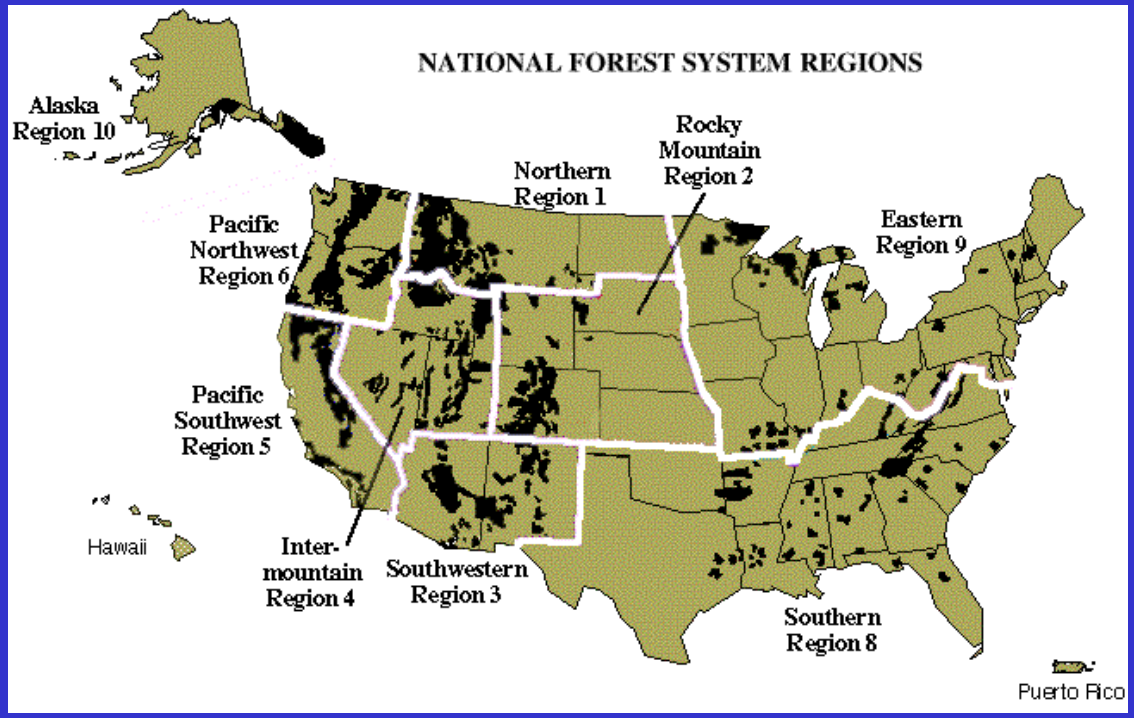
Overview of Operational Remote Sensing in the USDA Forest Service

Chuck Dull
USDA Forest Service
National Remote Sensing Program Manager
Washington, DC

USDA Forest Service



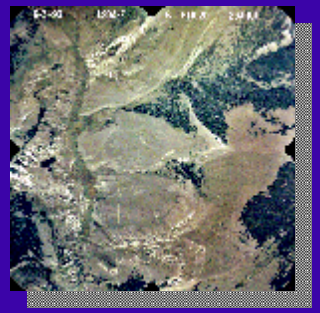
- 155 National Forests
- 192 Million acres
- 20 National Grasslands
- 30,000 employees
- 860 million recreation days/yr
- 3.4 billion board feet timber sales
- 4,400 miles of wild and scenic rivers
- 7,700 miles of scenic byways
- 23,000 recreation sites
- $21 billion worth of hunting & fishing to U.S. economy

The Forest Service carries out its mission, "Caring for the Land and Serving People," through four main activities:

- **National Forest System**
- **Research**
- **State and Private Forestry**
- **International Programs**

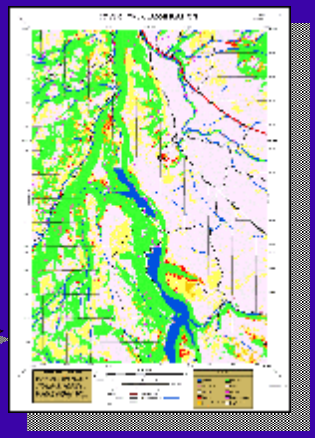
Role of Remote Sensing

Remotely Sensed Data



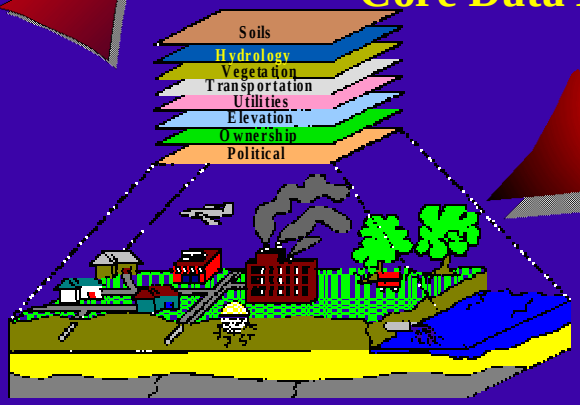
Forest Service GIS and Image Analysis

Forest Service Users



Products: Answers, Reports, Maps...

Forest Service Core Data Layers



Where do we get Remote Sensing to Support Conservation Leadership?

New and Traditional:

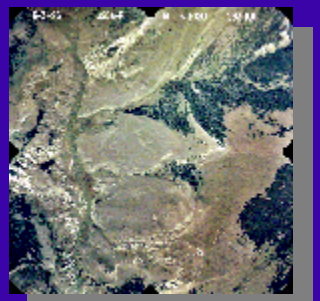
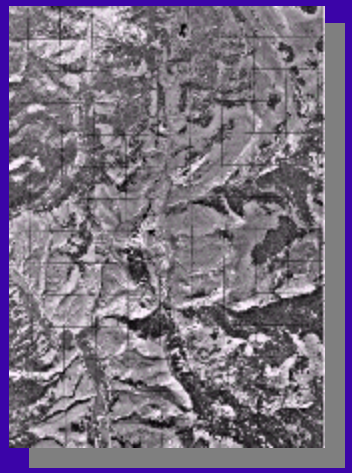
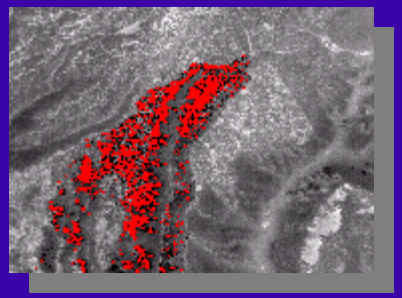
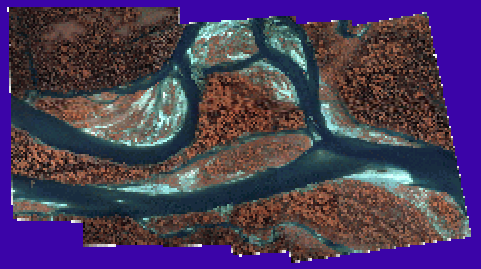
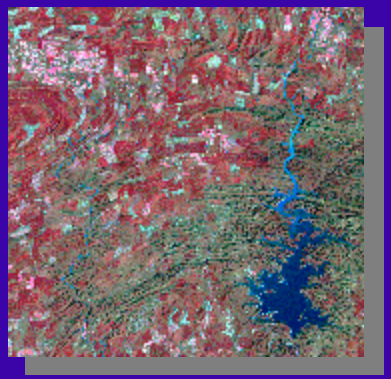
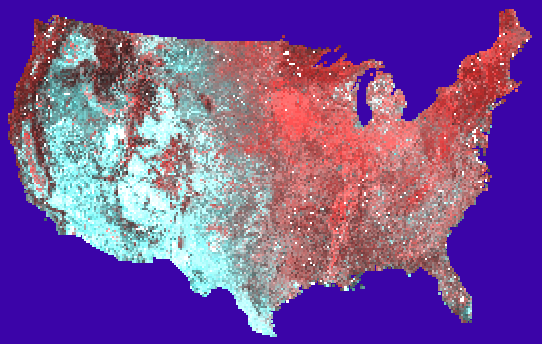
- Air Borne Observations
- Space Based Observations

Remotely Sensed Data

Aerial photography
- Natural color, color infrared, B&W
- Scales from 1:2,000 to 1:60,000

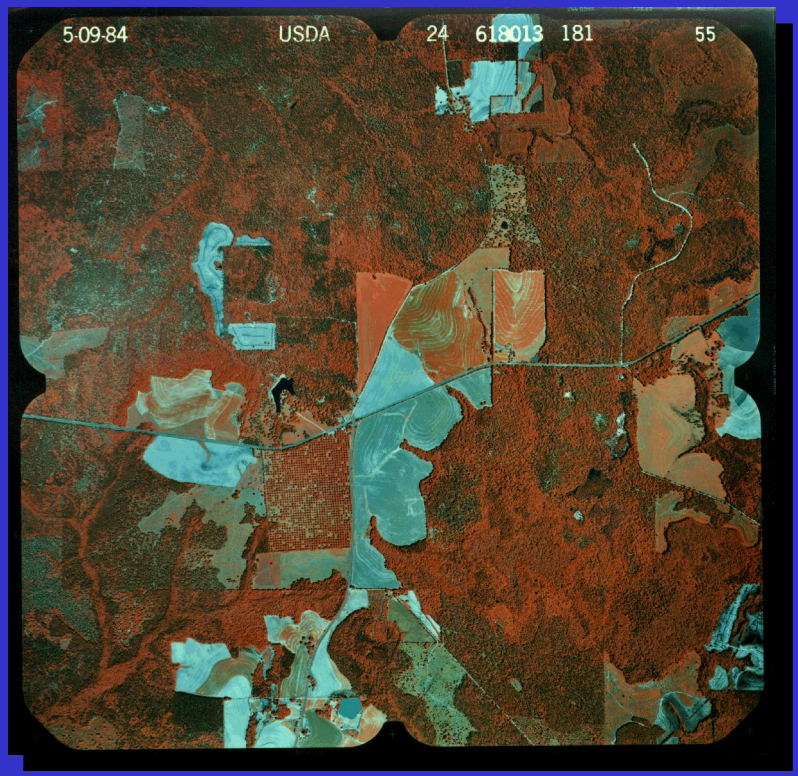
Airborne digital
- Thermal infrared scanner
- Multispectral scanner
- Digital frame cameras
- Airborne video

