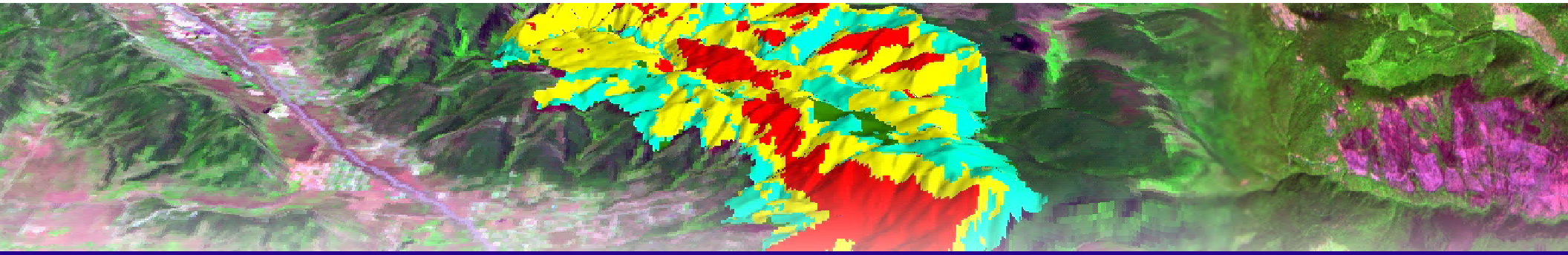


Monitoring Trends in Burn Severity (MTBS)

A Multi-Decadal Geospatial Data Record of Fire Severity for the United States

Brad Quayle
Brian Schwind
Mark Finco

USDA Forest Service
Remote Sensing Applications Center (RSAC)

Geospatial 09
April 27-May 1, 2009

Monitoring Trends in Burn Severity

USGS science for a changing world

Forest Service U.S. Department of Agriculture

RSAC

Geospatial Management Office
United States Forest Service

www.mtbs.gov

Presentation Objectives

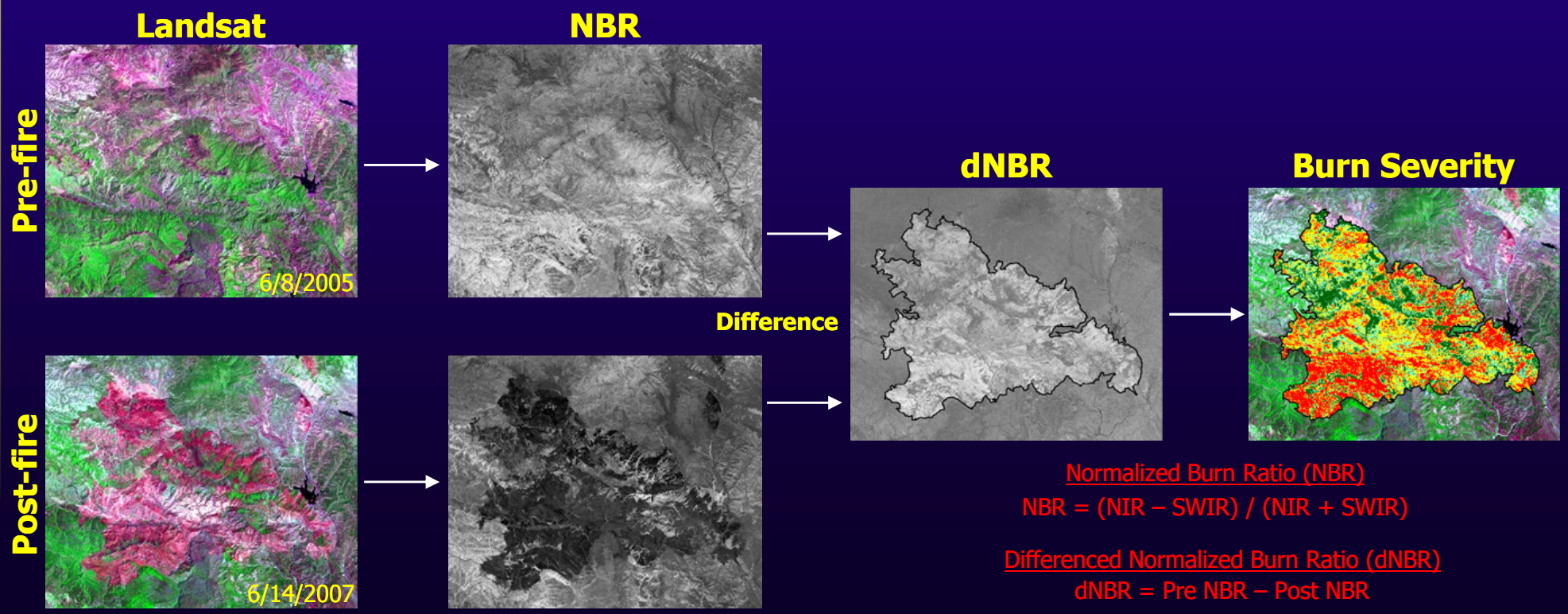
- MTBS Project Overview
- MTBS Project Status
- Available MTBS Geospatial Data Products
- MTBS Geospatial Data Product Distribution
- Summary of MTBS Data Results for the Western United States (1984-2006)

MTBS Project Overview

- Consistently map the location, extent and burn severity of large fires on all lands in the United States from 1984 and 2010
  - > 1,000 acres in the western United States
  - > 500 acres in the eastern United States
- Sponsored by the interagency Wildland Fire Leadership Council (WFLC)
  - One element of a strategy monitoring the effectiveness of NFP and HFRA
  - Provide an information base to synoptically assess environmental impacts and trends
  - Required for all lands in CONUS, AK, HI and PR
- GAO recommendation that land management agencies develop and implement comprehensive burn severity assessments
  - Provide consistent and comprehensive data characterizing wildfire effects to land managers and the scientific community
- Initiated in FY 2006
- Jointly implemented by USFS RSAC and USGS EROS
  - Equal funding from USDA-FS and DOI

MTBS Fire Mapping Methods 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 pre-processing, image differencing, burned area delineation and threshold dNBR images into burn severity classes
- Metadata, map products, burn severity data analysis and summary, and reporting



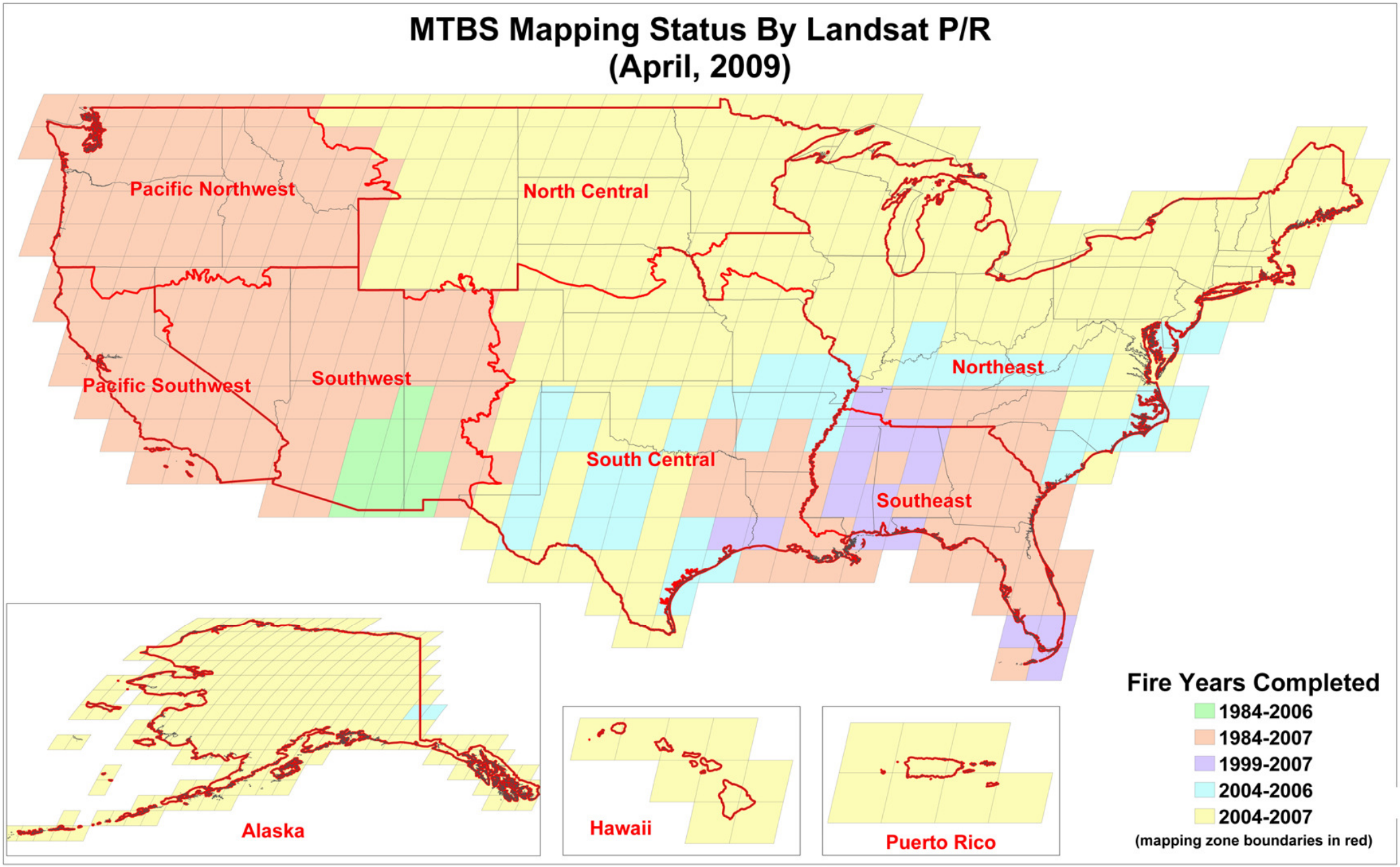
Normalized Burn Ratio (NBR)

