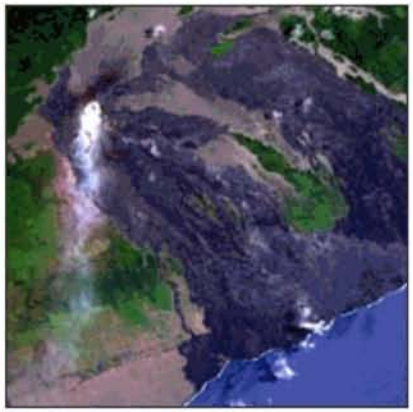
Working with Landsat Data

A Landsat Education and Public Outreach Presentation



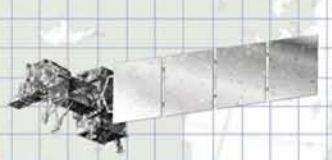
What?

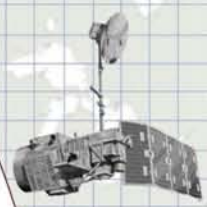
Why?

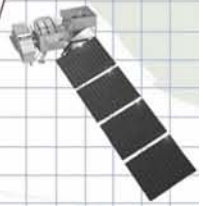
Where?

How?

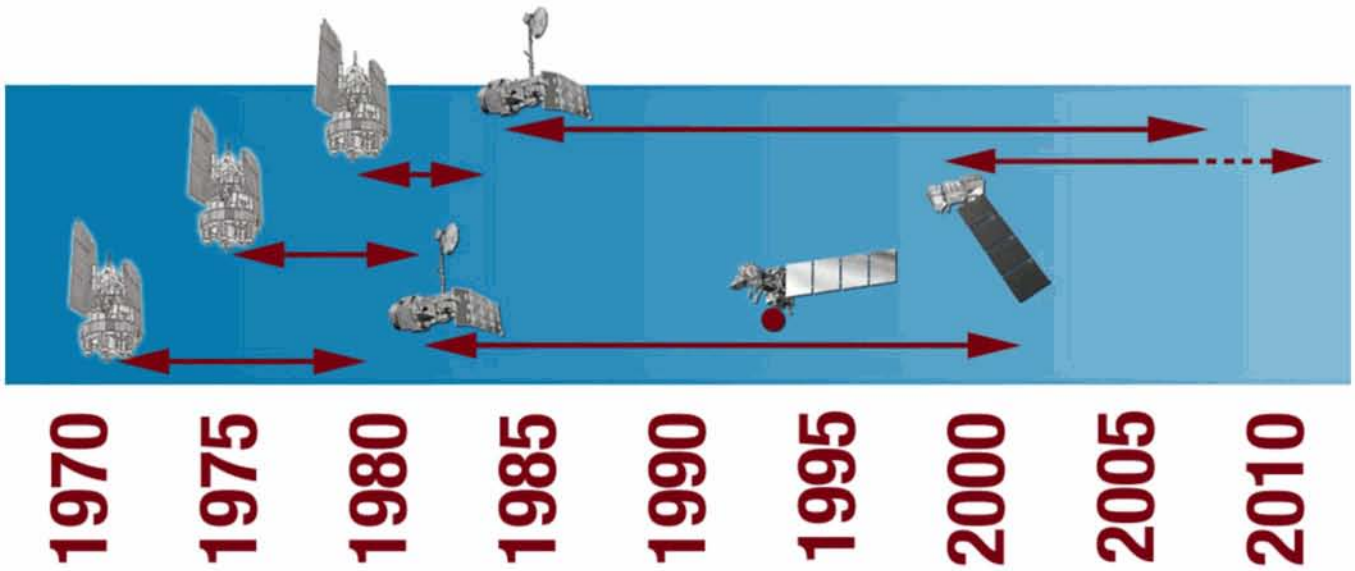
What?