Satellite
- Landsat TM & MSS
- SPOT; Ikonos II
- IRS C/D
- AVHRR, SeaWiFS

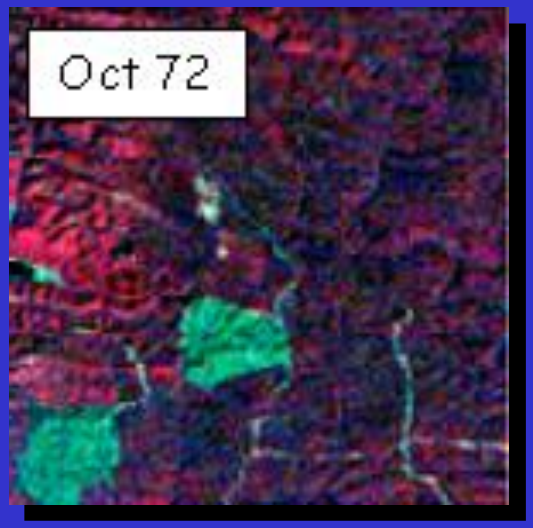
USDA Forest Service
Aerial Photography Program

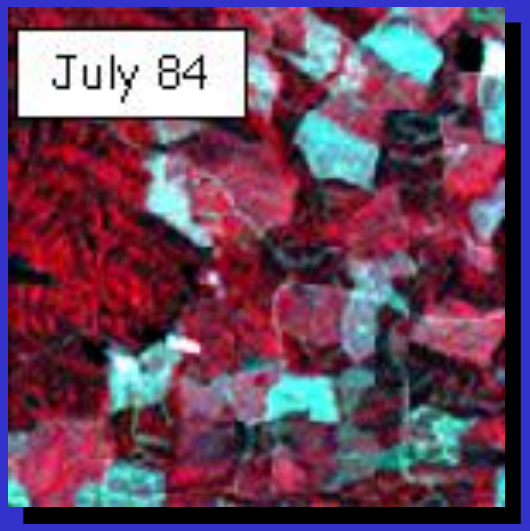
- National Aerial Photography Program (NAPP)
- Resource Aerial Photography
- Force Account Aerial Photography
- Project Aerial Photography
- NASA High Altitude Aerial Photography

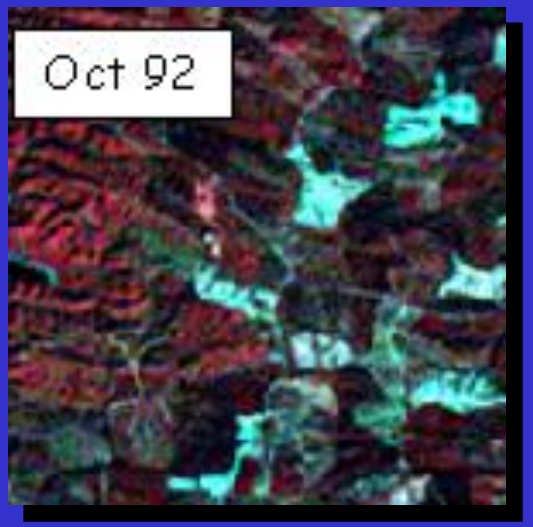


Opportunities for Sharing Satellite Imagery

- USDA - Satellite Imagery Library
- NIMA Commercial Imagery Program
- NASA Earth Science Enterprise Scientific Data Base
- Multi-resolution landscape characterization database MRLC - GAP data and continued collaboration with USGS-EDC





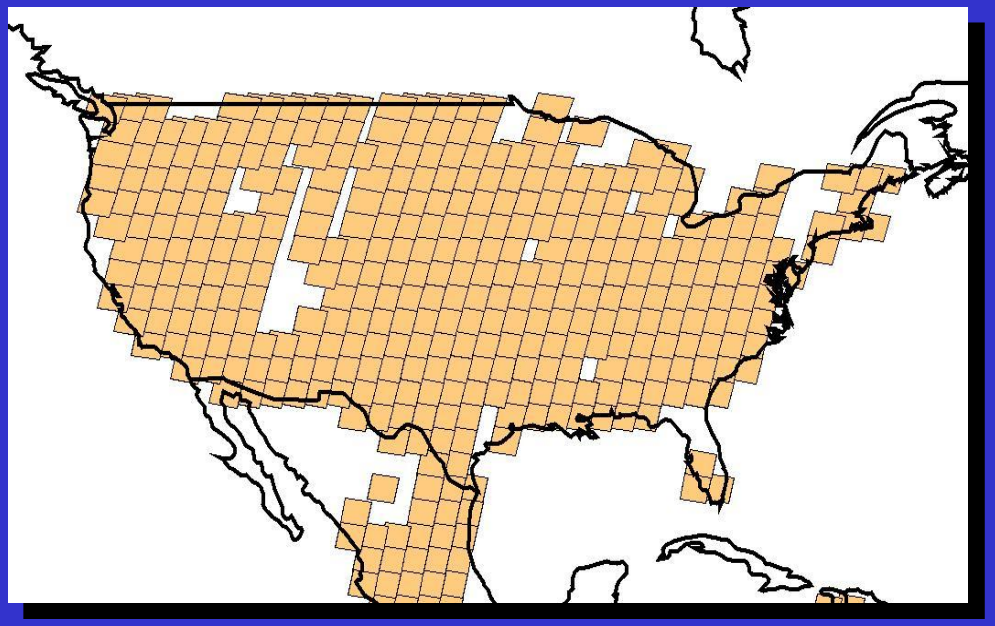


USDA – Satellite Imagery Library

- USDA is one of world's largest users of satellite imagery.
- Maximize cost of expenditures on satellite imagery; leverage gained from a single USDA purchasing body – unprecedented discounts.
- Especially important as the number of space-based sensors increases over the next few years.

1999 Acquisitions

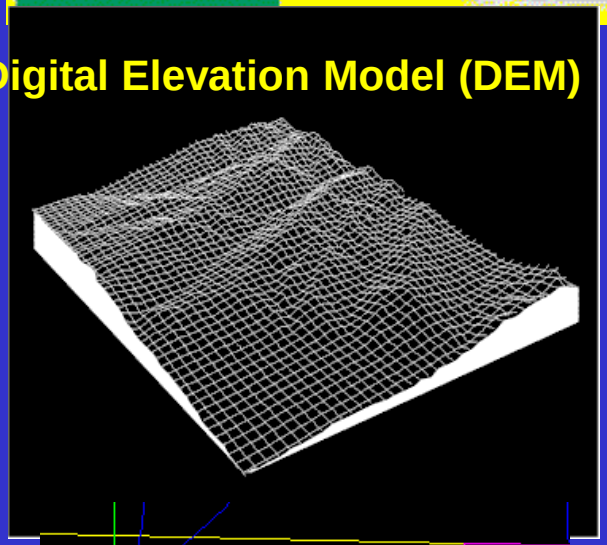
- 11,000 (Optimal) and 4,000 (Minimal) scenes per year
- Delivery within two weeks of acquisition
- 50% cloud cover or less
- Geocoded



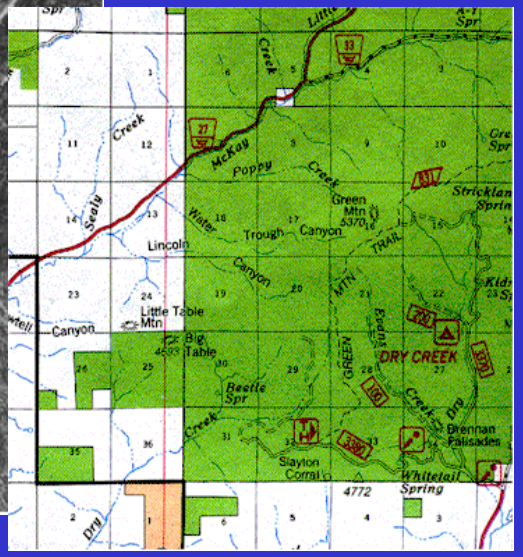
USDA Geospatial Service and Technology Center

USDA • FOREST SERVICE

Digital Elevation Model (DEM)

