



# Landsat Web Enabled Data

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# Landsat Web-Enabled Data

- In June 2007, Landsat released the first Web-Enabled (WE) data for public distribution as a pilot project for LDCM.
- The dataset included Landsat 7 Enhanced Thematic Mapper Plus (ETM+) data, post-Scan Line Corrector failure.
- The initial release of the WE data included only the United States, but the Landsat Project has gradually expanded processing to global coverage as the GLS 2000 dataset was available.
- All data that are high quality, with less than 20 percent cloud cover are automatically processed to standard L1T product.



# Secretary Kempthorne Showcases Free Public Availability of Landsat Satellite Image Archive at ESRI Conference

**SAN DIEGO, CA** -- Secretary of the Interior Dirk Kempthorne announced at the ongoing ESRI Conference that his direction to the U.S. Geological Survey (USGS) to make its 35-year Landsat satellite image archive available over the Internet for free marks the commitment of the department to breaking down information barriers.

“With the click of a mouse, scientists, government officials and land managers will be able to see the changes in the earth’s landscape at any point in the past three and a half decades,” he told the conference on Saturday.



*“As Secretary of the Interior, I have made breaking down barriers and building bridges a high priority of the department,” Kempthorne said to attendees of the ESRI International User Conference in San Diego.*

*[Photo Credit: Tami Heileman] [Hi-Res](#)*

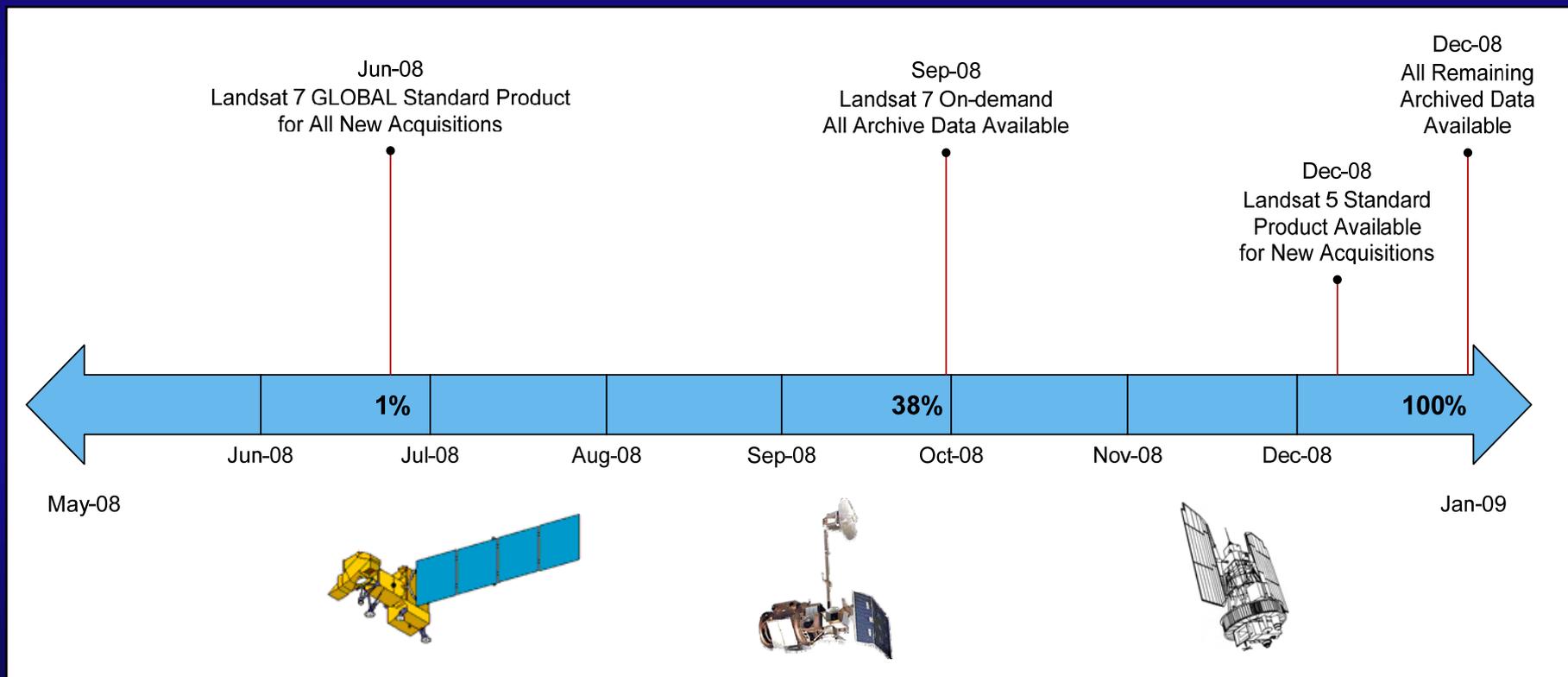


# Landsat Standard L1T

- **Newly acquired data that will be automatically processed**
  - $\leq 20\%$  cloud cover, 9 quality
- **All other data (and archive data) can be ordered at no-charge**
  - L7: Sep 30, 2008
  - L5 TM, L4 TM, L1-5 MSS: Dec 31, 2008
- Pixel size: 15m/30m/30m
- Media type: Download (web-enabled)
- Product type: L1T (terrain-corrected)
- Output format: GeoTIFF
- Map projection: UTM
- Orientation: North up
- Resampling: Cubic convolution
- DEM: GLS DEM (SRTM, NED, CDAD, DTED, GTOPO 30)



# Landsat Web-Enabling Timeline



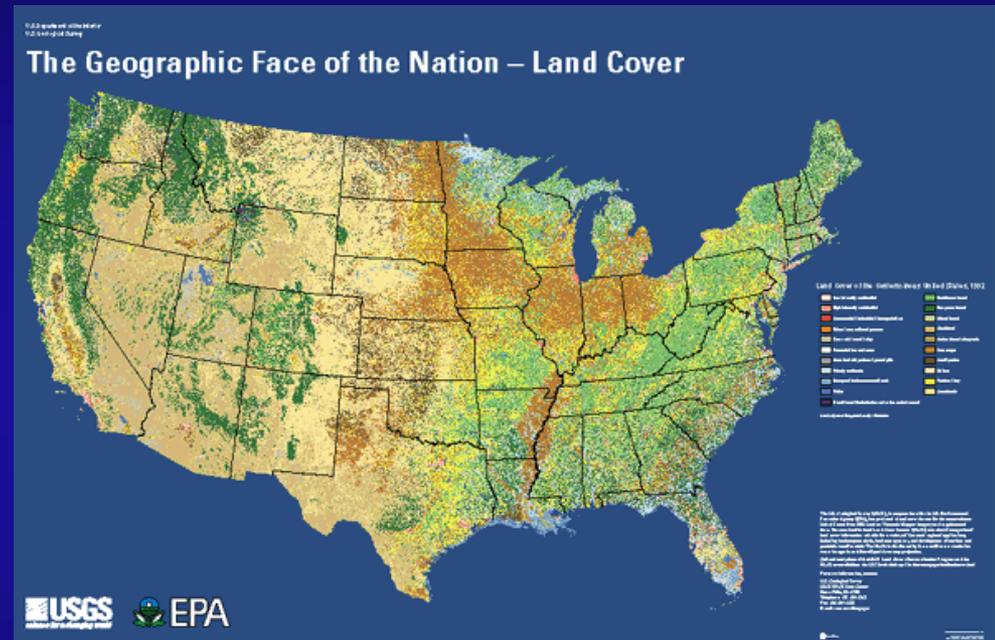
# No-Cost Data for Science and Applications

- Creates new science and applications opportunities over larger geographic areas and with greater temporal frequency
- Frees funds for other project activities
- Improves the accuracy and utility of results
- Removes the key barriers to operational terrestrial monitoring needed for near-real time ecological forecasting and assessment



# No-cost data puts funds back into science and applications project budgets

- The USGS National Land Cover Database (NLCD) requires at least 820 Landsat scenes for conterminous US coverage. The cost of data is at least \$656,000 per update.