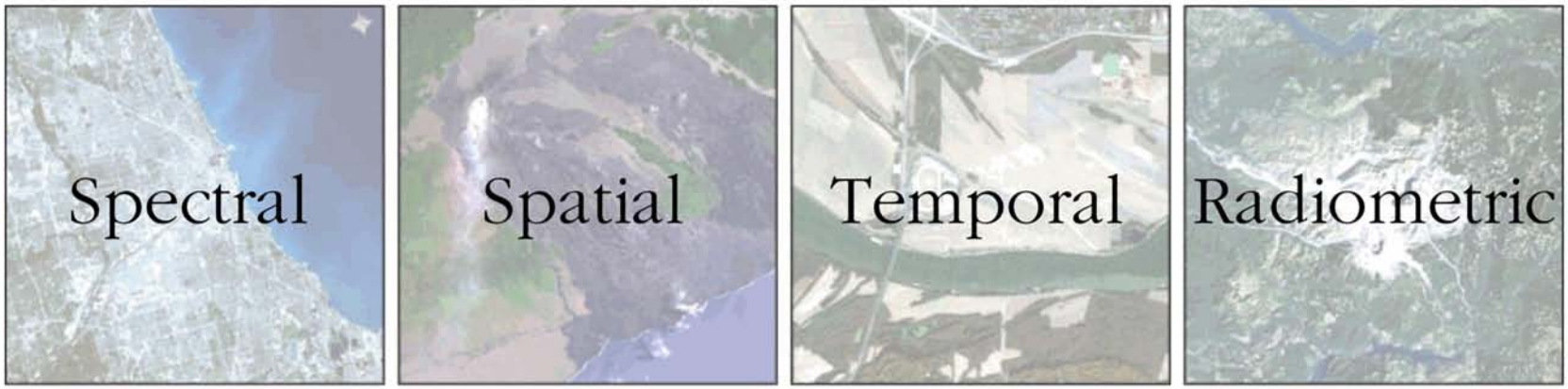




Welcome to the Landsat dynasty, 1972-



Describing remotely sensed imagery



Resolution

Spectral Resolution

MSS Bands

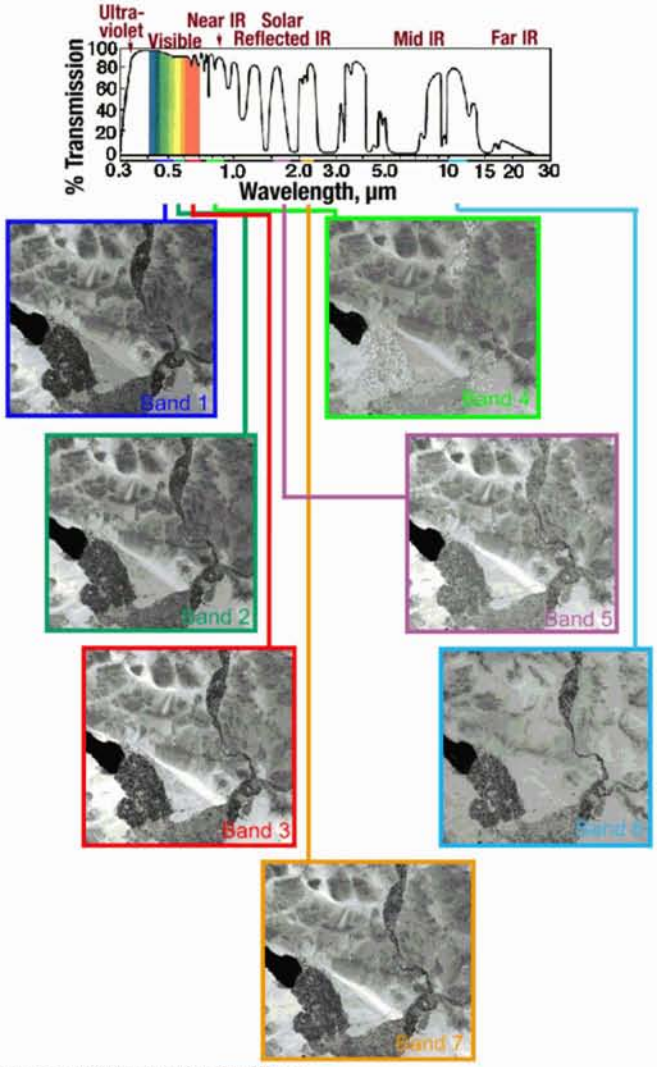
Band Number (L1-L3)	Band Number(L4-L5)	µm	Resolution
4	1	0.5-0.6	80 m
5	2	0.6-0.7	80 m
6	3	0.7-0.8	80 m
7	4	0.8-1.1	80 m
8	n/a	10.41-12.6	237 m

TM Bands

Band Number	µm	Resolution
1	0.45-0.53	30 m
2	0.52-0.60	30 m
3	0.63-0.69	30 m
4	0.76-0.90	30 m
5	1.55-1.75	30 m
6	10.4-12.5	120 m
7	2.08-2.35	30 m