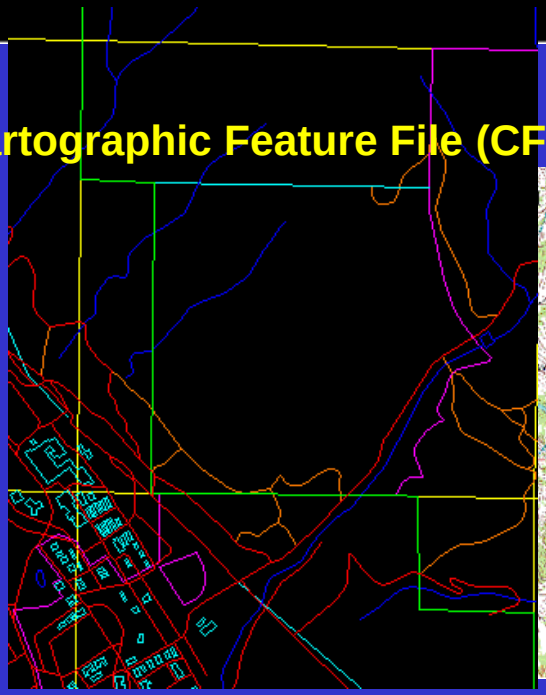


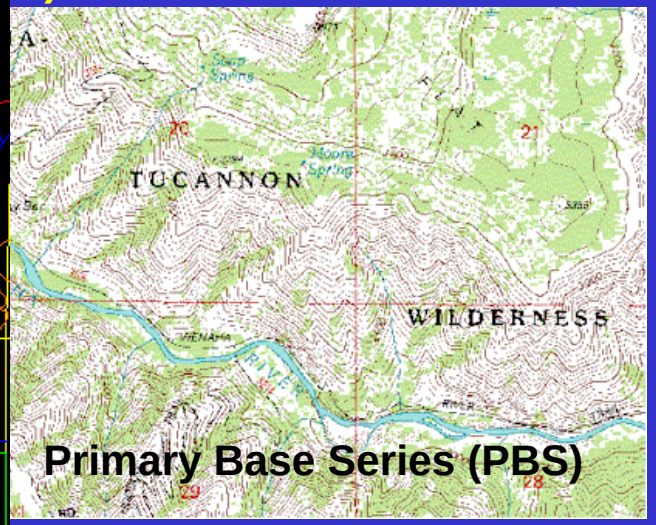
Digital Orthophotography



Secondary Base Series (SBS)

Cartographic Feature File (CFF)





Primary Base Series (PBS)

Services Include:

Digital Data Clearinghouse

Technology Transfer

Remote Sensing Applications Center

The mission of RSAC is to provide technical support to Forest Service resource specialists and managers in the use of remote sensing, image processing, GIS, and related geospatial technologies for all resource applications. The four main program areas are:

- Operations
- Liaison and Special Projects
- Integration of Remote Sensing
- Training & Technology Awareness

Current Rule Making Initiatives

- Planning Rule

  Overarching framework for implementing roadless and road policy initiative.

  Rewrite existing planning regulations.
  http://www.fs.fed.us/forum/nepa/rule/

- Road Management Policy

  For existing roaded areas.

  Draft rule March 2000— Final rule October 2000.
  http://www.fs.fed.us/news/roads/

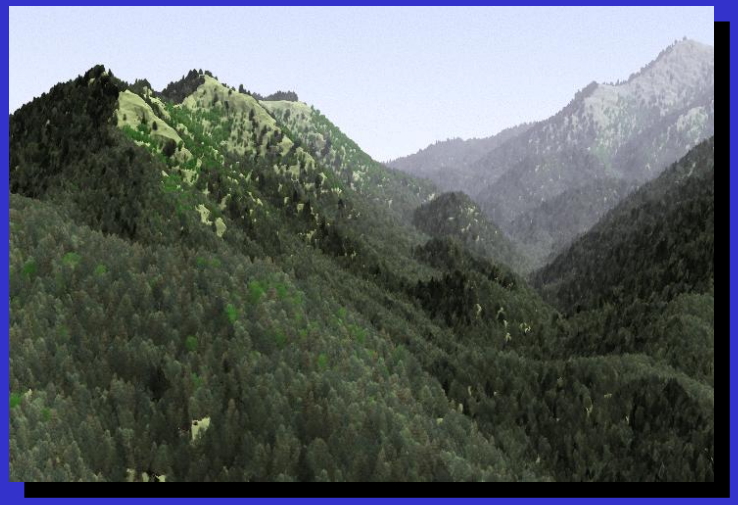
- Roadless Conservation

  For inventoried and other roadless areas.

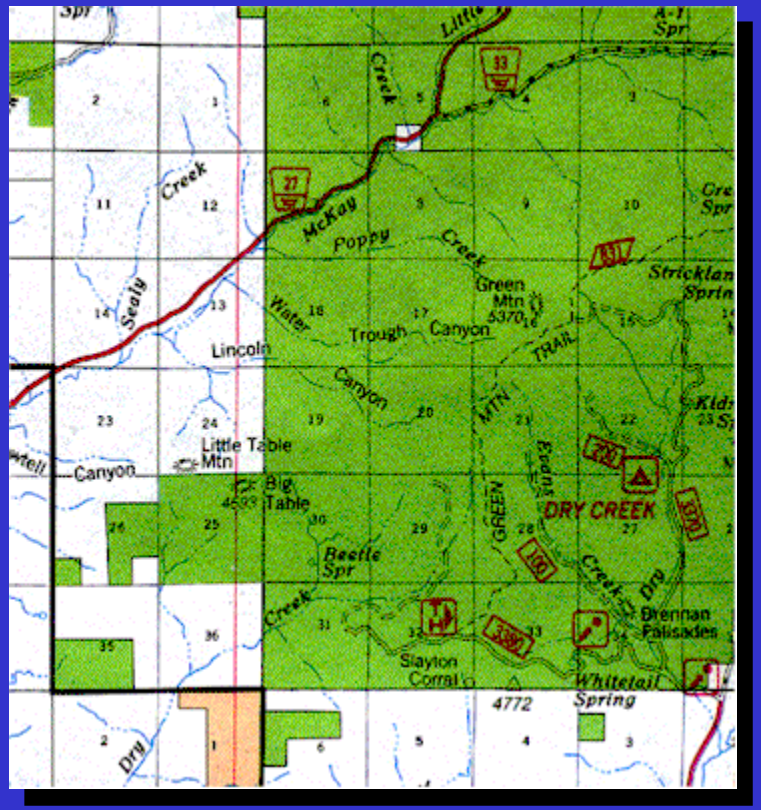
  Draft EIS/rule May 2000— Final EIS/rule December 2000.
  http://roadless.fs.fed.us/

Proposed Road Management Policy

- To provide a National Forest road system that is safe, responsive to public needs, environmentally sound, affordable, and efficient to manage.



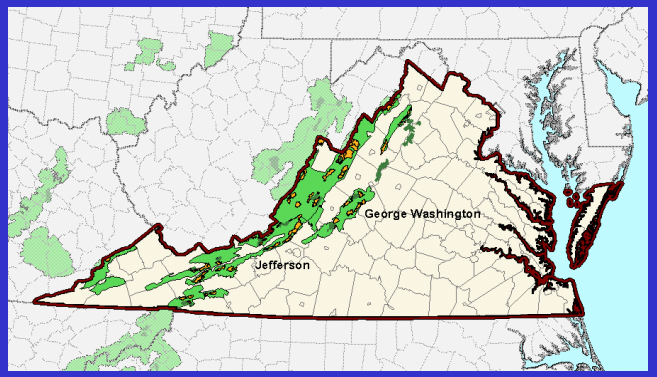
3-D Computer Data Visualization

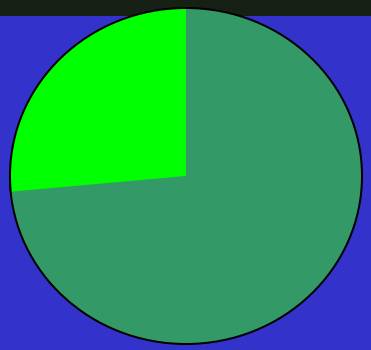


Secondary Base Series

Roadless EIS Project

Data, Maps and Guidelines



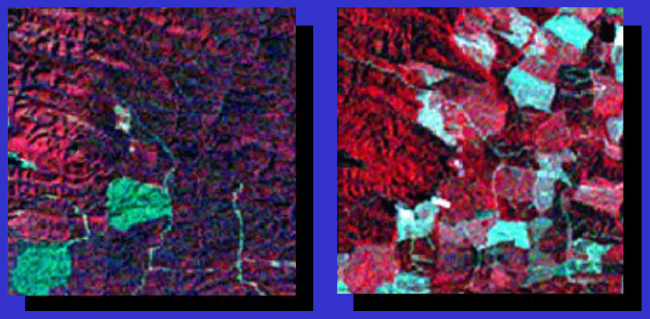


- Total NFS acres 192 million
- Inventoried Roadless Acres 58.5 million – 30% of NFS

Natural Resource Agenda

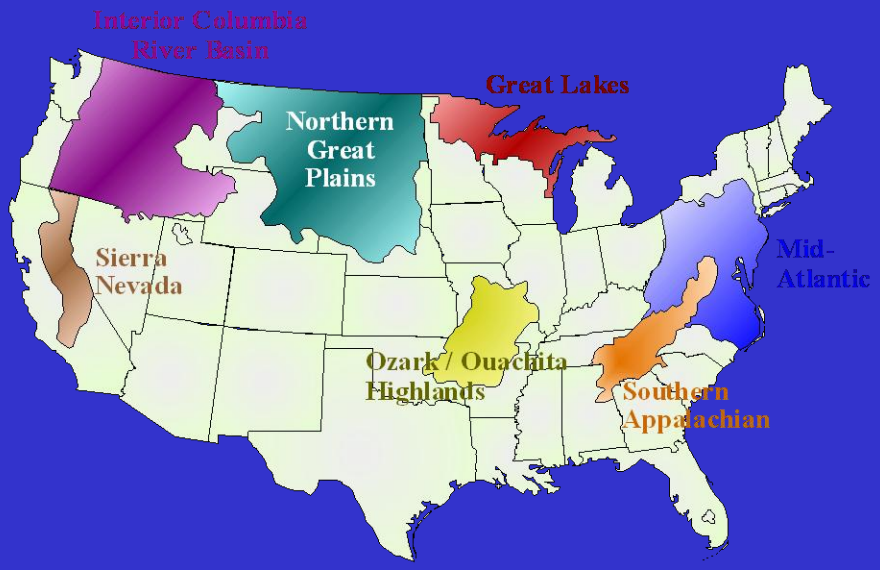
Sustainable Forest Management

- Meeting the needs of the present without compromising the needs of the future.