NBR = (NIR – SWIR) / (NIR + SWIR)

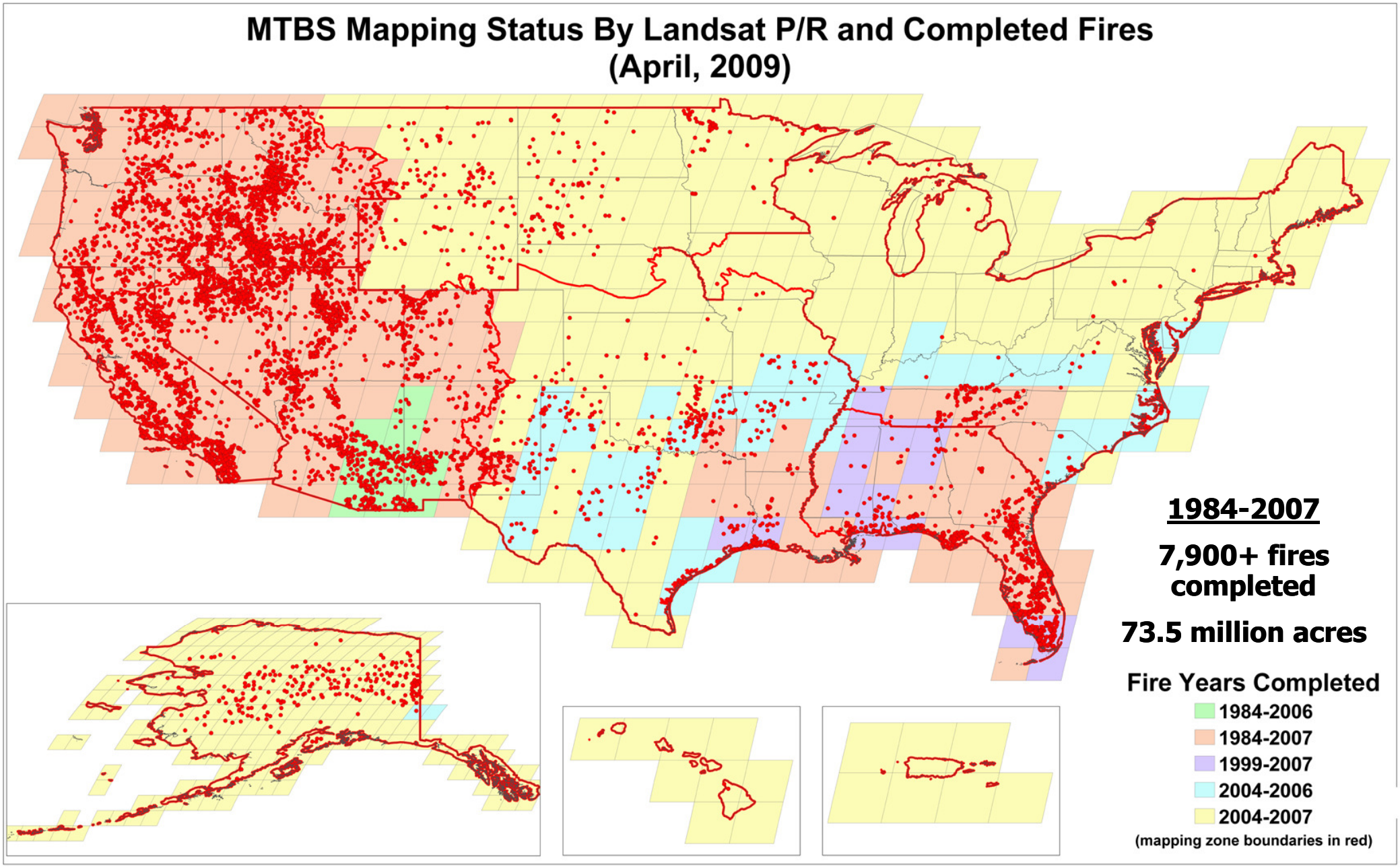
Differenced Normalized Burn Ratio (dNBR)

dNBR = Pre NBR – Post NBR

MTBS Production Schedule/Status



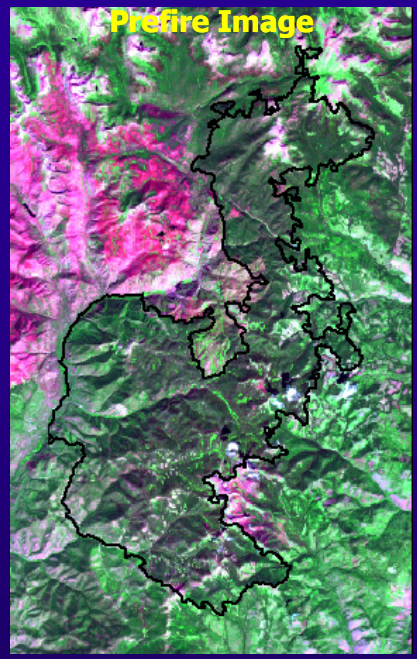
MTBS Production Schedule/Status

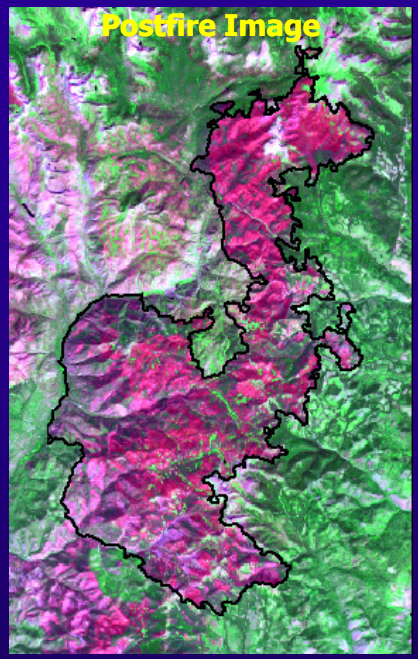


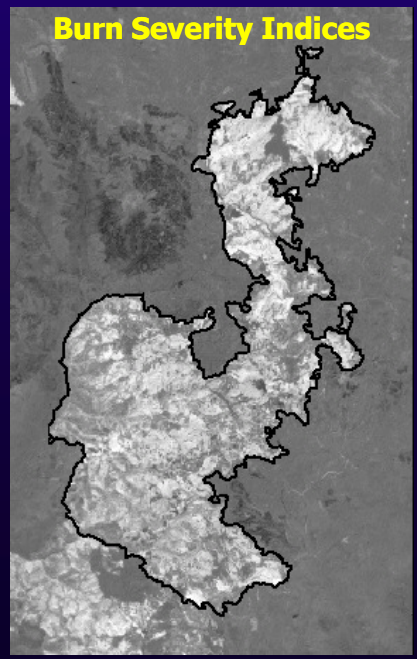
MTBS Geospatial Products

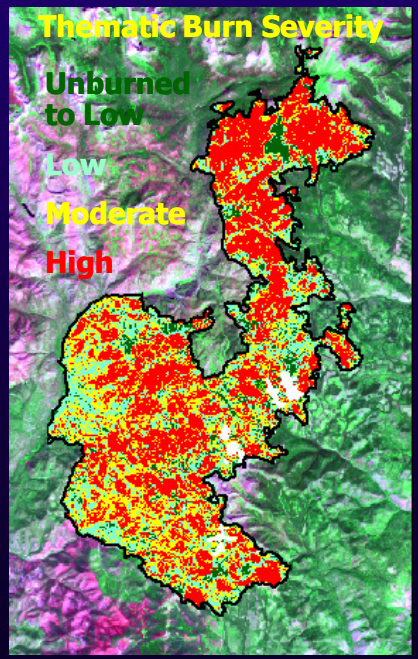
Individual MTBS Fire Datasets

- Pre/Post-fire Landsat imagery
  - Bands 1-5, 7
  - 8-bit GeoTiff
- Burn scar boundary
  - Vector delineation of burned area extent based on image analysis
  - ESRI Shapefile
- Continuous burn severity indices
  - dNBR/RdNBR
  - 16-bit GeoTiff
- Thematic burn severity data
  - 6 classes (unburned to low, low, moderate, high, increased vegetation response, non-mappable areas)
  - 8-bit GeoTiff
- Metadata
- Data are bundled by fire in compressed archive file