ETM+ Bands

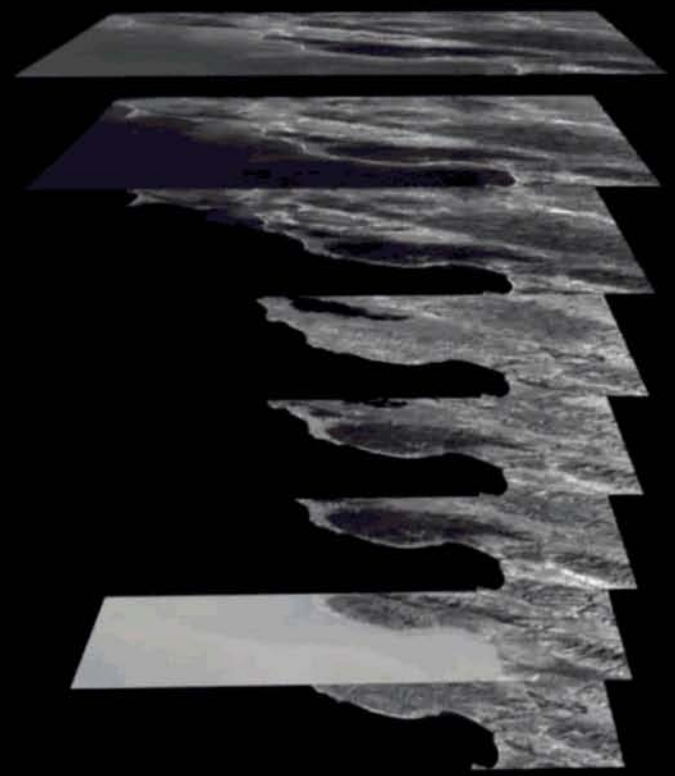
Band Number	µm	Resolution
1	0.45-0.515	30 m
2	0.525-0.605	30 m
3	0.63-0.69	30 m
4	0.75-0.90	30 m
5	1.55-1.75	30 m
6	10.4-12.5	60 m
7	2.09-2.35	30 m
8	0.52-0.9	15 m



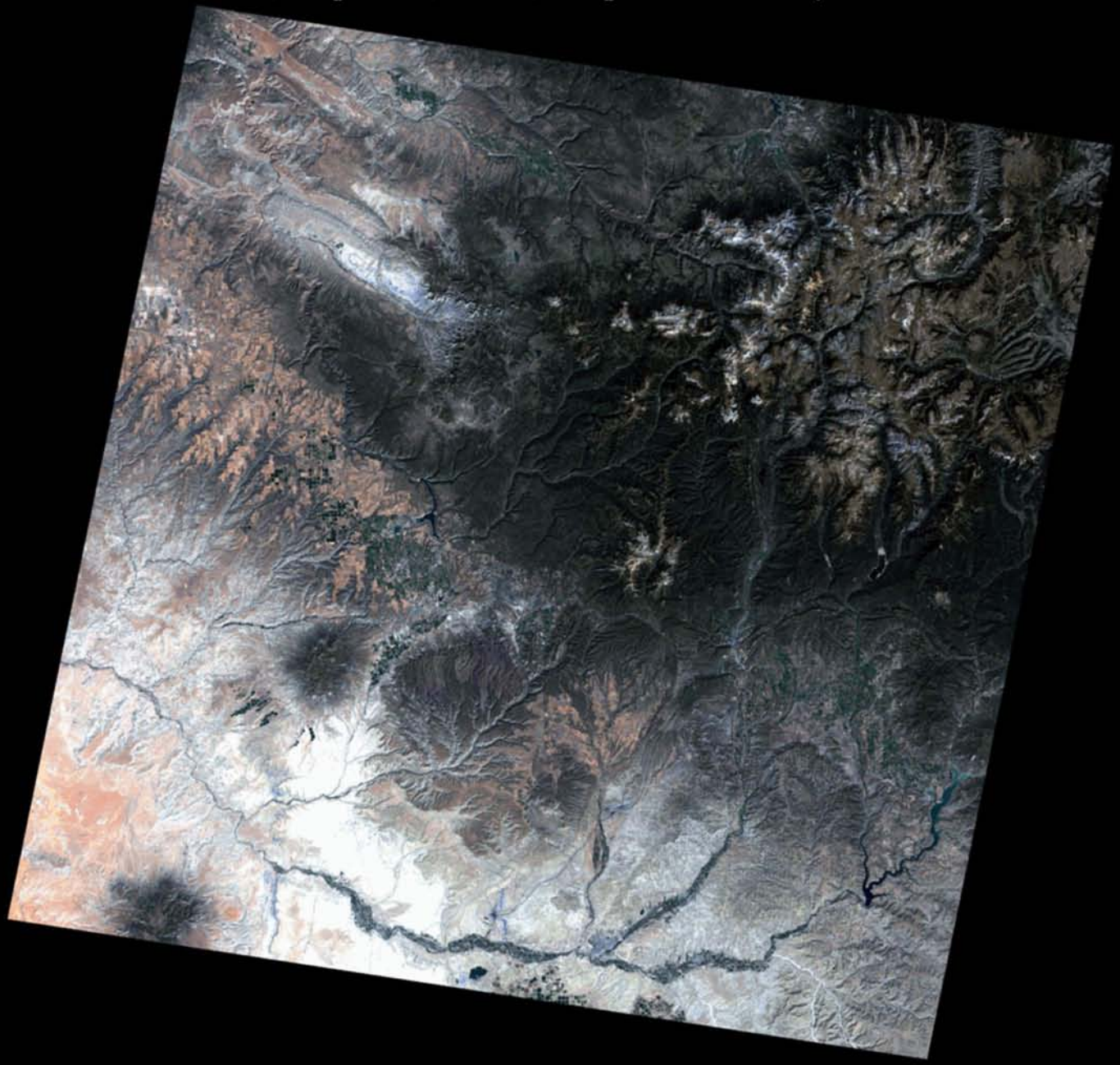
Electromagnetic Spectrum Image from Virtual Hawaii.