Ouchita NF 1972 Ouchita NF 1984

Identifies Ecosystem Fragmentation



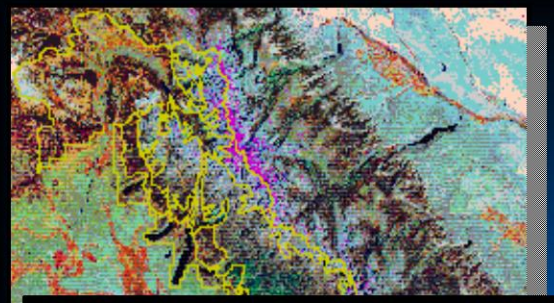
Large area assessments provide status and conditions across all ownerships.

Supports measurements of sustainable forest management such as "Criteria and Indicators"

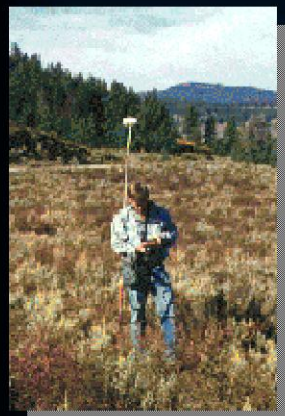
Remotely Sensed Data & Project Scale

AVHRR Satellite Imagery

Landsat TM (medium resolution) Satellite Imagery

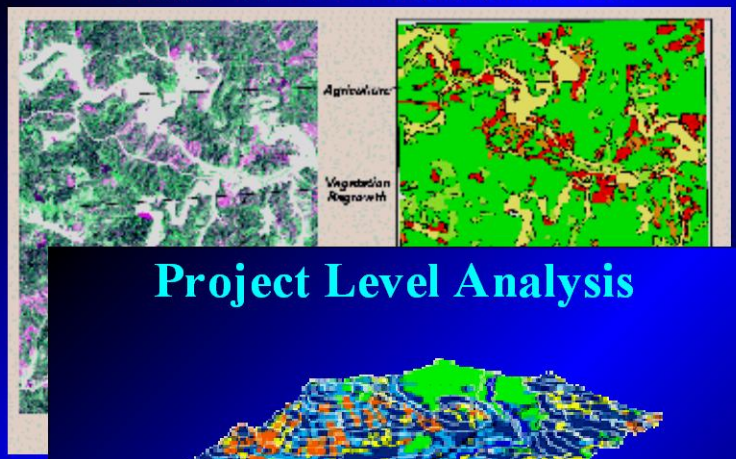


Large Scale Aerial Photographs

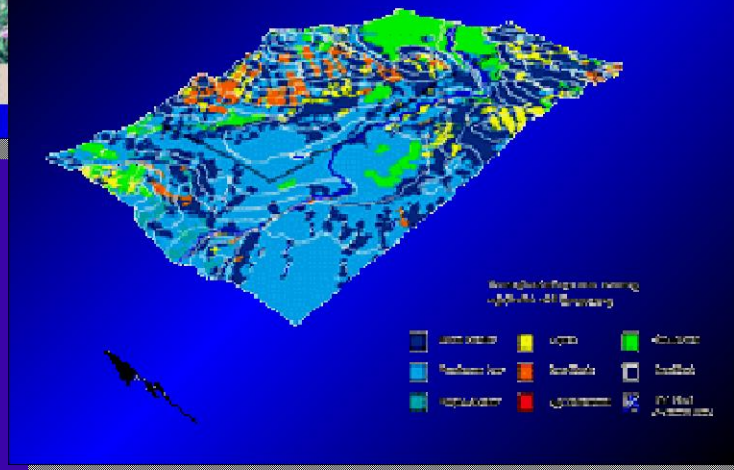


Large Area Assessments

Forest-Wide Assessments



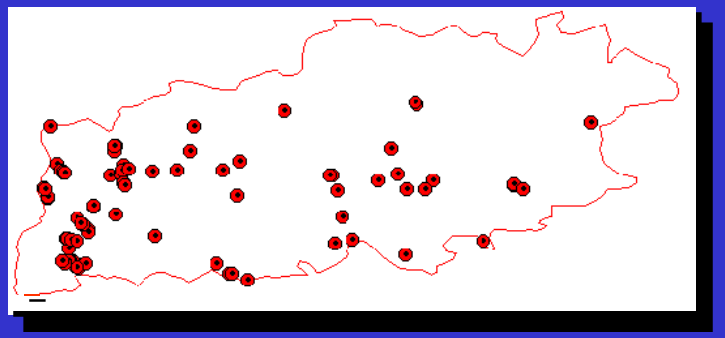
Project Level Analysis



Data

Applications

Recreation--Improving the quality and quantity of public information

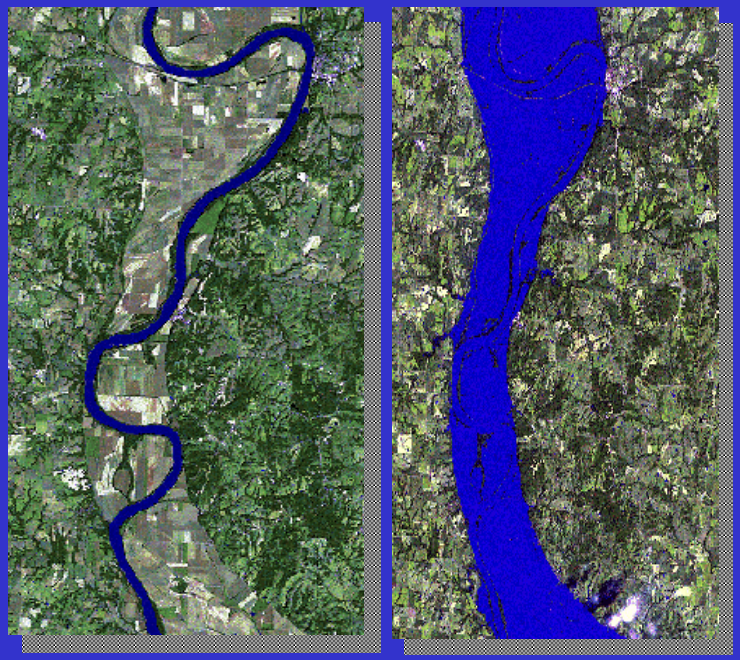


High Uintas Wilderness Campfires mapped using NIFC scanner

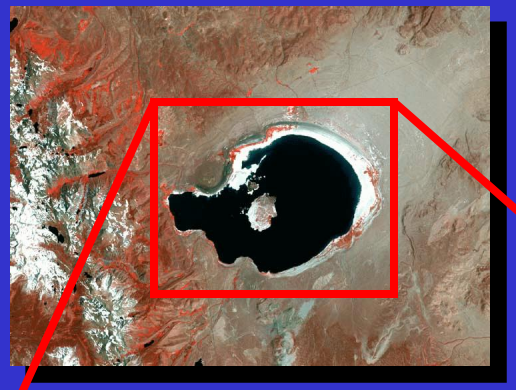
An information shared resource to strengthen relationships with partners, communities, and others.