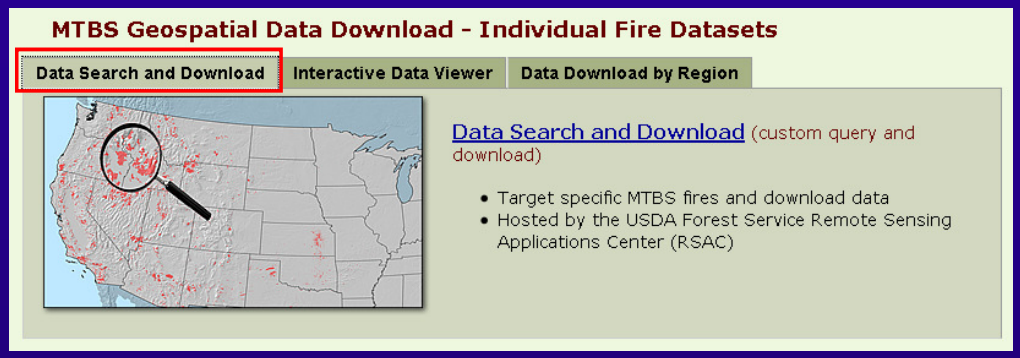






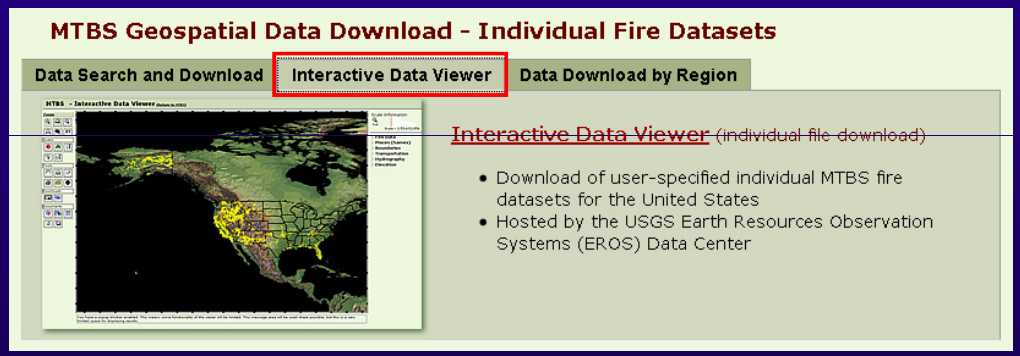
MTBS Geospatial Data Distribution

Individual MTBS Fire Dataset Access



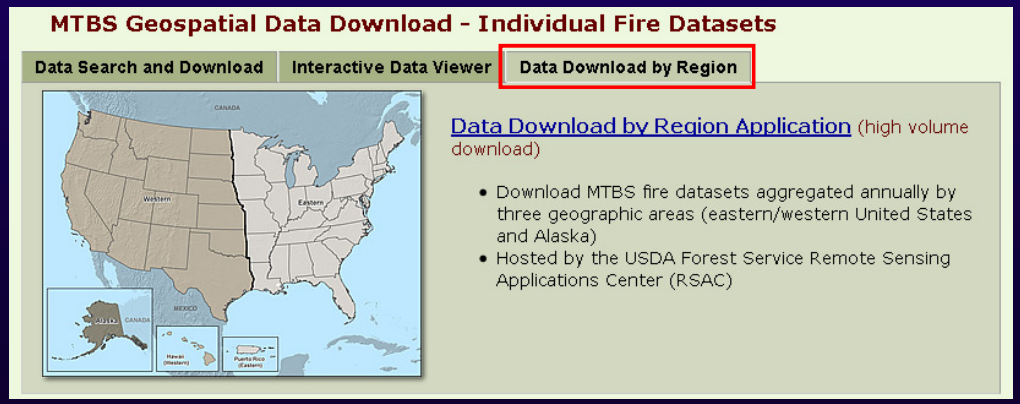
Data Search and Download

- Search fires based on one or more user-defined criteria
- Access to fire datasets and mapping/visualization products



Interactive Viewer and Download

- Selection of fires via user-defined map area (similar to National Map interface)
- Access to fire datasets



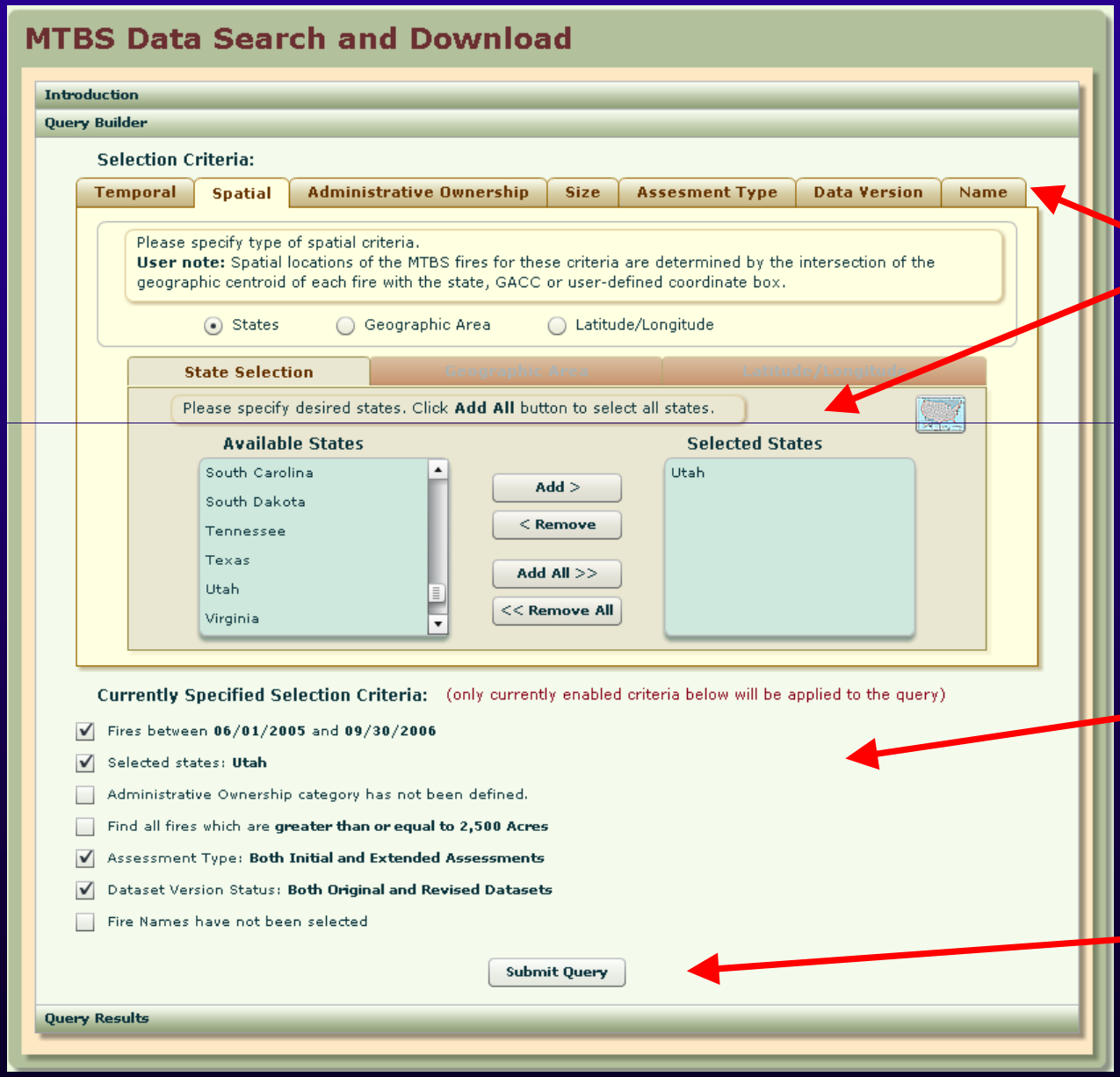
Bundled Data Delivery

- Pre-staged "bundles" of fire data by geographic area/year
  - Eastern U.S., Western U.S. & Alaska
- High volume download of bundled fire data

