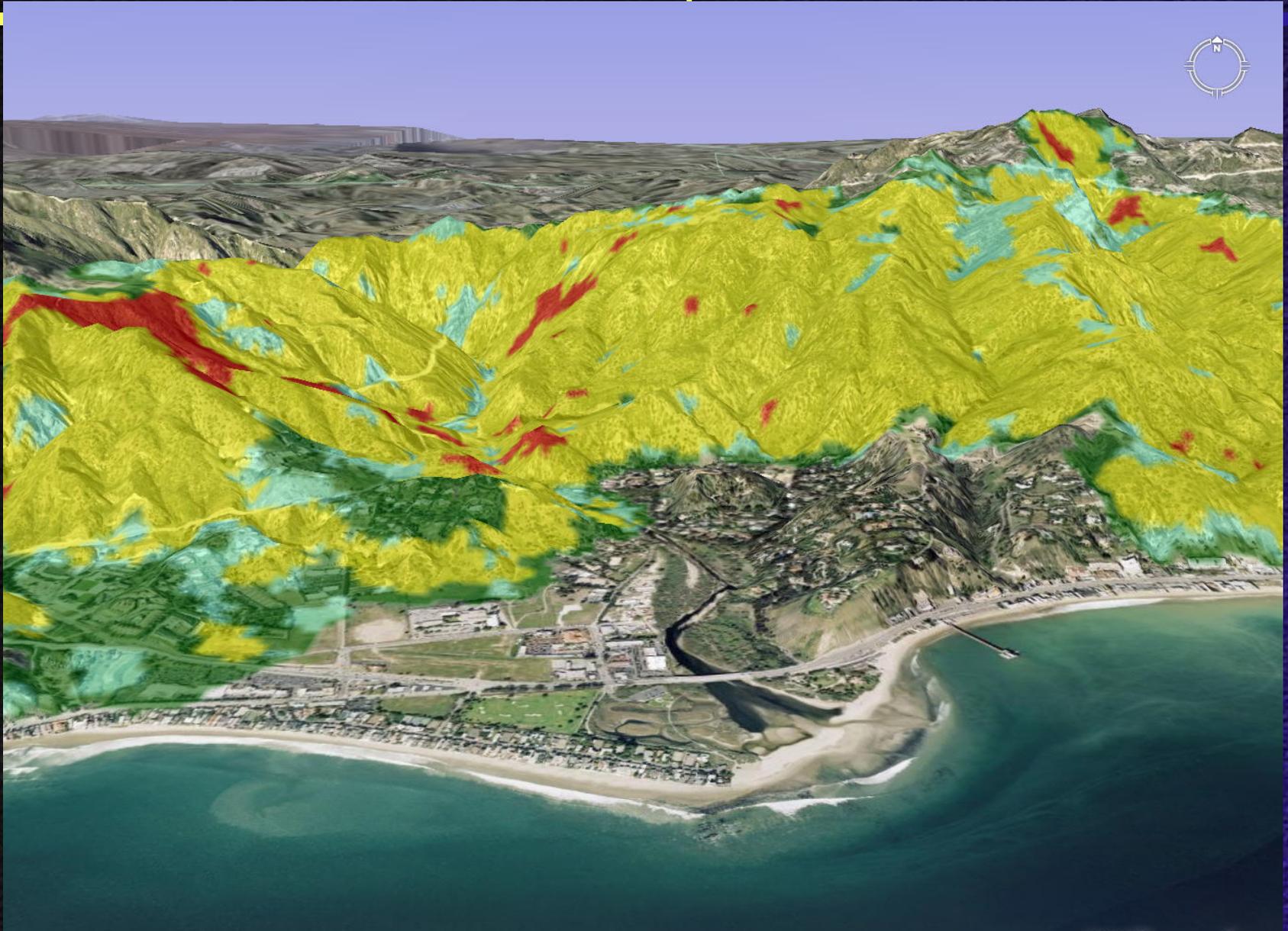
- Burned Area Emergency Response (BAER)
 - ◆ Post-fire damage assessment due to wildfire
 - Focus on soil and water quality effects
 - Calculate potential erosion and debris flows
 - Determine values at risk downstream
 - Determine appropriate treatments that help to mitigate some of the risk
 - ◆ All within 7 calendar days of fire containment
 - ◆ Remote sensing support must come in the first few days after fire containment