Spectral Resolution

ETM+ Band	Wavelength (um)	
1	0.450 - 0.515	Blue
2	0.525 - 0.605	Green
3	0.63 - 0.69	Red
4	0.75 - 0.90	Near Infrared
5	1.55 - 1.75	Infrared
7	2.09 - 2.35	Shortwave Infrared
6	10.40 - 12.50	Thermal Infrared
8	0.52 - 0.90	Panchromatic

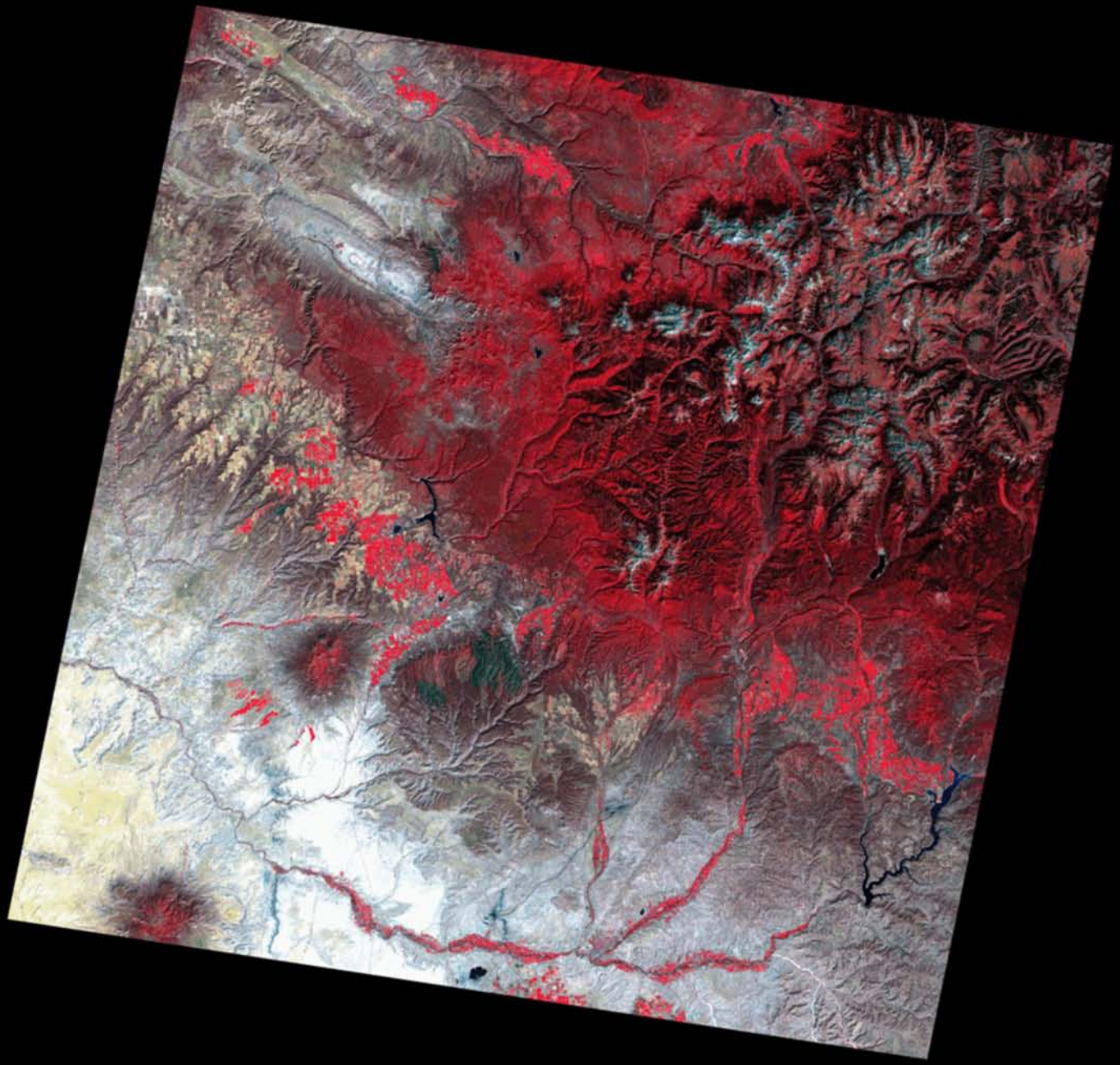


Landsat 7, Path 35 Row 34, Sept. 12, 2000; acquired shortly after 2000 Mesa Verde fire