http://www.mtbs.gov/dataaccess.html

MTBS Geospatial Data Distribution

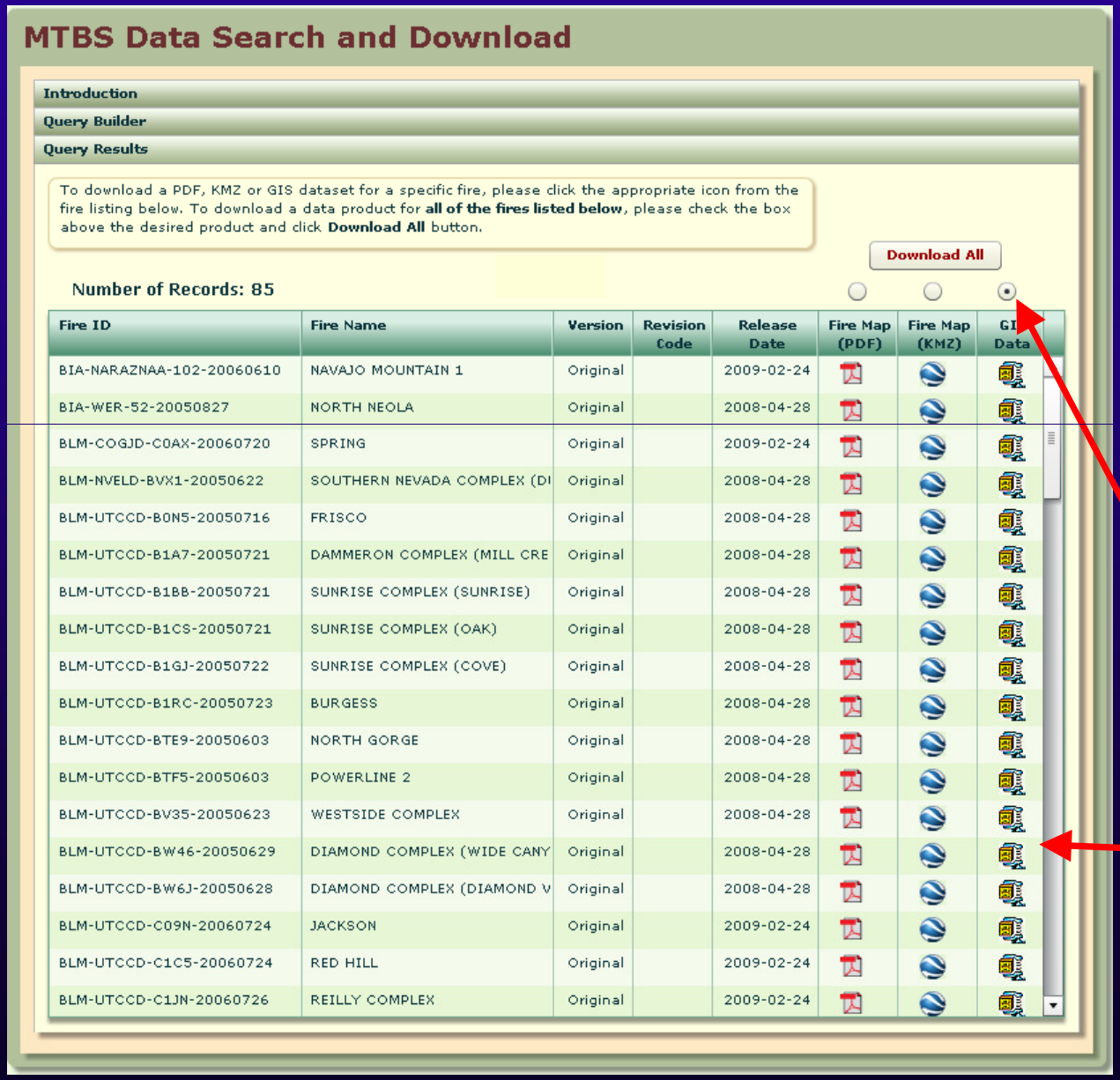
Data Search and Download Example



- Build query using one or more of seven available criteria
- Criteria easily enabled/disabled
- Submit query

MTBS Geospatial Data Distribution

Data Search and Download Example



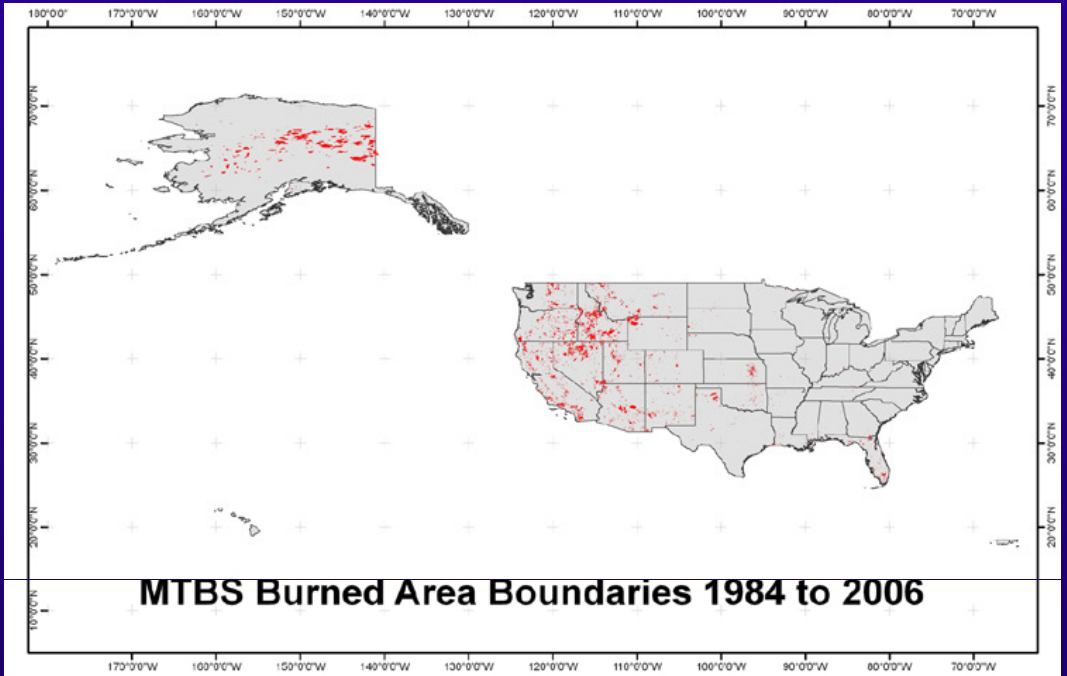
Fire ID	Fire Name	Version	Revision Code	Release Date	Fire Map (PDF)	Fire Map (KMZ)	GIS Data
BIA-NARAZNAA-102-20060610	NAVAJO MOUNTAIN 1	Original		2009-02-24			
BIA-WER-52-20050827	NORTH NEOLA	Original		2008-04-28			
BLM-COGJD-C0AX-20060720	SPRING	Original		2009-02-24			
BLM-NVELD-BVX1-20050622	SOUTHERN NEVADA COMPLEX (DI	Original		2008-04-28			
BLM-UTCCD-B0N5-20050716	FRISCO	Original		2008-04-28			
BLM-UTCCD-B1A7-20050721	DAMMERON COMPLEX (MILL CRE	Original		2008-04-28			
BLM-UTCCD-B1BB-20050721	SUNRISE COMPLEX (SUNRISE)	Original		2008-04-28			
BLM-UTCCD-B1CS-20050721	SUNRISE COMPLEX (OAK)	Original		2008-04-28			
BLM-UTCCD-B1GJ-20050722	SUNRISE COMPLEX (COVE)	Original		2008-04-28			
BLM-UTCCD-B1RC-20050723	BURGESS	Original		2008-04-28			
BLM-UTCCD-BTE9-20050603	NORTH GORGE	Original		2008-04-28			
BLM-UTCCD-BTF5-20050603	POWERLINE 2	Original		2008-04-28			
BLM-UTCCD-BV35-20050623	WESTSIDE COMPLEX	Original		2008-04-28			
BLM-UTCCD-BW46-20050629	DIAMOND COMPLEX (WIDE CANY	Original		2008-04-28			
BLM-UTCCD-BW6J-20050628	DIAMOND COMPLEX (DIAMOND V	Original		2008-04-28			
BLM-UTCCD-C09N-20060724	JACKSON	Original		2009-02-24			
BLM-UTCCD-C1C5-20060724	RED HILL	Original		2009-02-24			
BLM-UTCCD-C1JN-20060726	REILLY COMPLEX	Original		2009-02-24			