Burn Area Reflectance Classification

Burned **A**rea **R**eflectance **C**lassification (BARC)



Southern California - Canyon Fire



BAER Support Statistics

| Year | USGS EROS | | USFS RSAC | | Sum | |
|------------|------------|-------------------|------------|-------------------|------------|-------------------|
| | Fires | Acres | Fires | Acres | Fires | Acres |
| 2001 | 5 | N/A | 15 | 310,500 | 20 | >310,500 |
| 2002 | 10 | >500,000 | 73 | 2,710,599 | 83 | >3,210,599 |
| 2003 | 17 | 307,034 | 54 | 1,637,471 | 71 | 1,944,721 |
| 2004 | 24 | 5,000,000 | 25 | 471,102 | 49 | 5,471,102 |
| 2005 | 23 | 800,000 | 46 | 734,559 | 69 | 1,534,559 |
| 2006 | 61 | 2,532,907 | 115 | 2,470,856 | 176 | 5,003,763 |
| 2007 | 39 | 2,451,891 | 103 | 3,497,601 | 142 | 5,949,492 |
| Sum | 179 | 11,592,102 | 431 | 11,832,688 | 610 | 23,424,790 |

Note: USGS EROS mapped most of the 2004 Alaska Fires for DOI and Alaska State Lands

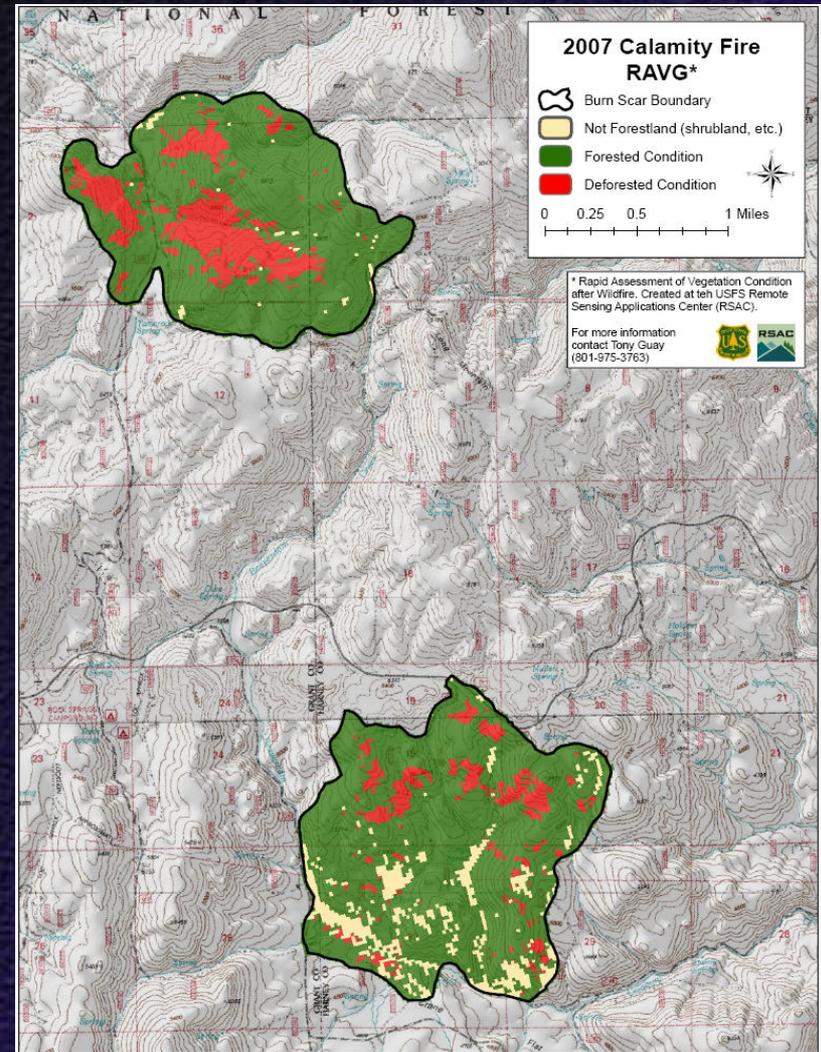
RAVG Requirements

- **R**apid **A**ssessment of **V**egetation Condition after Wildfire (RAVG)
 - ◆ Post-fire damage assessment due to wildfire
 - Focus on vegetation - forestry silviculture perspective
 - Calculate acres of land suitable for reforestation
 - Spatially represent forested vs. deforested areas following wildfire
 - ◆ Data delivered to Regional Silviculturists to help determine reforestation needs
 - ◆ All within 30 calendar days of fire containment