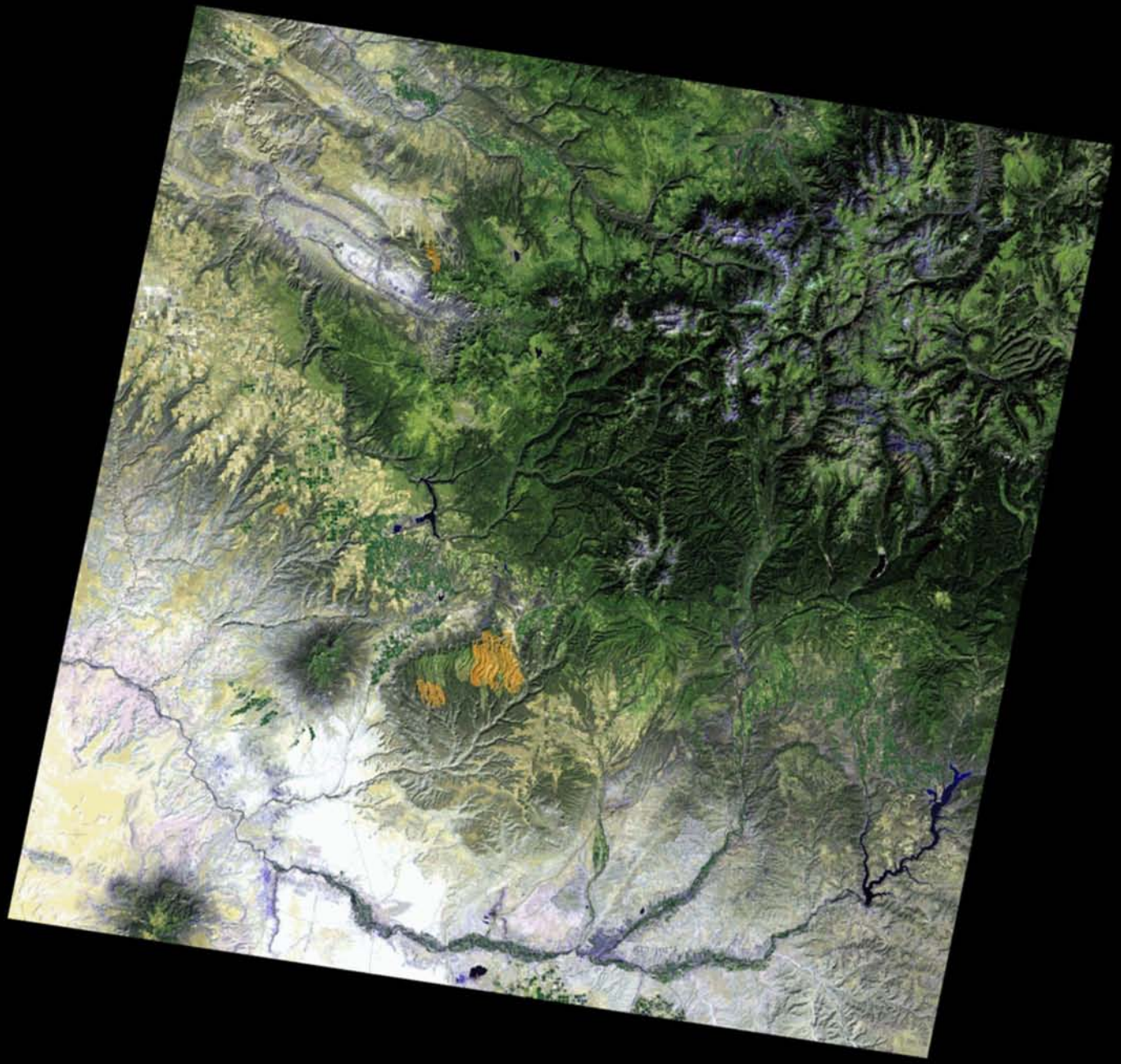
Different band combinations highlight different features, this image uses bands: 3,2,1

Can you see the fire scar?