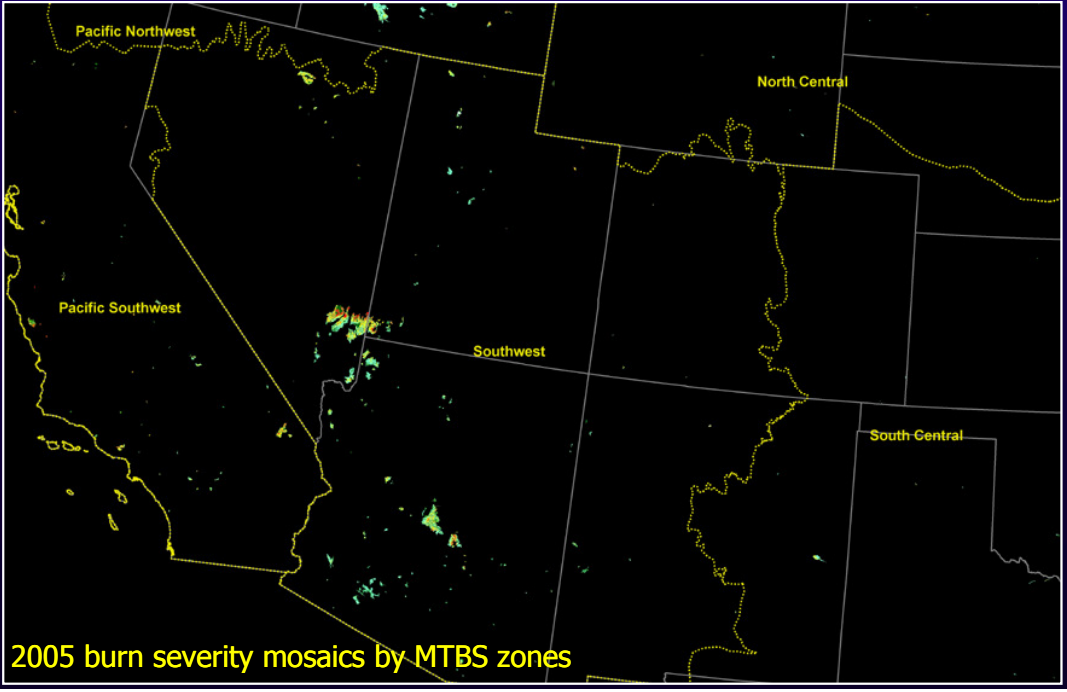
- MTBS fires meeting the query criteria are listed
- Available MTBS products for each fire:
  - PDF map
  - KMZ
  - Compressed archive file containing fire geospatial data
- Streamed downloading of designated product for all selected fires
- Select/download products individually

MTBS Geospatial Products

Composite MTBS Fire Datasets

- National
  - Burn Scar Boundaries
    - ESRI Shapefile w/metadata
    - Fire attributes
  - Fire Occurrence Database
    - ESRI Shapefile w/metadata
    - Geographic centroid of burn scar boundary for each fire
    - Fire and MTBS processing attributes
- Regional
  - Thematic Burn Severity Image Mosaics
    - 6 class thematic GeoTiffs w/metadata
    - Available by MTBS mapping zone/year

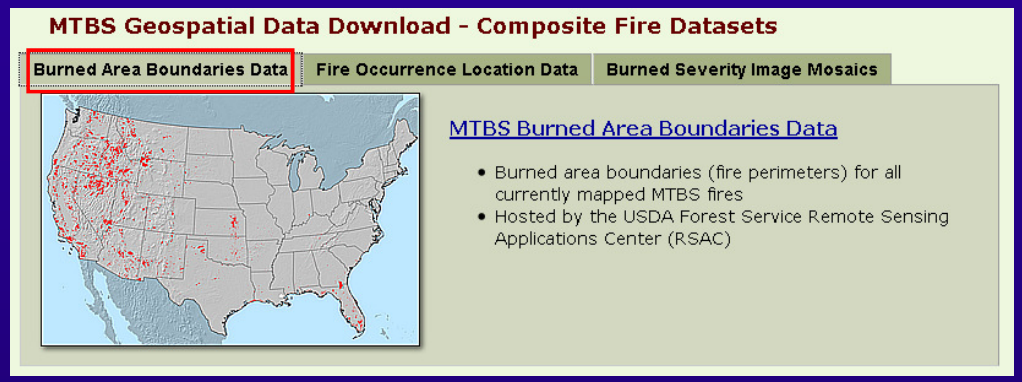


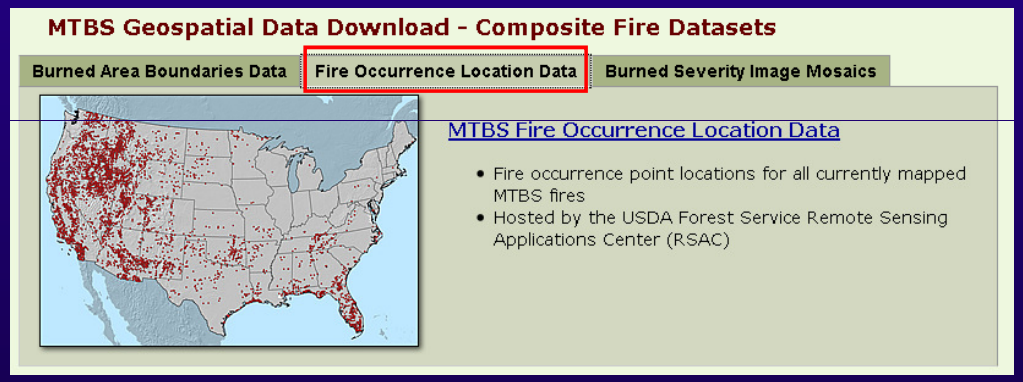


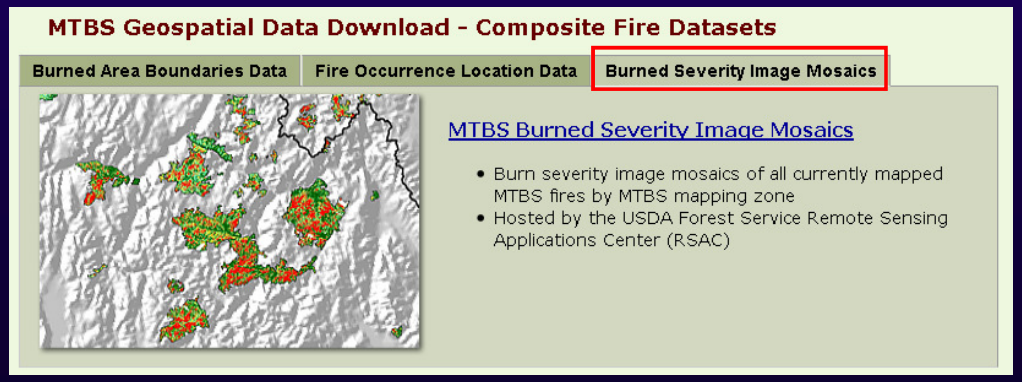
2005 burn severity mosaics by MTBS zones

MTBS Geospatial Data Distribution

Composite MTBS Fire Dataset Access







Downloadable Datasets

- Burn scar boundaries
- Fire occurrence database (FOD)
- Burn severity mosaics by mapping zone