RAVG Table & Map Products

| 2007 Calamity Fire - Malheur NF Rapid Assessment of Vegetation Condition after Wildfire (RAVG) | | | |
|---|----------------------|---------------|----------------|
| Vegetation Group (LANDFIRE)* | Vegetation Condition | Slope | Acres |
| Grassland / Shrubland / Non Veg Total | | | 164.8 |
| Pinyon - Juniper Woodland | Forested | Flat (< 30%) | 88.1 |
| | | Steep (> 30%) | 8.9 |
| | Deforested | Flat (< 30%) | 3.6 |
| | | Steep (> 30%) | 0.9 |
| Pinyon - Juniper Woodland Total | | | 101.4 |
| Deciduous Open Tree Canopy | Forested | Flat (< 30%) | 96.7 |
| | | Steep (> 30%) | 11.6 |
| | Deforested | Flat (< 30%) | 12.2 |
| | | Steep (> 30%) | 1.6 |
| Deciduous Open Tree Canopy Total | | | 122.1 |
| Evergreen Closed Tree Canopy | Forested | Flat (< 30%) | 586.2 |
| | | Steep (> 30%) | 171.2 |
| | Deforested | Flat (< 30%) | 166.4 |
| | | Steep (> 30%) | 50.0 |
| Evergreen Closed Tree Canopy Total | | | 973.9 |
| Evergreen Open Tree Caopy | Forested | Flat (< 30%) | 697.0 |
| | | Steep (> 30%) | 132.8 |
| | Deforested | Flat (< 30%) | 95.2 |
| | | Steep (> 30%) | 13.3 |
| Evergreen Open Tree Caopy Total | | | 938.3 |
| Mixed Evergreen - Deciduous Open Tree Canopy | Forested | Flat (< 30%) | 83.4 |
| | | Steep (> 30%) | 10.5 |
| | Deforested | Flat (< 30%) | 9.6 |
| | | Steep (> 30%) | 0.7 |
| Mixed Evergreen - Deciduous Open Tree Canopy Total | | | 104.1 |
| Grand Total | | | 2,404.6 |

* See RAVG - LANDFIRE Crosswalk worksheet below for Vegetation Group definitions



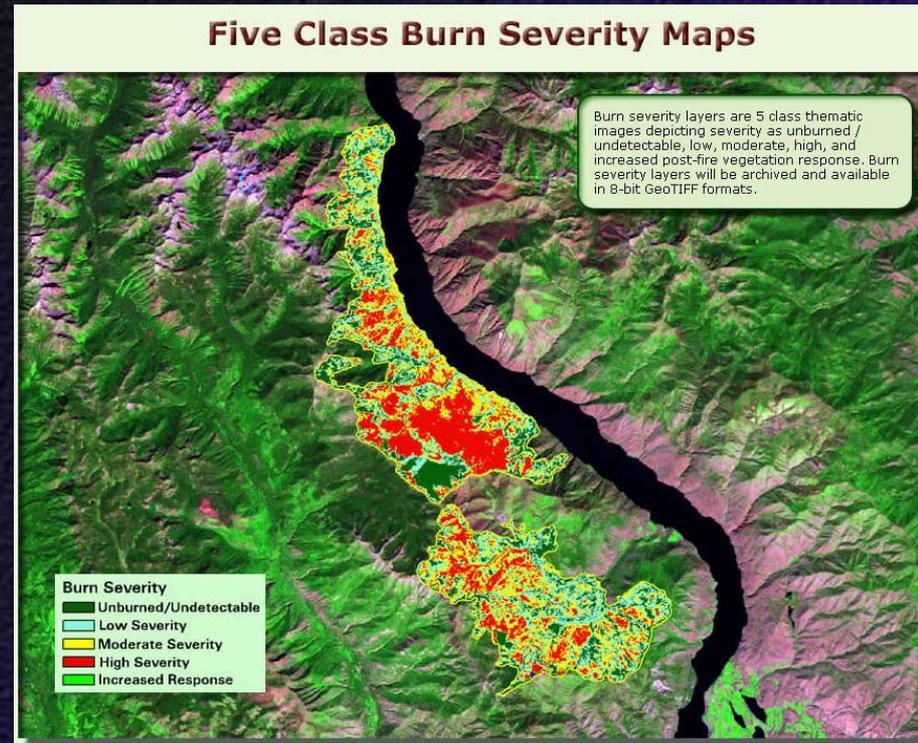
- Vegetation Groups summarized by:
- severity (forested vs. deforested condition)
 - ownership and land status
 - slope