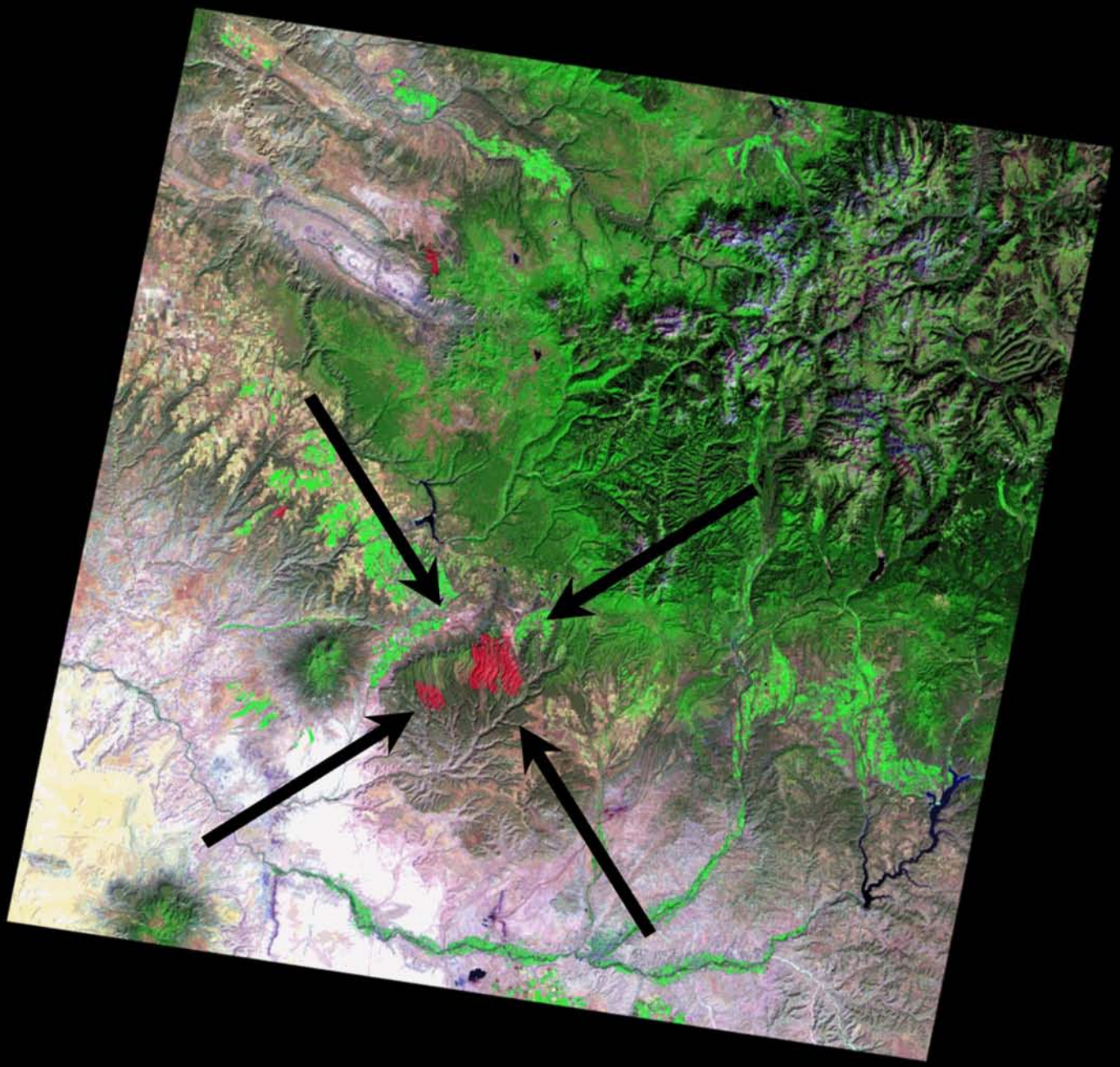
Different band combinations highlight different features, this image uses bands: 4,3,2

Can you see the fire scar now?



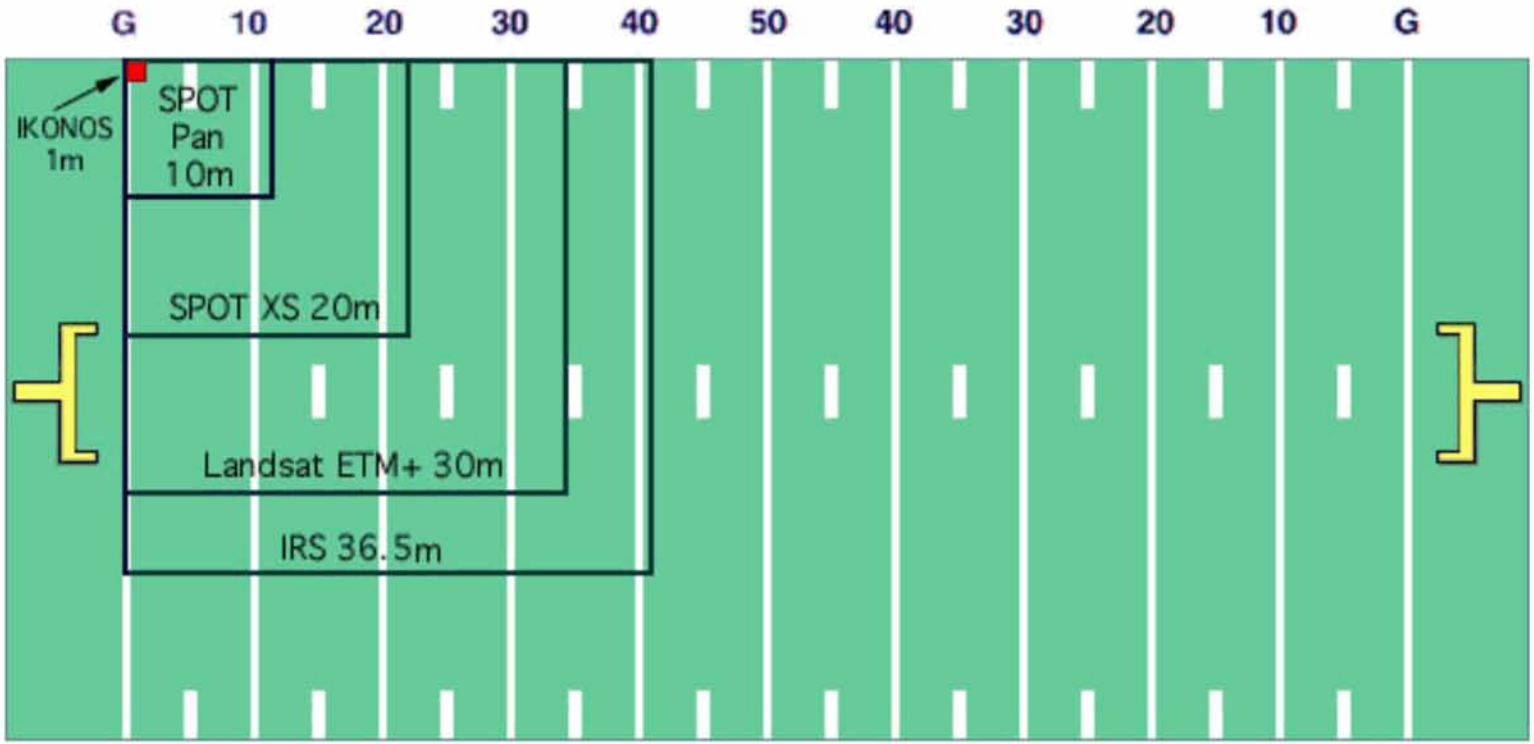
Different band combinations highlight different features, this image uses bands: 7,5,2