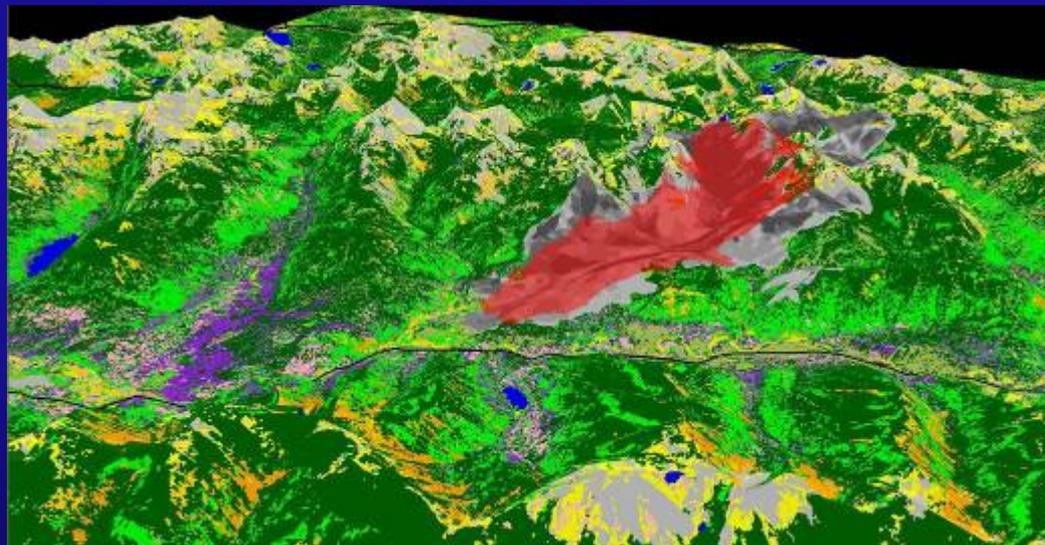


Money used for Landsat image purchases can now be used to expand research and applications



Landsat research has shown that the use of additional temporal data improves the accuracy and utility of derived data sets, which will lead to expanded applications.

- Historically, most Landsat data users were limited to the data they could afford rather than the data they need.



Wildfire modeling





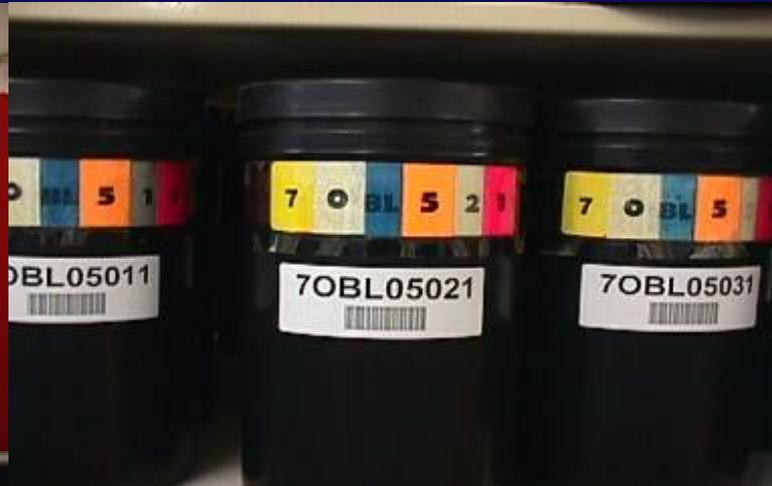
# Data Management and Digital Delivery of Analog Data