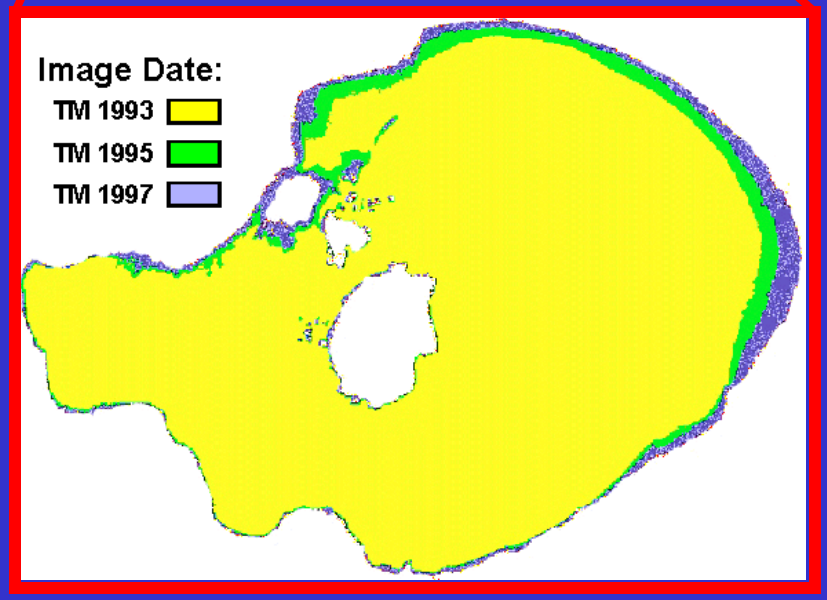
Watershed Health and Restoration

Pre and Post Flood Mapping



Lake Level Monitoring



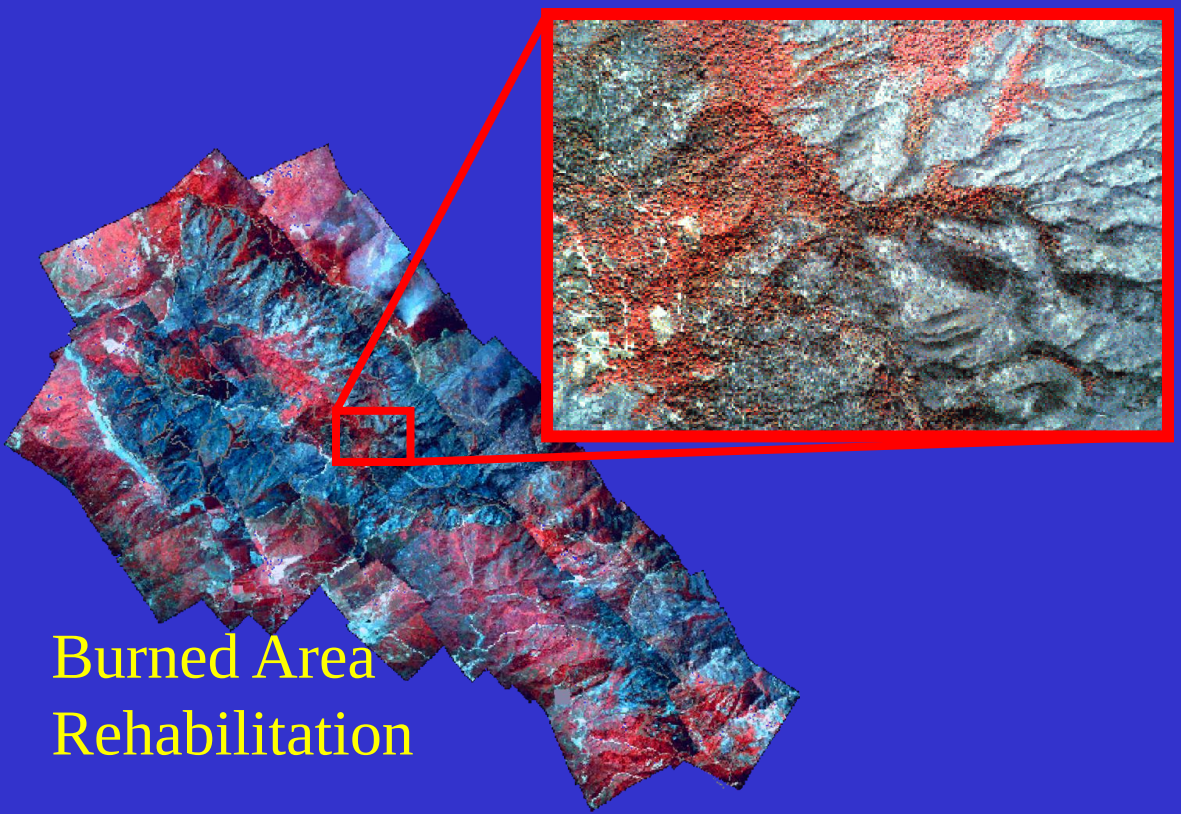


Forest Health Protection

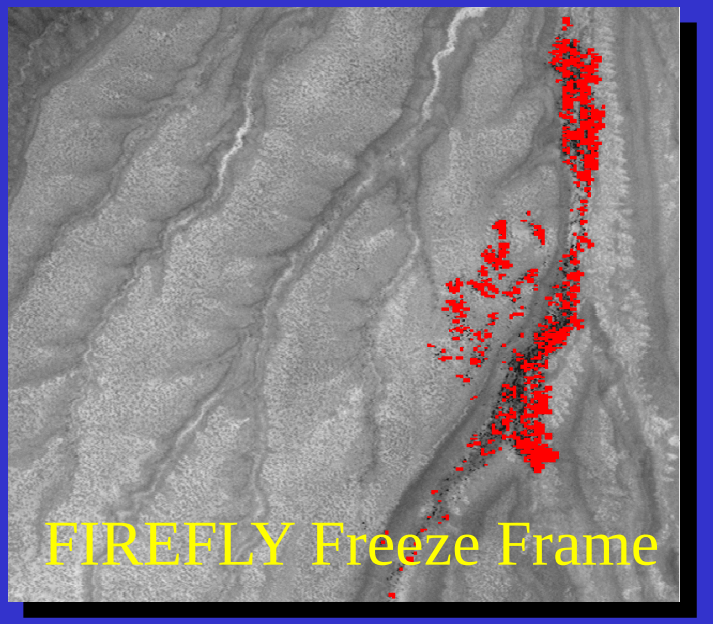
Inventory Resources
Transcend Ownership Boundaries
Monitoring Change and Progress
Assure Favorable Flow

Wildland Fire Support

- Wildland Fire Requirements and Support
  - Joint Fire Sciences Program
  - Disaster Initiatives
  - Committee for Earth Observation Satellites



Burned Area
Rehabilitation



FIREFLY Freeze Frame

Thirteen-Year Wildland Fire Comparison Statistics Year-to-Date for the United States

As of August 30	Number of Wildland Fires	Number of Acres
2000	**73,357**	**6,359,395**
1999	69,582	4,220,908
1998	58,438	1,910,850
1997	48,010	2,692,804
1996	85,128	5,291,697
1995	62,468	1,571,543
1994	57,382	3,037,756
1993	47,809	1,567,552
1992	69,798	1,570,809
1991	59,906	1,985,386
1990	47,770	3,764,570
1989	44,574	1,440,308
1988	67,248	3,409,728