How about now?



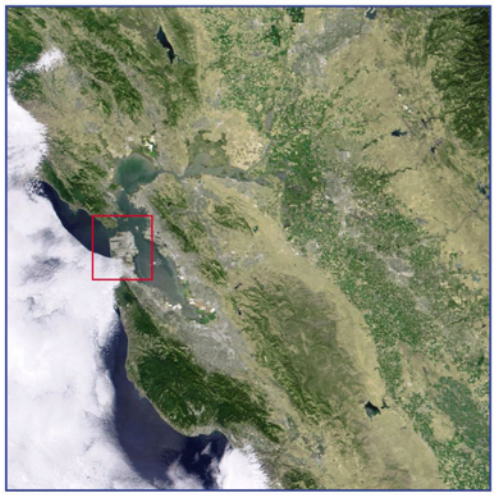
Different band combinations highlight different features, this image uses bands: 7,4,2

Spatial Resolution



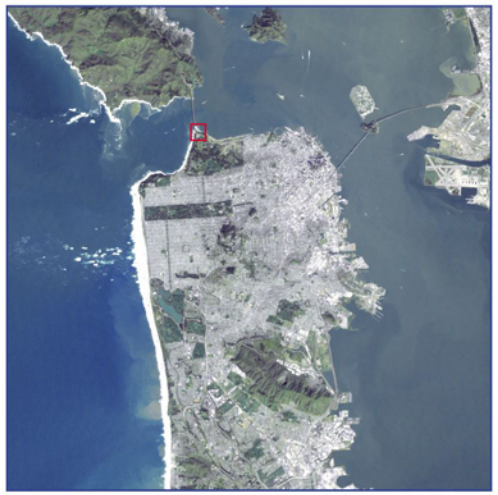
Spatial Resolution

MODIS



250 m

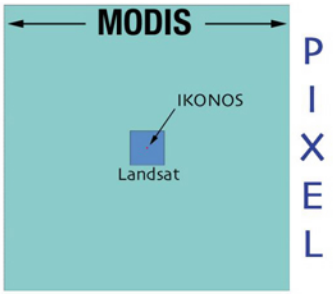
Landsat-7



30 m

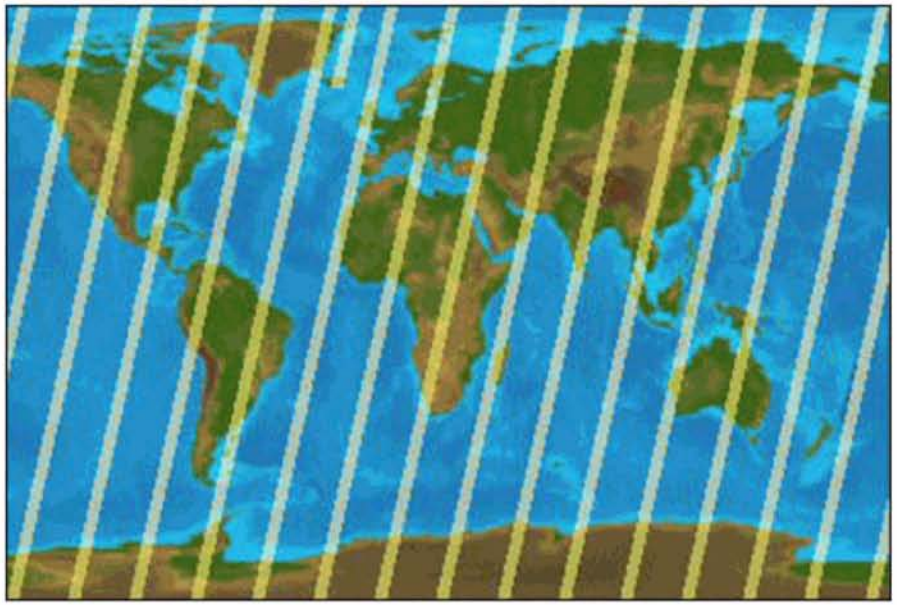
IKONOS

1 m

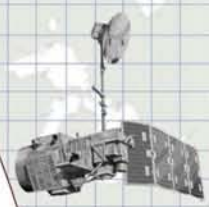


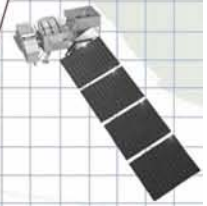
Temporal Resolution

- Landsats 4, 5, and 7 all have/had a 16 day repeat cycle