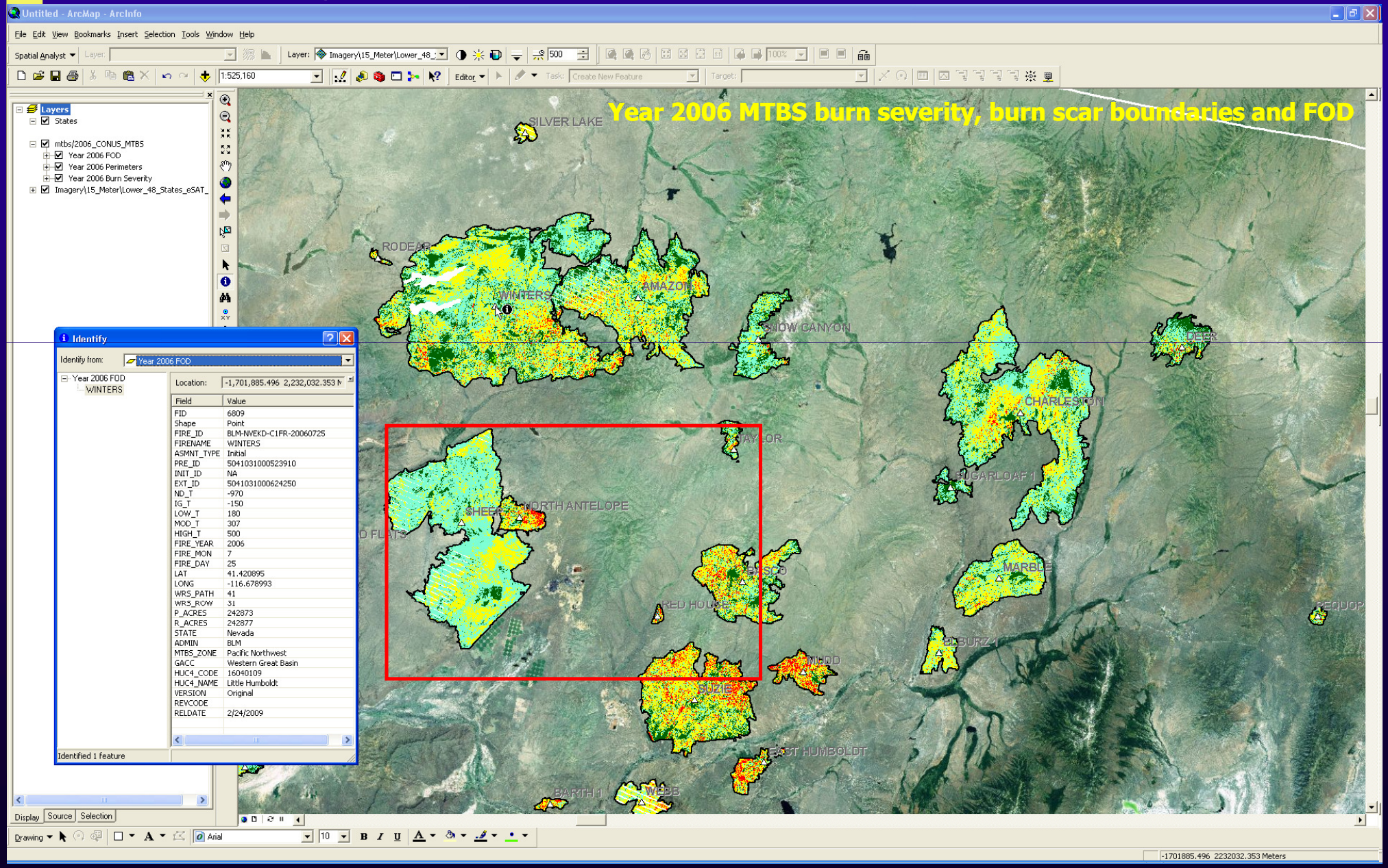
Mapping Services

- Annual composite datasets provided as:
  - ArcGIS Server mapping services
  - OGC Web Map Services (WMS)
- Connection strings to services published on MTBS data access web page
- Currently available within USFS/BLM intranet

http://www.mtbs.gov/dataaccess.html

MTBS Geospatial Data Distribution

MTBS Mapping Services Example



MTBS Results – Summary for Western United States

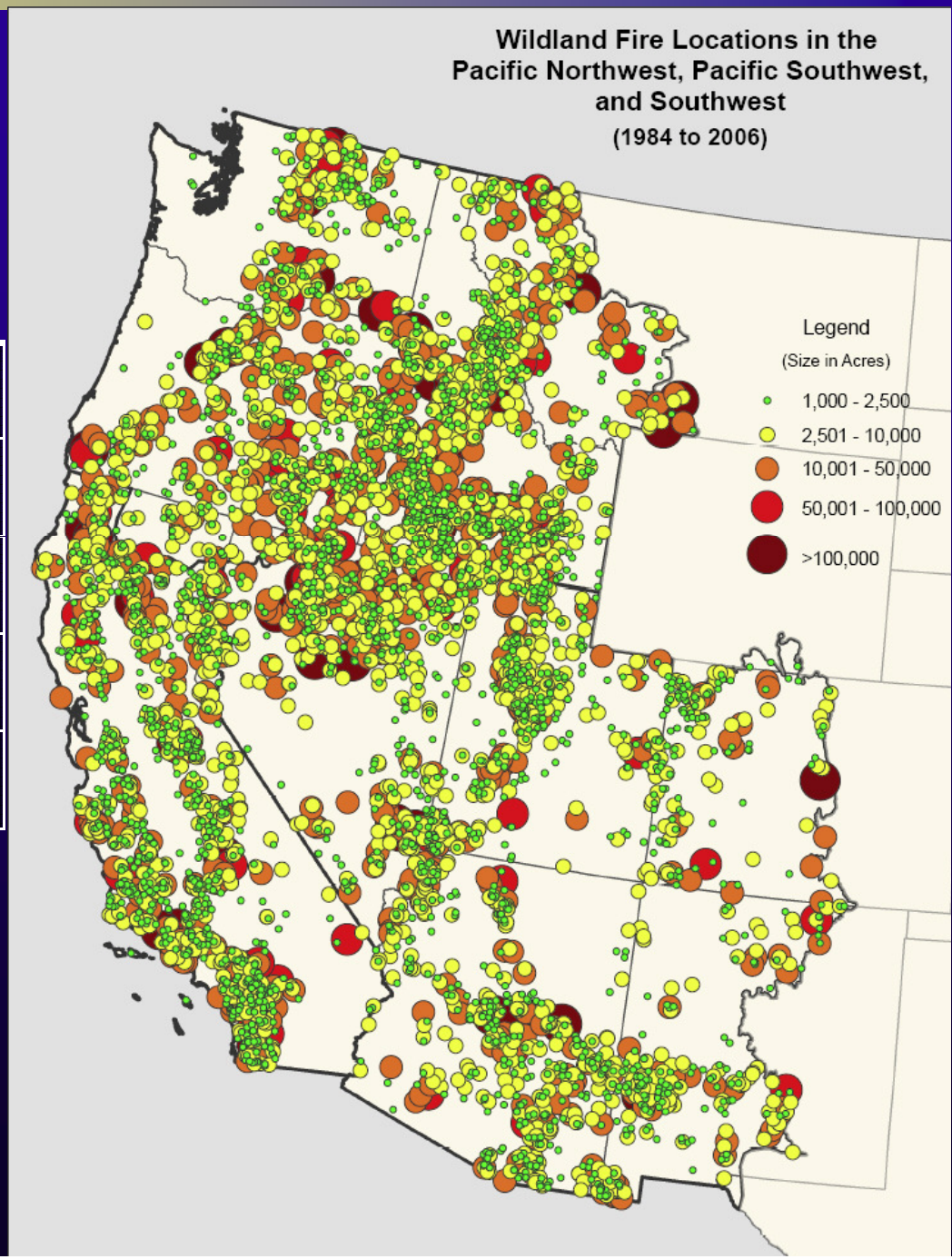
PNW, PSW and SW mapping zones

- Fires completed for 1984-2006
- Largest set of temporally and spatially continuous MTBS data currently available

MTBS Results – Summary for Western United States

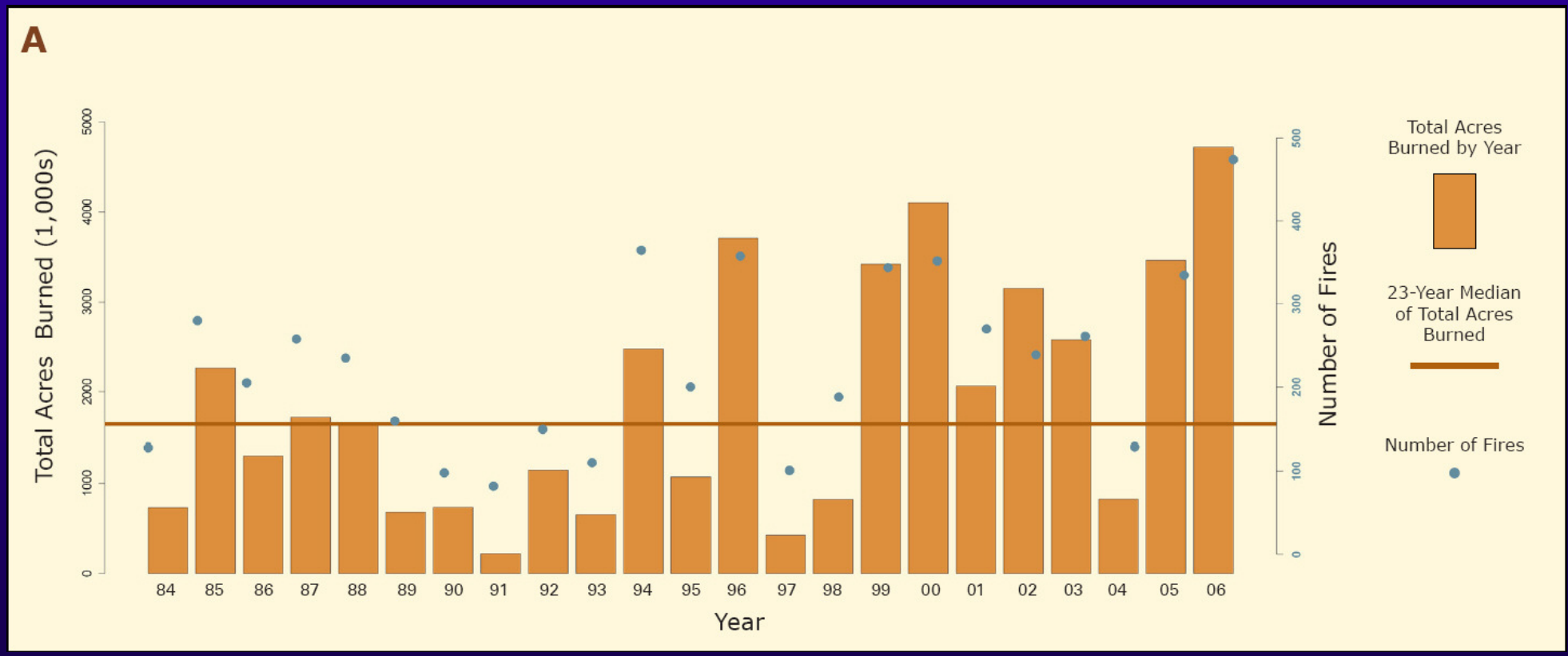
Zone	Fires*	Acres	Unburned -Low	Low	Moderate	High
PNW	2,129	19.8 m	27%	39%	20%	14%
PSW	1,224	8.6 m	25%	31%	26%	18%
SW	2,039	15.5 m	23%	39%	27%	11%
All 3 Zones	5,320	43.9 m	26%	37%	24%	13%