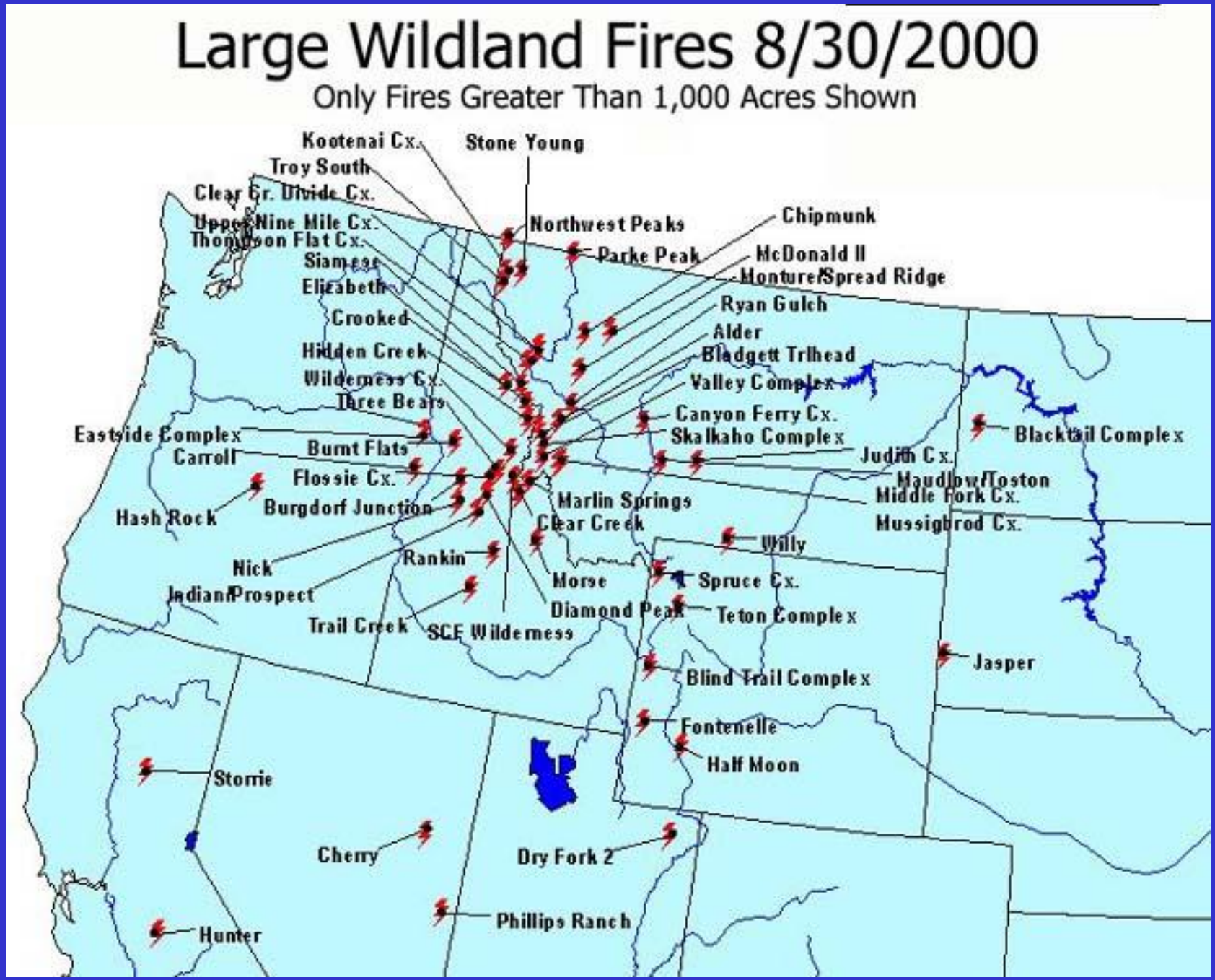
2000 6,359,395

1996 5,291,697

1989 3,409,728

Large Wildland Fires 8/30/2000

Only Fires Greater Than 1,000 Acres Shown



Boise, Idaho

National Interagency Fire Center

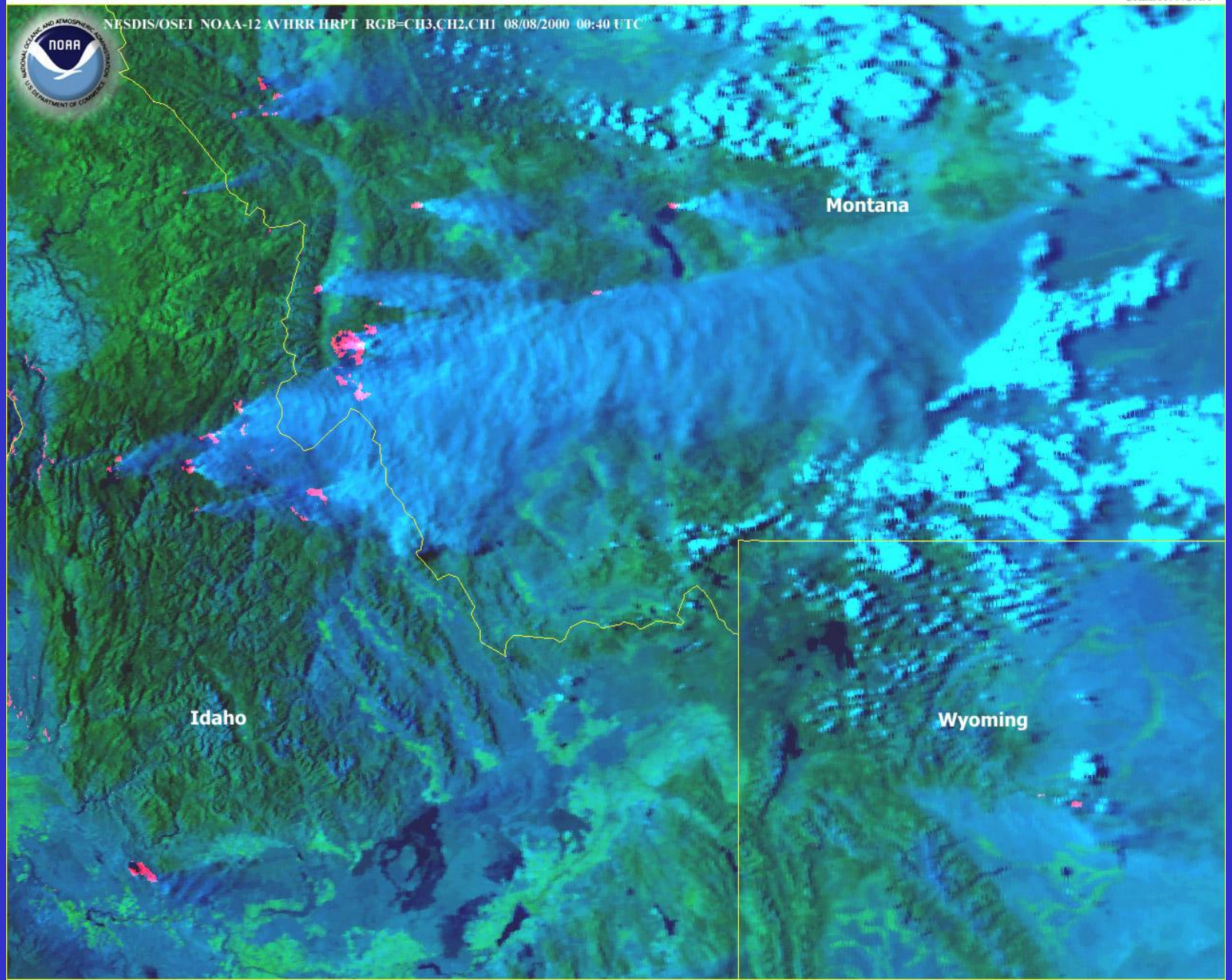
The National Interagency Fire Center (NIFC) in Boise, Idaho is the nation's support center for wildland firefighting. Seven federal agencies call NIFC home and work together to coordinate and support wildland fire and disaster operations.

Wildland Fire Suppression and Response

- Work involves acquiring imagery, mapping polygons, transmitting polygons via e-mail, uploading to FTP site, coordinating with the incident, and coordinating with national level priorities at NIFC
- Fire data includes:
  - Fire Perimeter
  - Active Fire Front
  - Spot Fires
  - Estimated Perimeters

Large heat signatures (red) and a dense blanket of smoke (light blue) from the many large fires burning in Idaho and western Montana are visible in this NOAA-12 image. The dense blanket of smoke extends approximately half way across Montana while a thinner blanket continues into the Dakotas.

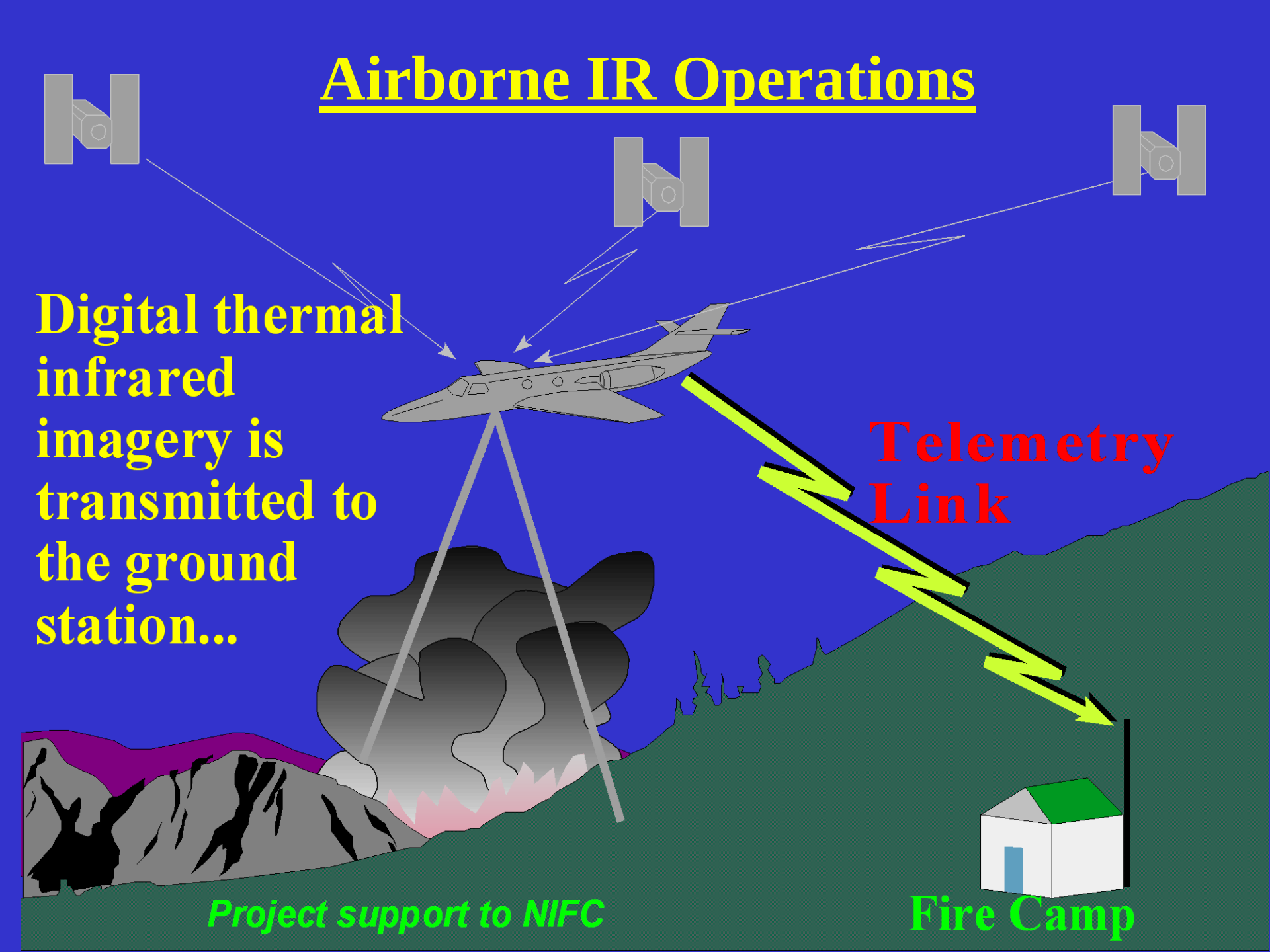
CREDIT: NOAA



Mapping Emphasis Varies by Fire Progress

- Initially, primary interest is in fire perimeter, active fire fronts and any spot fires outside the line
- After the fire is mostly contained, interest shifts to internal fire progress and success of backfires
- Lastly, during the mop-up phase, interest is for concentrated fire areas

Airborne IR Operations



Clear Creek Incident – Central Idaho

Valley/Sula Complex – Western Montana

Manter Incident – Southern California

Manter Incident – Southern California

Wildland Fire Suppression Support (Fire perimeter mapping)

- Fire perimeter and location of intense burns, located on topographic maps or images at a scale of 1:24000 or larger
- Improvements required:
  - Increased electronic delivery speeds of image derived products or literal images directly to the incident command
  - Georeferenced and terrain corrected products
  - Fuels, terrain, infrastructure, natural and man made fire breaks must be clearly identified on products
  - Available for 5a.m. Incident command planning and briefing session