What about historical fires and trends?

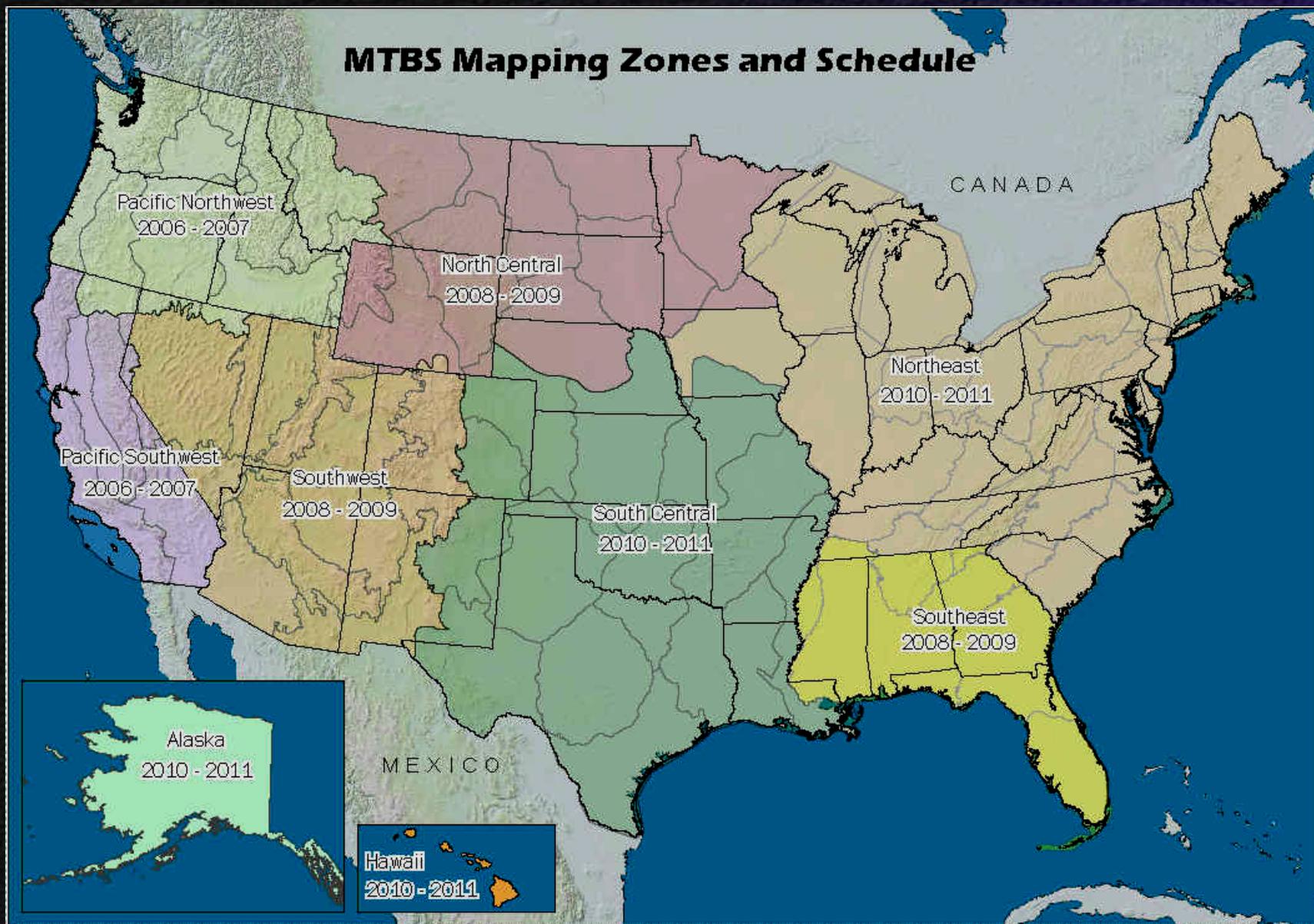
- **MTBS (Monitoring Trends in Burn Severity)**
 - ◆ USFS RSAC and USGS Center for EROS
 - ◆ Map *every* fire > 1,000 acres (in West) and > 500 acres (in East) between 1984 - present
 - Historical fires
 - Current year fires
 - ◆ Mapped with extended assessment protocol
 - Post-fire imagery acquired during next growing season
 - ◆ Severity classifications focused on vegetation and ecological effects