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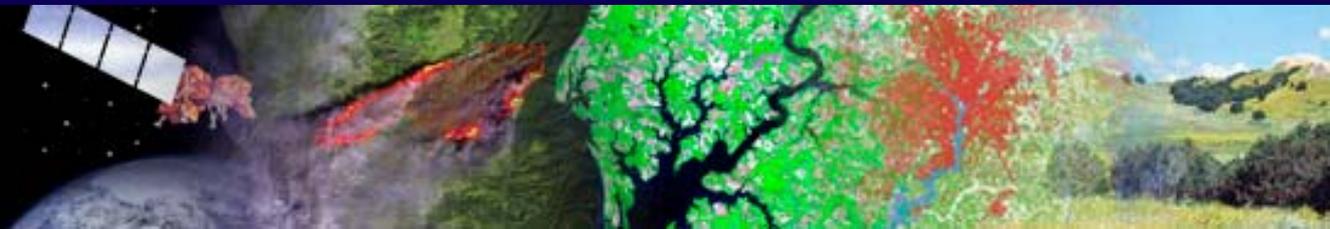
**USGS Center for Earth Resources Observation and Science (EROS)**  
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# The USGS Film Archive

- 59,500 rolls of film
  - 8.6 million images

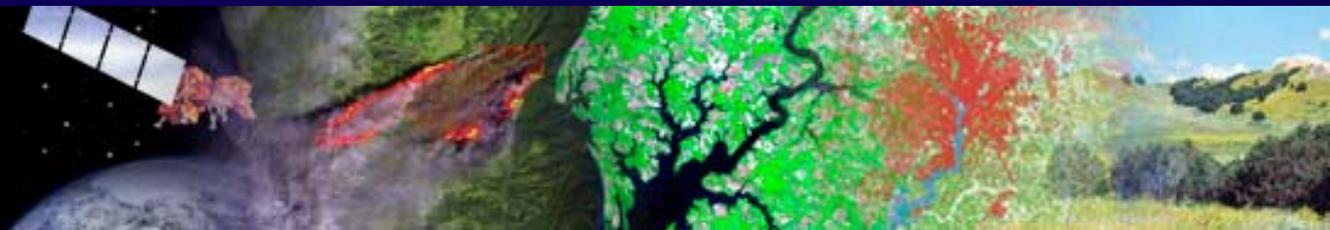


- Over 70,000 photo indexes



# Background

- After 30 years of operation, the decision was made in 2004 to close the photo lab and only provide digital access to the more than 9-million frames of imagery in the archive



# Why Change was Necessary

- Customer demand for film based products was declining
- Cost to produce film/paper products was increasing
- Some raw stock used at EROS was no longer being manufactured
- Demand for digital products was increasing



# Decision

- Provide on-demand scanning at 7, 14, or 21 micron spot size
- Digitize USGS aerial collections using automated high performance cameras and generate a searchable browse
- Create single frame metadata from photo indexes to improve user access to historical photos
- Provide internet access and electronic data delivery at no charge to the user



# Scanning

- Use High Resolution photogrammetric quality scanners
- Standard output spot size is 21 micron (1200 dpi) with options to 7 micron spot size (3600 dpi)
- Output format = TIFF
- File size = 120 MB for B/W and 360 MB for Color
- All scanned products are currently generated on-demand and not archived



# Phoenix IV Digitizing System

- Phoenix IV was built in house using a Logetronic photographic printer base
- Outfitted with a frame edge detection system for film advancement and a light source consisting of 144 LEDs
- Utilizes a Kodak 13.9 mega-pixel digital camera to capture each frame
- Streams data into a PC to generate an on-line browse and a medium resolution (400 dpi) digital file



# Digitizing Output Specifications

- **Browse files**
  - Format = JPG
  - Black and White size = 148 KB
  - Color size = 400 KB
  - Resolution = 72 dpi
- **Medium-resolution files**
  - Format = TIFF
  - Black and White size = 13 MB
  - Color size = 38 MB
  - Resolution = 400 dpi
  - Non-photogrammetric quality
  - Minimal data editing (format, adjust polarity, add USGS Visual Identification)



# Digitizing Process

- Digitize photo indexes and provide on-line access
- Digitize each roll of film to generate a full frame browse including orphans and provide on-line access
- Archive the medium-resolution products in a mass storage system and provide on-demand electronic access to the data