Wildfire Suppression Support

- Air Tanker & Helibucket
- Medivac
- Equipment recovery
- Hazards avoidance
- Staging areas
- Urban boundaries
- Fire perimeter
- Line location
- Water sources
- Firefighter safety

Remote Sensing Needs for Fire and Fuels Management

- Seasonal Fuel Moisture and Fire Hazard Mapping
- National Fuel Mapping
  - Higher resolution than current maps
  - Field validation; links to ground-based sampling
  - Periodic updates
  - Uniform national system
- Mapping of current fire activity on a national level
  - Real-time mapping of specific fires (aircraft & satellite)
- Mapping of burned areas and fire severity
  - No national data base currently exists
  - Improved Methods for mapping severity & linking to fire effects
  - Essential for understanding global, national, regional effects

International Programs Support

Assessing the Causes & Impacts of Fires in Southeast Asia

Remote Sensing Applications Center
Salt Lake City, UT

International Center for Research in Agroforestery

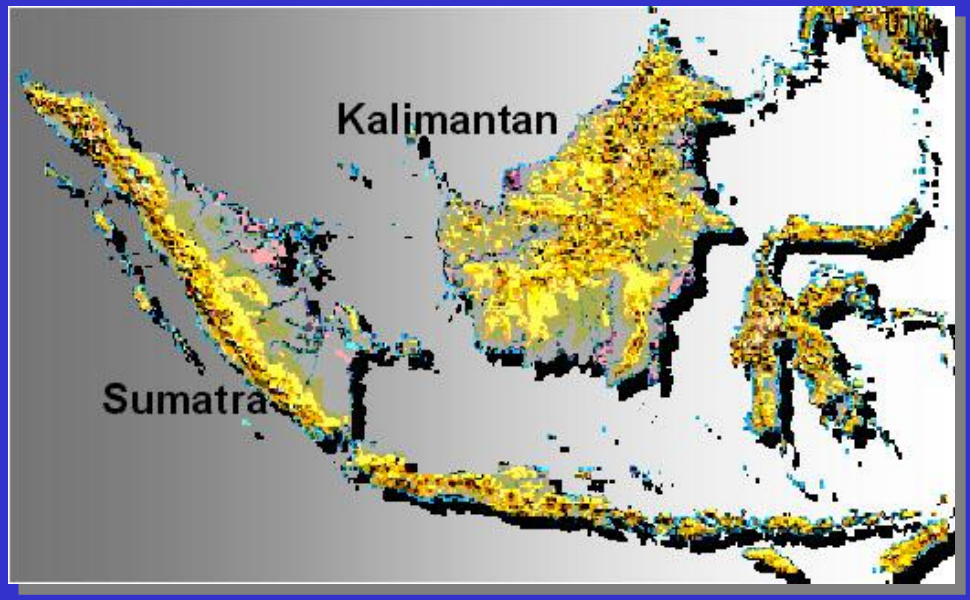
Center for International Forestry Research

Causes & Impacts of Fires

During 1997 and 1998 an estimated 9.5 million hectares burned in Indonesia, mostly in Sumatra and Kalimantan.

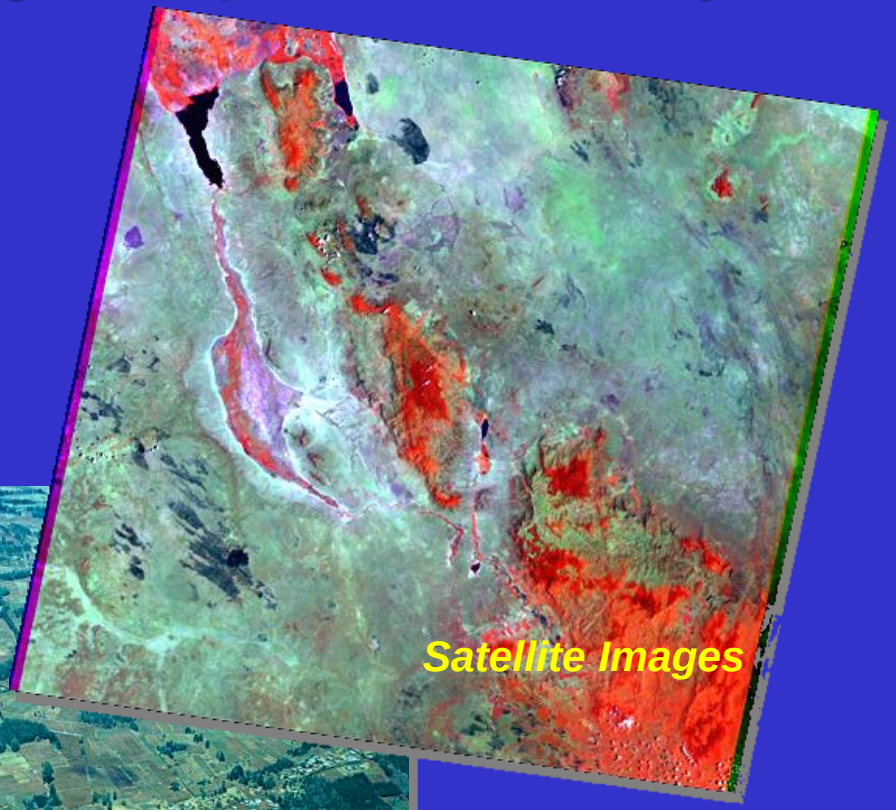
This study uses remote sensing and field surveys to answer the following questions:

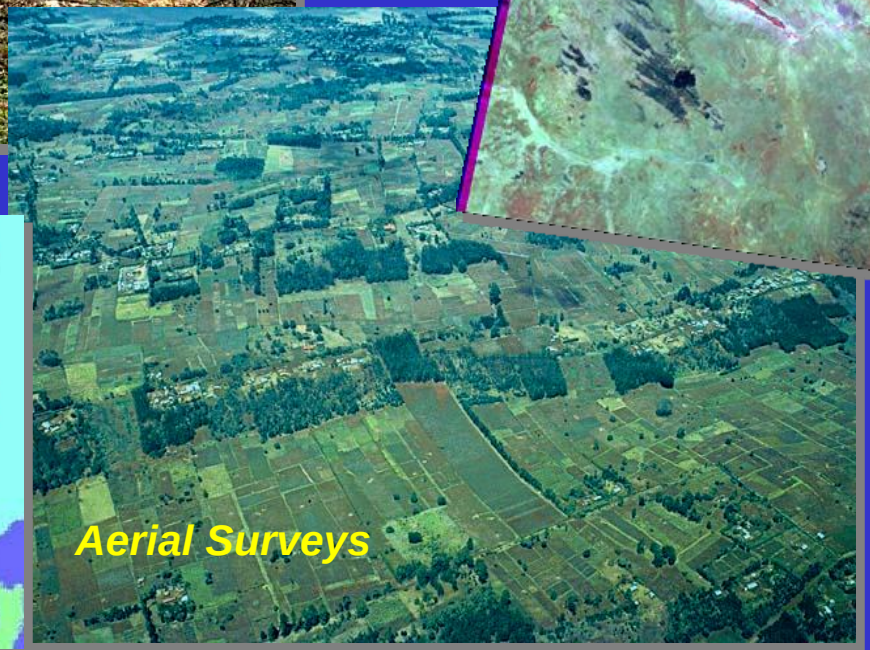
- What?
- How much?
- Who?
- Why?
- Where?



Eastern Arc Mountains, Kenya and Tanzania

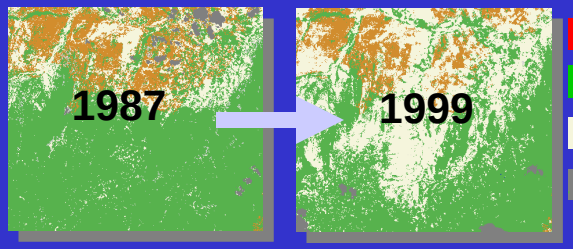
Mapping and Monitoring is being accomplished in three ways