MTBS Deliverables

- Prefire Image (full scene)
- Postfire Image (full scene)
- Continuous value dNBR / RdNBR (full scene)
- Thematic 5-class severity layer
- Vector shapefile fire perimeter
- Nationwide fire occurrence database
- Trends analyses
 - ◆ Acres of severity by vegetation, ownership, etc., over time



MTBS Mapping Schedule



Imagery and Geospatial Data Support

- FSGeodata clearinghouse - web delivery of geospatial data
 - ESRI Image Server - rapid interactive access to nationwide imagery ArcMap
 - Data Doors - delivery of larger geospatial data sets
- Image acquisition for field users
 - EROS Data Center, NASA, USDA, commercial vendors

ESRI Image Server

Launched in October, 2006

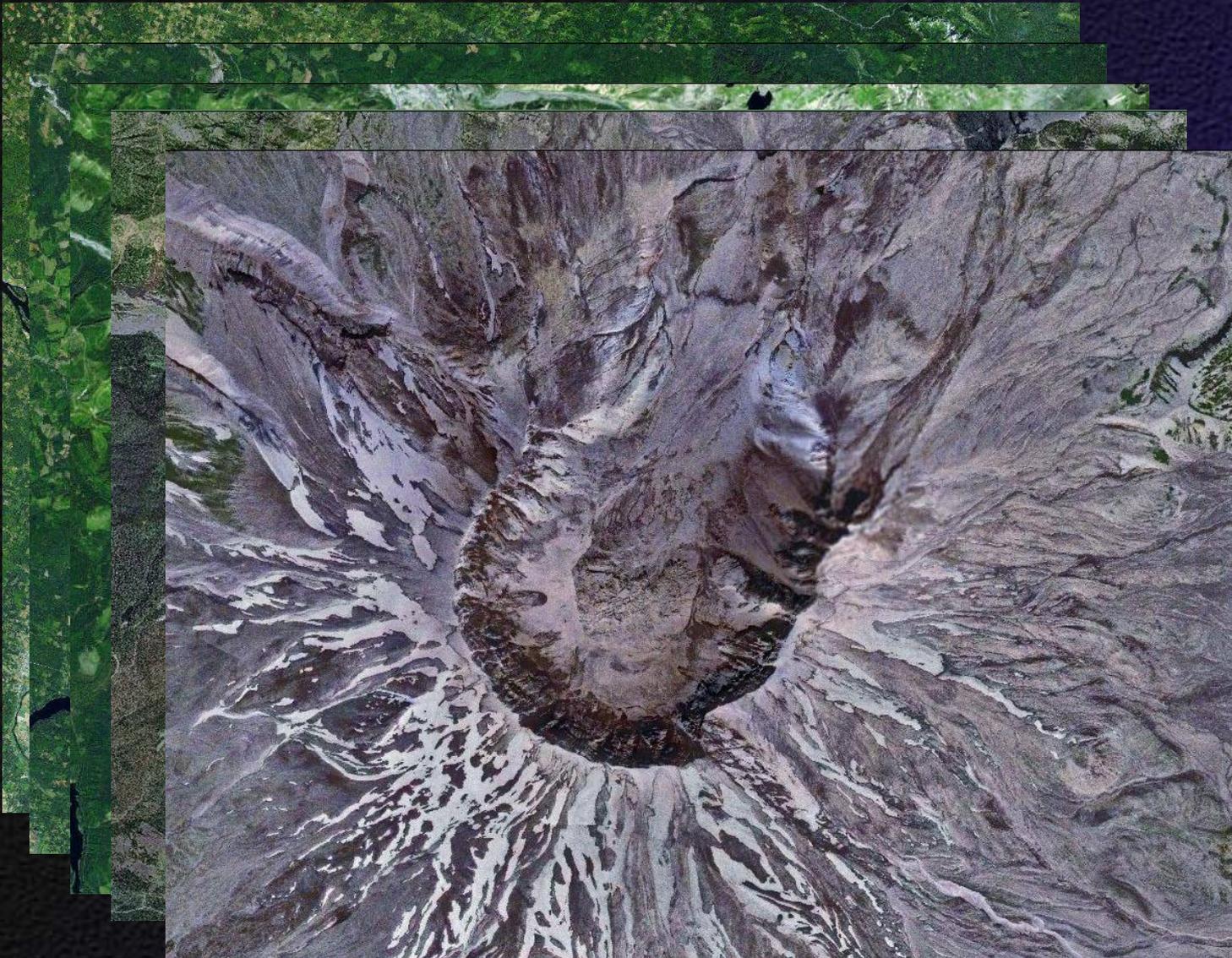
- Three Access Methods:
 - ◆ FS & BLM intranet - through ArcMAP client, v9.1 & v9.2
 - ◆ I-Web and National Apps access through Citrix
 - ◆ ArcServer, provides Image Server access for Web Map Services (WMS), ArcIMS and HTML web services
- Development for Specific Communities:
 - ◆ National Interagency Fire Center
 - ◆ Active Fire Map, internet ArcIMS access
 - ◆ Forest Inventory Analysis
 - ◆ ArcGIS Explorer (3D Globe viewing)