Medium-resolution  
Digitization System



Digitized Map Index



Digitized Aerial Image



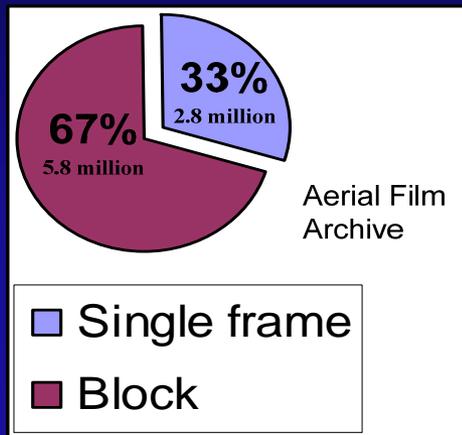
# Phoenix V Prototype

- Phoenix V was built using the same Logetronic printer base and automated frame edge detection system as the Phoenix IV
- Uses an enhanced light source consisting of 675 LED's to improve scanning efficiency
- Utilizes a Better Light 416 mega-pixel scanning back
- Outputs a 25 micron spot size (1000 dpi) digital image



# Creating Single Frame Metadata

8.6 Million Frames



- Implemented processes and software
- Working USGS historical collection
  - 68,000 indexes
  - 2,600,000 frames
- 350,000 frames annually



Photo Index



Single Frame



# Preservation and Access

- Manage all on-line, near-line and off-site data locations using a mass storage system architecture
  - Robotic tape storage
  - Data migration to newer media
  - Creation of backup copies for off-site storage
  - Supports electronic data distribution



**SL8500 Mass Storage System**



# Data Discovery

- Combines “Point and Click” ease with textual query capabilities to form an easy to use search and order interface
- Allows users to search spatially over multiple datasets

The screenshot displays the USGS EarthExplorer website. At the top, the USGS logo and tagline "Science for a changing world" are visible. The page is titled "EarthExplorer" and includes navigation links for Home, Prices, and Help. A message banner indicates "There are 3 messages" (updated 09/22/2008). Below this, a search bar is present with the text "Query and order satellite images, aerial photographs, and cartographic products through the U.S. Geological Survey." The main interface is divided into three numbered steps: 1. Select your dataset(s), 2. Enter your search criteria, and 3. Search >>>. Step 1 shows a list of dataset categories such as Aerial Photography, AVHRR, Declassified Data, Digital Elevation, Digital Line Graphs, Digital Maps, EO-1, Global Land Survey, Landsat Archive, Landsat Decadal, Landsat Science, Radar, SPOT, and USGS Commercial. Step 2 includes a search form with fields for Address/Place name, From (mm/dd/yyyy) (01/01/1920), and To (mm/dd/yyyy) (12/31/2020). A map of the United States is displayed below the search form, showing a selected area. The map includes a scale bar (1000 m) and a coordinate display (37 43 07 N, 095 27 30 W). The bottom of the page features a "Selected Datasets" section with "None Selected" and a "Help" link.



# Data Search Results

- Search results grouped by dataset
- Displays browse imagery and footprints by scene
- Allows users to export results into a KML file viewable in Google Earth