*Includes fires that overlap multiple mapping zones



MTBS Results – Summary for Western United States

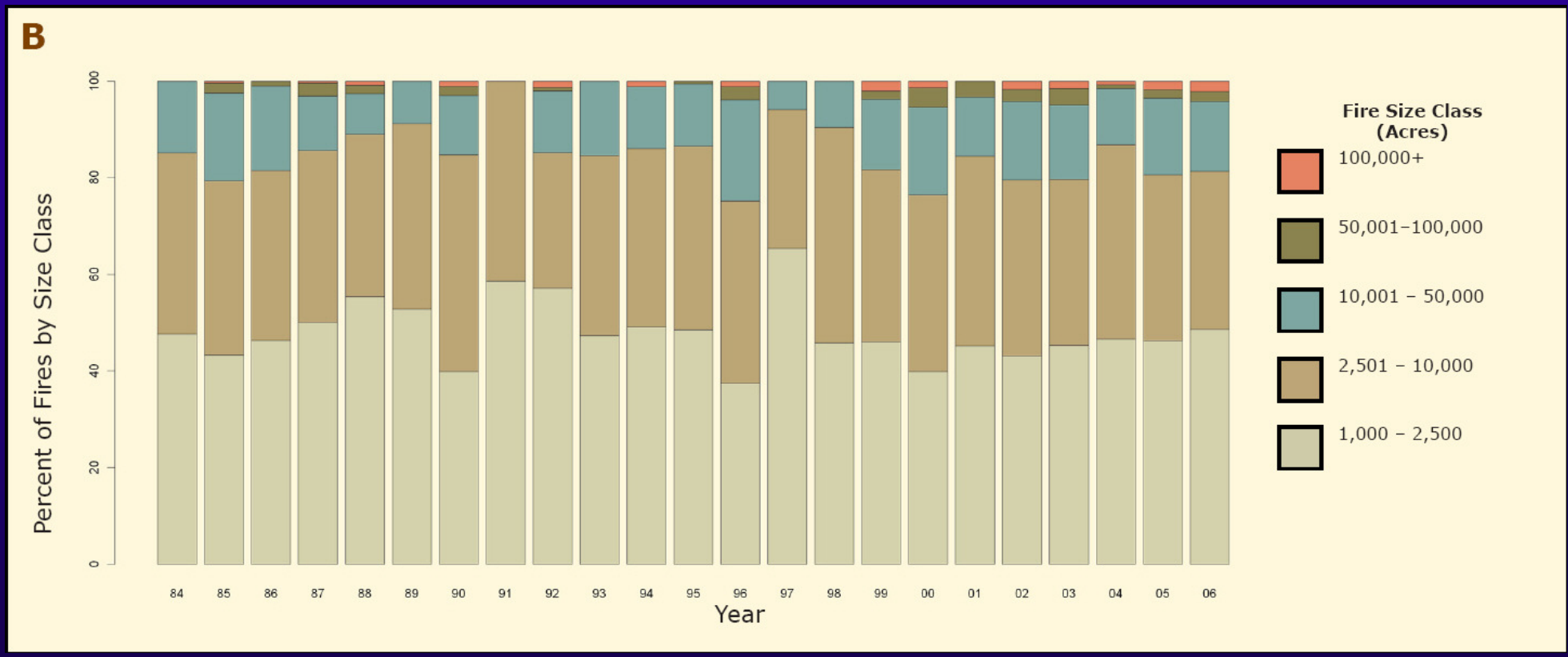
Fire Frequency and Total Acres



- Area burned and number of fires well correlated
- Significant fire years not always related between PNW, PSW and SW
- No consistent overall trend towards increased area burned or total number of fires per year
  - High and low fire years distributed across the data record
- More extraordinary fire years in the last decade

MTBS Results – Summary for Western United States

Percent of Fires by Size Class



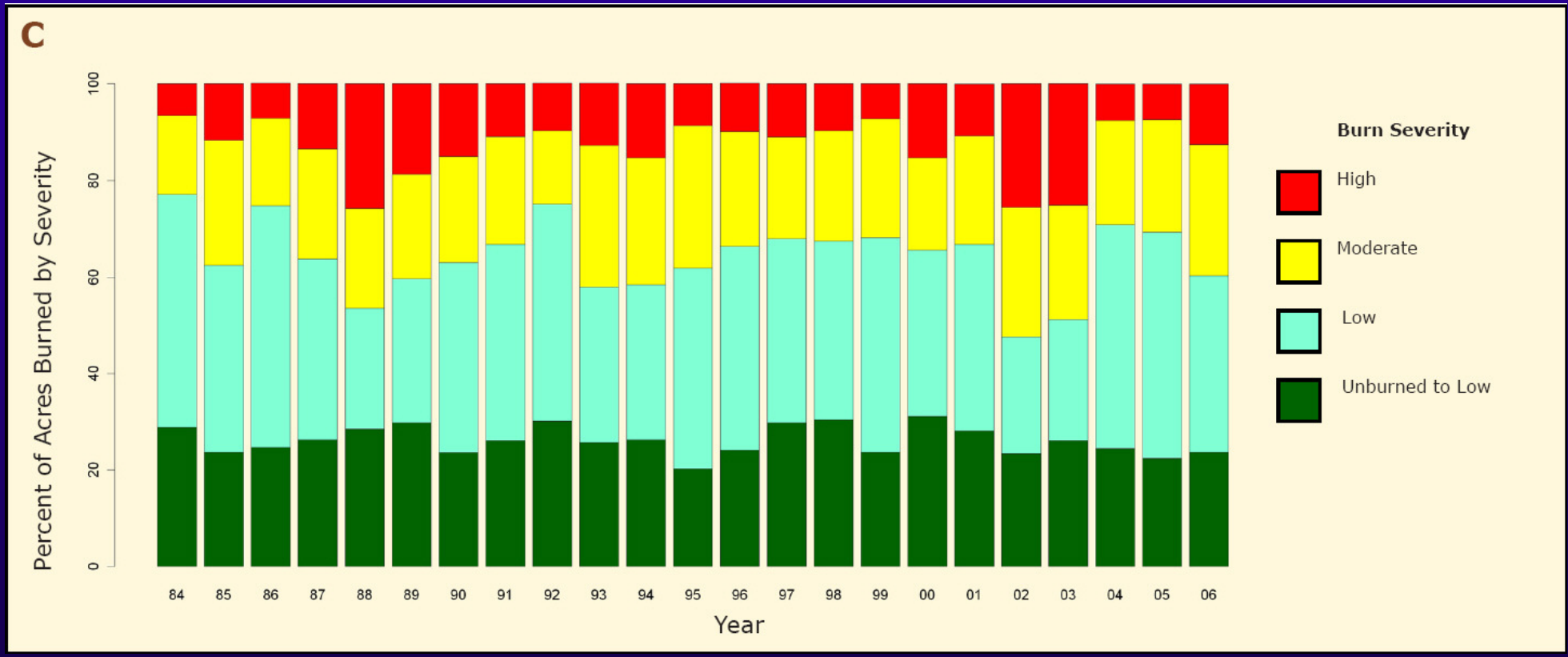
Fire size classes:

- Fires < 10,000 acres (83% of all fires; 30% of total burned area)
- Fires > 50,000 acres (2.7% of all fires; 35% of total burned area)
- Fires > 100,000 acres (1% of all fires; 21% of total burned area)

- Increasing proportion of burned area coming from large fires
- Trend toward larger mean fire size