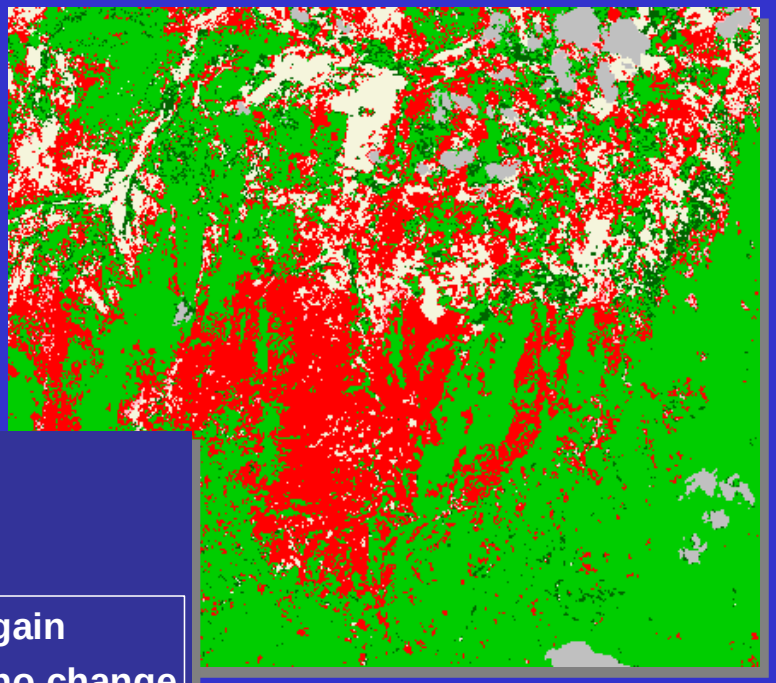


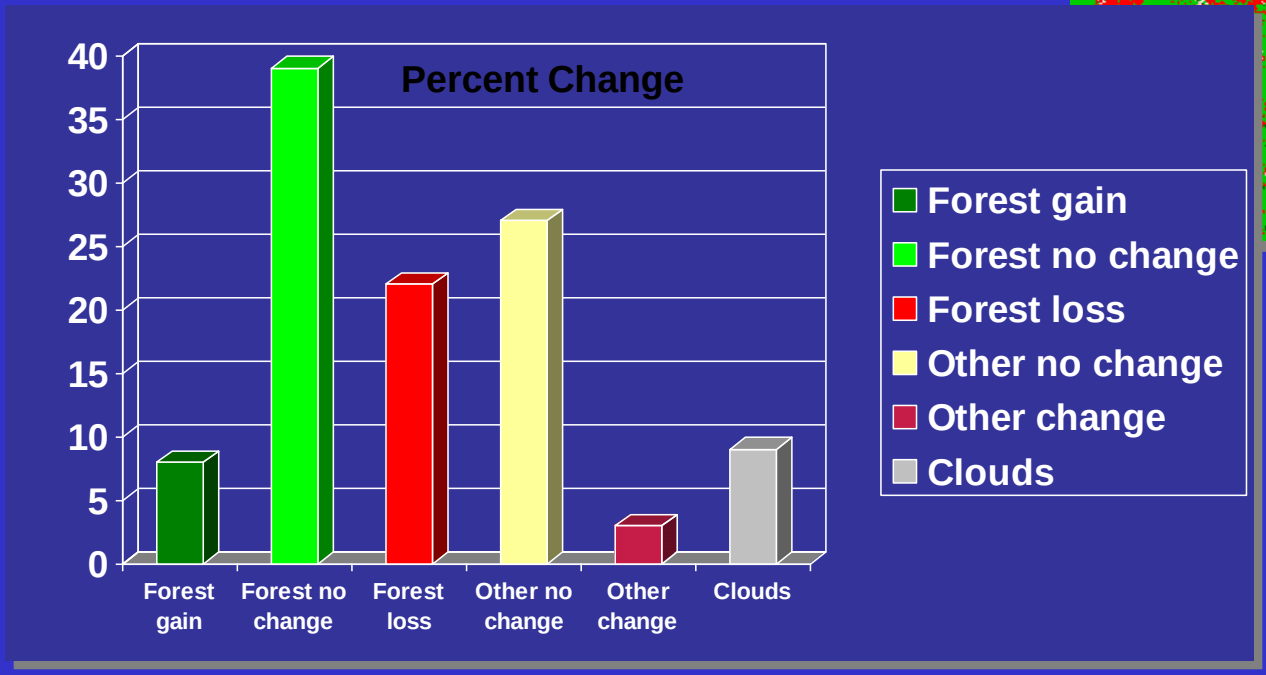
Eastern Arc Mountains, Kenya and Tanzania

Taita Hills, Kenya Study Area



Forest loss
Forest – no change
Other – no change
Clouds



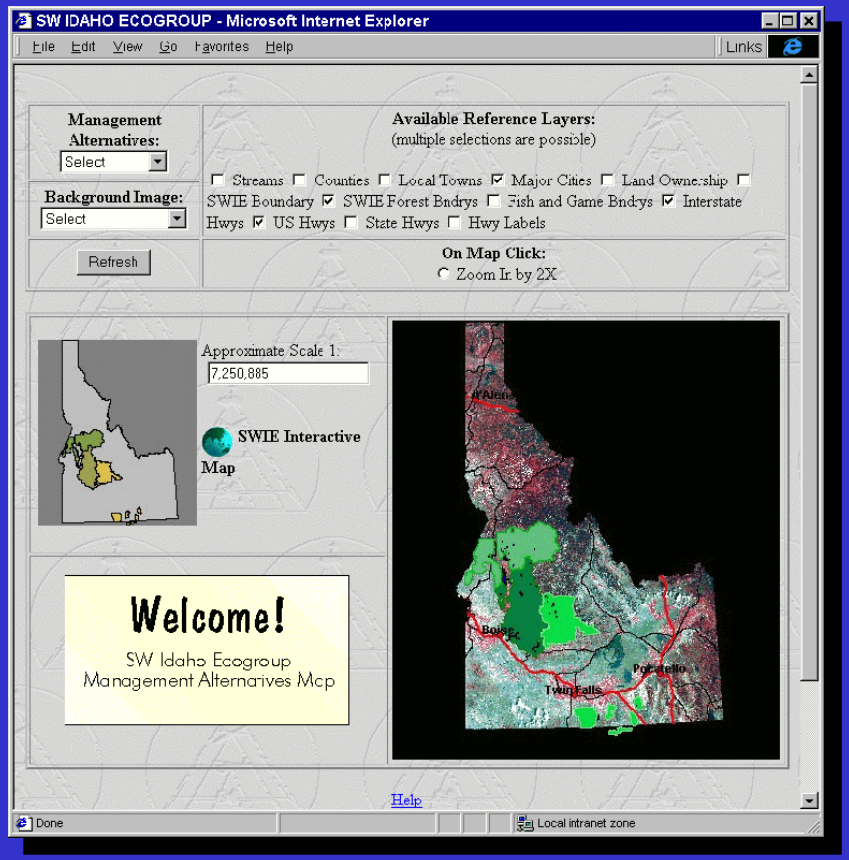


Collaborative Problem Solving

- Building partnerships with our publics, scientists, federal, state, tribal, and local agencies.

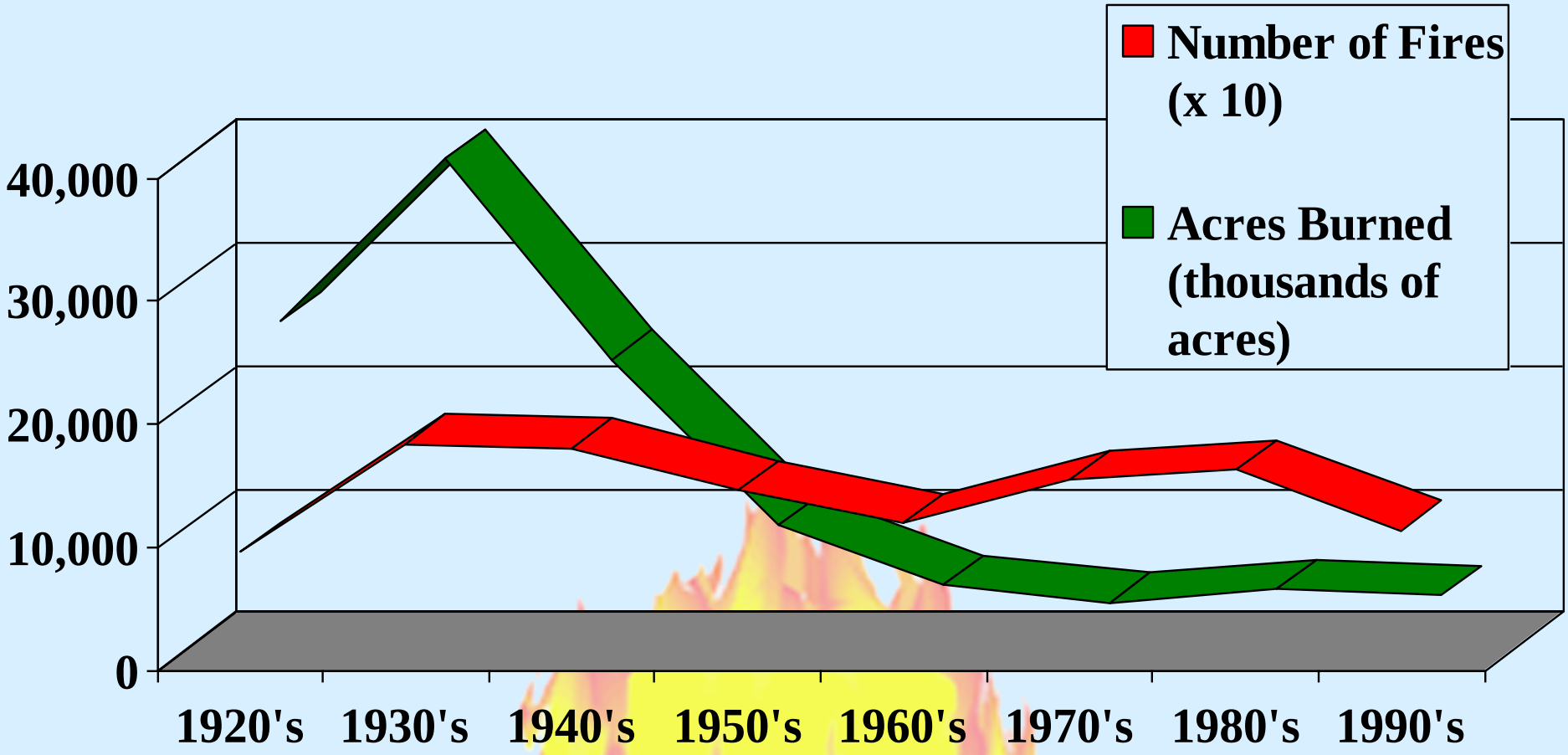
- Working together to:
  - Define goals
  - Define issues
  - Collect information
  - Identify solutions

Internet-based Forest Plan Revision Process




GOD BLESS
FIREFIGHTERS

Historical Fire Statistics in U. S.



Fire Protection - Stages and Costs