Product Image	Show Footprint	Show All Fields	Exclude	Order	Qty	Price	Product Availability	Entity ID	Acquisition Date	Quality	Cloud Count	Image Year	Scene ID	Scale	Footprint Width (MM)	Footprint Area (km <sup>2</sup> )	HW Corner	NE Co	
	Show	Show	<input type="checkbox"/>			\$3.00 \$36.00	View	High/Medium	AR5780026164731	1978/06/20	0	0	CR	65003	65660	229 x 229	Vertical Rectangular	60° 81°18.00'N, 152° 37°18.00'W	60 81°18.1 152° 42°18.1
	Show	Show	<input type="checkbox"/>			\$3.00 \$36.00	View	High/Medium	AR5780026164732	1978/06/20	0	0	CR	65003	65660	229 x 229	Vertical Rectangular	60° 81°18.08'N, 152° 35°48.00'W	60 81°18.1 152° 40°41.1
	Show	Show	<input type="checkbox"/>			\$5.00 \$50.00	View	High/Medium	AR5780026176028	1978/06/20	0	0	BR	65003	13333	229 x 229	Vertical Rectangular	60° 27°48.00'N, 152° 10°48.00'W	60 28°15.1 152° 40°48.1
	Show	Show	<input type="checkbox"/>			\$3.00 \$36.00	View	High/Medium	AR5780026176029	1978/06/20	0	0	BR	65003	13333	229 x 229	Vertical Rectangular	60° 27°48.99'N, 152° 09°42.49'W	60 28°14.7 151° 39°34.1
	Show	Show	<input type="checkbox"/>			\$3.00 \$36.00	View	High/Medium	AR5780026176030	1978/06/20	0	0	BR	65003	13333	229 x 229	Vertical Rectangular	60° 27°50.12'N, 152° 08°30.01'W	60 28°18.1 151° 39°12.1
	Show	Show	<input type="checkbox"/>			\$7.00 \$70.00	View	High/Medium	AR5780026164820	1978/06/20	0	0	CR	65003	67333	229 x 229	Vertical Rectangular	60° 34°06.00'N, 152° 05°23.99'W	60 34°23.1 151° 46°55.1
	Show	Show	<input type="checkbox"/>			\$5.00 \$50.00	View	High/Medium	AR5780026164821	1978/06/20	0	0	CR	65003	67333	229 x 229	Vertical Rectangular	60° 34°06.72'N, 152° 02°26.50'W	60 34°23.1 151° 46°55.1
	Show	Show	<input type="checkbox"/>			\$3.00 \$36.00	View	High/Medium	AR5780026164822	1978/06/20	0	0	CR	65003	67333	229 x 229	Vertical Rectangular	60° 34°12.37'N, 151° 59°32.01'W	60 34°33.1 151° 43°48.1
	Show	Show	<input type="checkbox"/>			\$3.00 \$36.00	View	High/Medium	AR5780026164652	1978/06/20	0	0	CR	65003	64000	229 x 229	Vertical Rectangular	61° 48°12.00'N, 138° 03°26.00'W	61 48°12.1 138° 48°00.1
	Show	Show	<input type="checkbox"/>			\$3.00 \$36.00	View	High/Medium	AR5780026164683	1978/06/20	0	0	CR	65003	64000	229 x 229	Vertical Rectangular	61° 48°12.00'N, 138° 08°06.00'W	61 48°12.1 138° 52°23.1



# Data Download

Sign in

## Register to Download

You must be a registered user to download files. If you are already a registered user, please sign in below. If you are not a registered user, you may become one by initiating the [registration process](#).

\* Please Note: Once you sign in, you may be asked a subset of questions if they were left blank in your registration profile.

Sign in using your USGS registered user name and password

Enter User Name:

Enter Password:

[Forgot your password?](#)

and continue using this site without signing on or registering.

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U.S. Department of the Interior | U.S. Geological Survey  
URL: <http://earthexplorer.usgs.gov/>  
Page Contact Information: [pubs@usgs.gov](mailto:pubs@usgs.gov)  
Page Last Modified: April 21, 2008

- Registered users can electronically download selected datasets at no cost to them