MTBS Results – Summary for Western United States

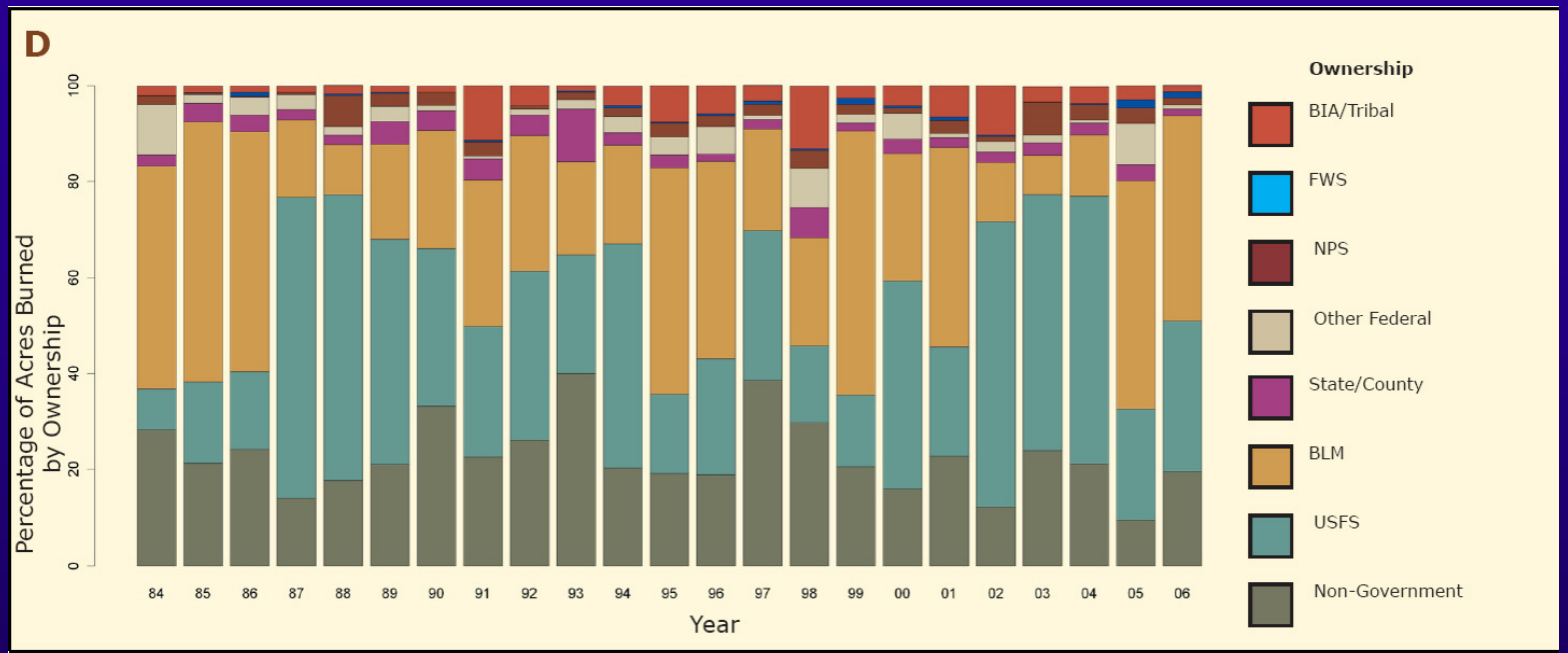
Percent of Acres Burned by Severity Class

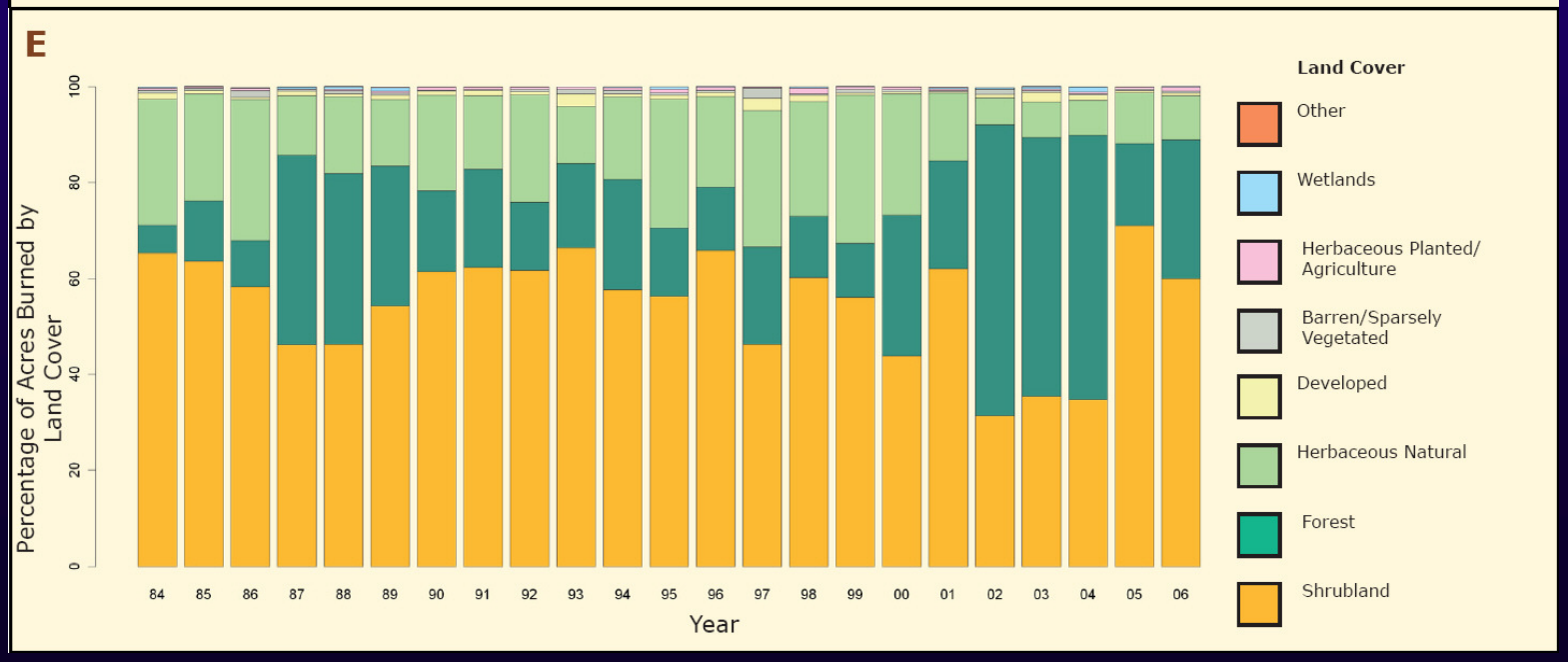


- No significant correlation between high severity years and high burned area years
- No consistent trend toward more high severity across all fires
- Large fires show higher proportions of high severity in the last decade
  - Fires > 50,000 acres: 17% high severity

MTBS Results – Summary for Western United States

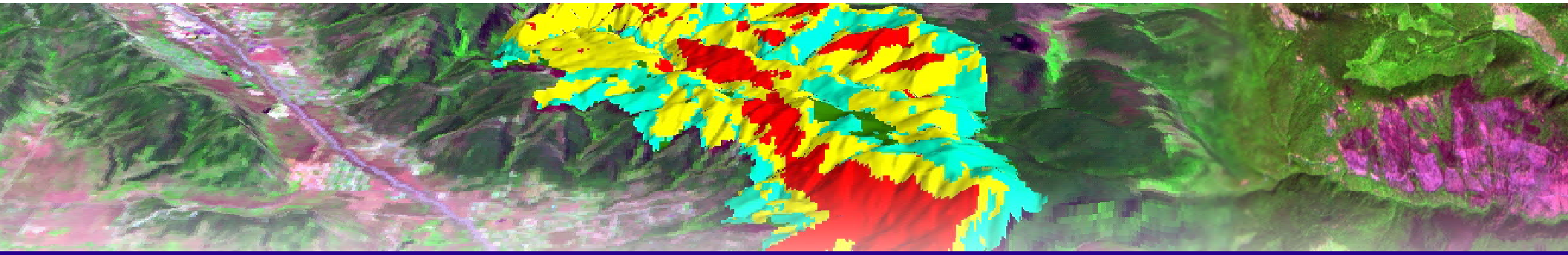
Percent of Acres Burned by Ownership and Land Cover





MTBS Data Results – Wrap Up

- Additional MTBS data summaries/information
  - MTBS Reporting Application
  - MTBS project reports
- Spatial-temporal analysis at finer scales
  - Administrative units
  - Ecological/climatic units
- Leverage additional available data to identify possible relationships and trend causation
  - Climate, fuel conditions, weather
  - Management activity and disturbance relationships
    - Fuel treatments
    - Insect and disease activity
    - Invasives



MTBS Contact Information

USDA FS – Brian Schwind bschwind@fs.fed.us
USDA FS – Brad Quayle bquayle@fs.fed.us

US Geological Survey – Jeff Eidenshink jeidenshink@usgs.gov
US Geological Survey – Steve Howard smhoward@usgs.gov

http://www.mtbs.gov

Monitoring Trends in Burn Severity

science for a changing world

Geospatial Management Office
United States Forest Service