ESRI Image Server

Current Services Published

- Imagery:
 - ◆ Nationwide Select - 1 meter color (Continental US)
 - ◆ Other 1 & 2 Meter - Alaska, Puerto Rico, National Forest image archives
 - ◆ eSAT - 15 meter color (Continental US and Alaska)
 - ◆ MODIS - Blue Marble - 1 kilometer (North America)
 - ◆ Various small footprint 1 meter image datasets
- Maps :
 - ◆ 1:24k, 1:100k, & 1:250k eTOPO - DRG's - Continental US, Alaska, Puerto Rico
 - ◆ All current Softcopy produced by GSTC
 - ◆ All digital Secondary Base Series produced by GSTC
- Terrain:
 - ◆ 200, 90, 30, and 10 meter Shaded Relief (Continental US)
 - ◆ 30 and 10 meter Aspect (Continental US & Puerto Rico)
 - ◆ 60 meter Shaded Relief (Alaska)

ESRI Image Server



ESRI Image Server

Statistics

- Servers have been in operation for 12 months, 24/7 access.
 - ◆ 1 hour down time each weekend during off-peak hours
 - ◆ Only **25 minutes** down time during business hours over the last 12 months.
- IS client access:
 - ◆ Average **1,600** client connections per day (business days)
 - ◆ Each client connection zooms or pans an average of **16** times
 - ◆ Each zoom or pan averages **350 KB** / image
 - ◆ Average daily output across the network - **25,600** compressed images, or **8.96 GB's**
 - ◆ Total business days in operation - **7,680,000** compressed images delivered to date, or **2.7 TB's**

Virtual Globe Applications

- Virtual Globe technical report
 - ◆ *"Implementing Virtual Globe: Geographic Exploration System Software Applications in the US Forest Service" - April, 2007*
- Collaboration with Google Earth
 - ◆ Forest Service presence on Google Earth
 - Published map data sets on free client
 - ◆ Forest Service Enterprise Client Google Server
 - Building raster and vector globe data in SLC
 - Served from ABQ data center

Virtual Globe Applications

- ArcGIS Explorer
 - ◆ Building a pilot "Home Server" in SLC with 3-D Nationwide Select 1 meter data
- Includes terrain, vectors and some fire activity information