## Download Information

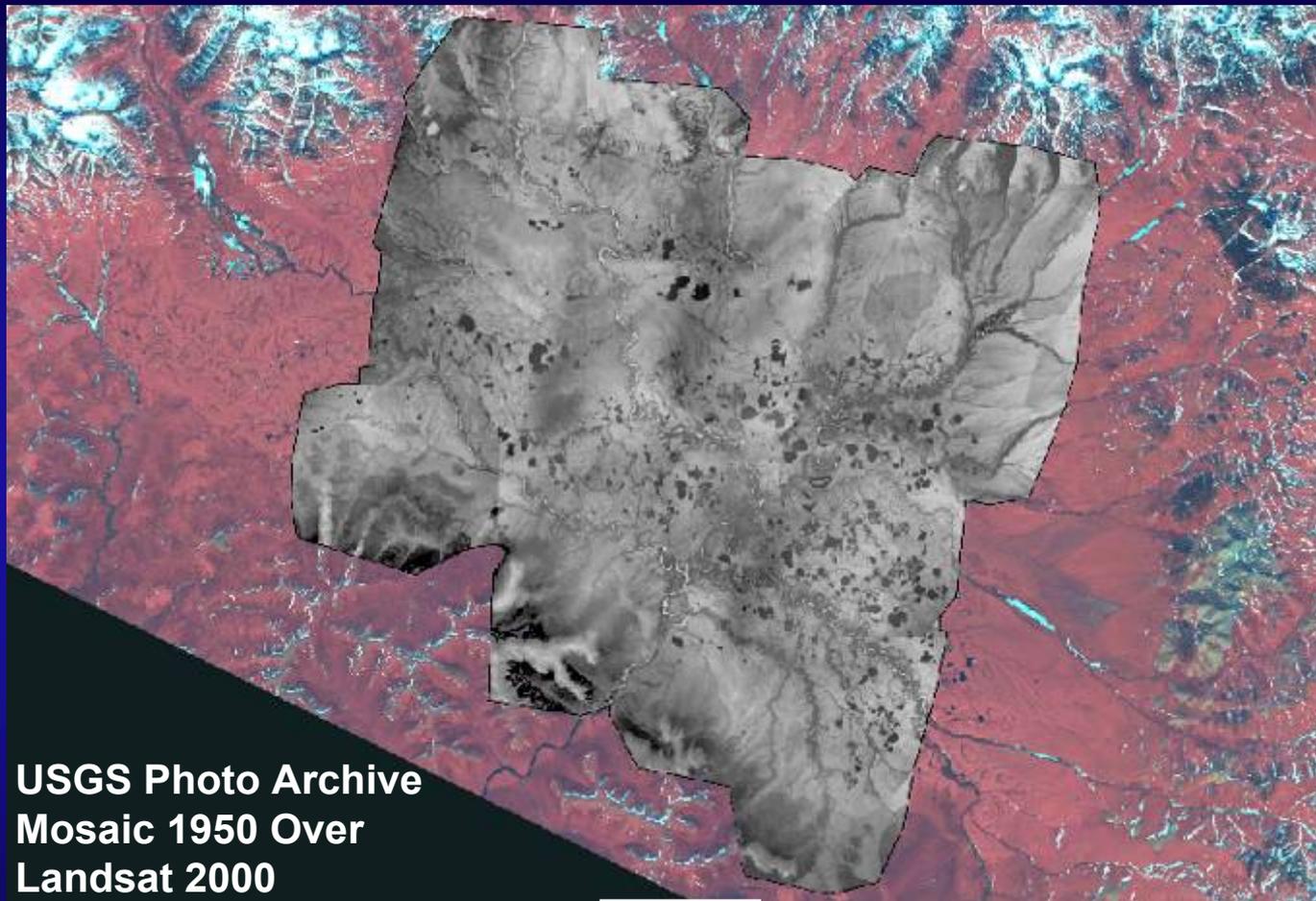
for

**File Name: 5RRD07012\_201.tif**

- **Due to high demand and limited bandwidth, please limit downloads to one file per session.**
- This free service is intended to satisfy low volume data requests.
- Use of this data requires analysis software which is not typically found on workstations. Software is available on the internet or from commercial vendors.
- **Initiation of this data transfer may be delayed several minutes** while the file is retrieved from our robotic tape library.
- Note that data you have requested may be several hundred megabytes in size and transfer time may exceed an hour on a broadband (DSL, cable, T1) line.



# Change Analysis



USGS Photo Archive  
Mosaic 1950 Over  
Landsat 2000

~ 55 miles



# Summary

- Over 6 million frames have been digitized and over one million single frame metadata records have been generated since the program began
- On-line indexes and browse files simplifies archive access and promotes increased interest in the USGS/EROS film archive
- Digitizing effort uncovers images that were not previously accessible (orphan imagery)
- Once the data are in digital form it can be easily combined with other data sources to support change analysis
- This new approach enhances archive value and assures continued data access to support the ever changing needs of the science community



# Questions?