- Landsat 1, 2, and 3 had an 18 day repeat cycle
- Landsat 5 and 7 eight days apart, (see on Glovis)



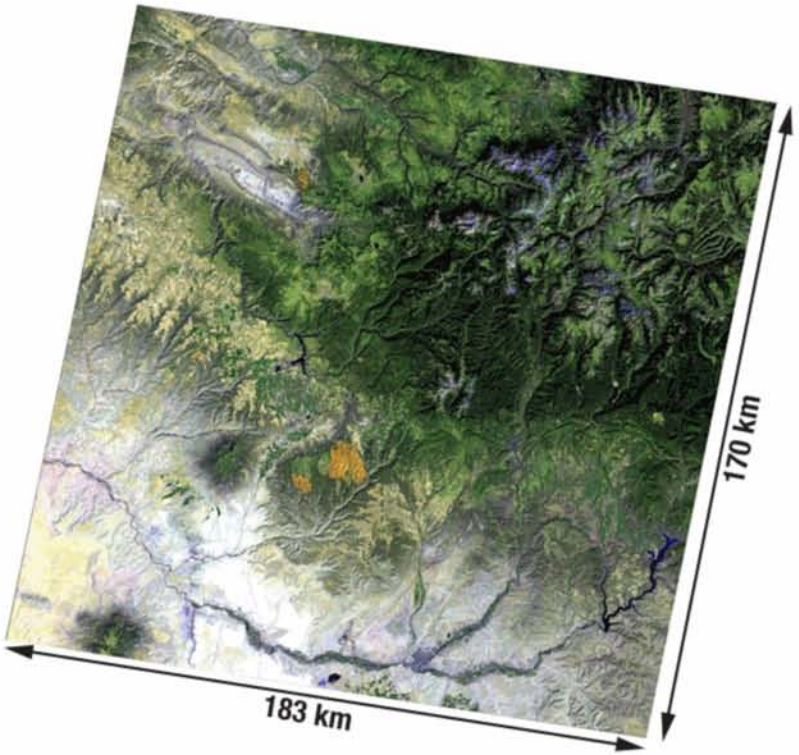
Why?





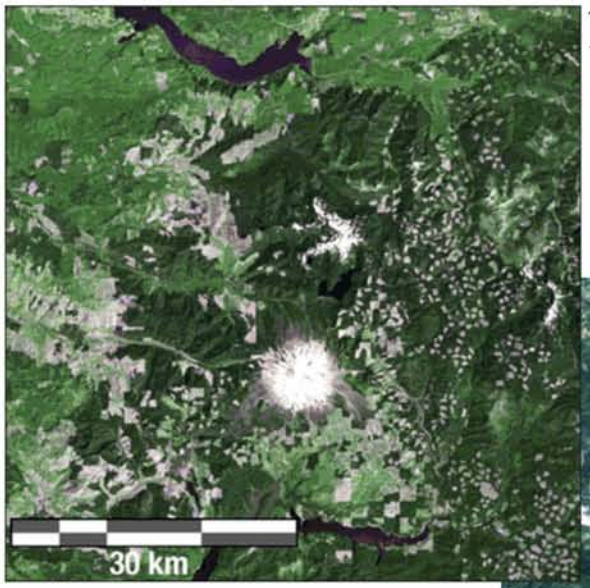
The Landsat niche

- A mid-resolution satellite
- Affords a synoptic view (and is coarse enough for global coverage)
- Yet detailed enough to characterize human scale processes, e.g. urban growth



Depth of the Landsat archive

- Landsat has been collecting data for 34 years!



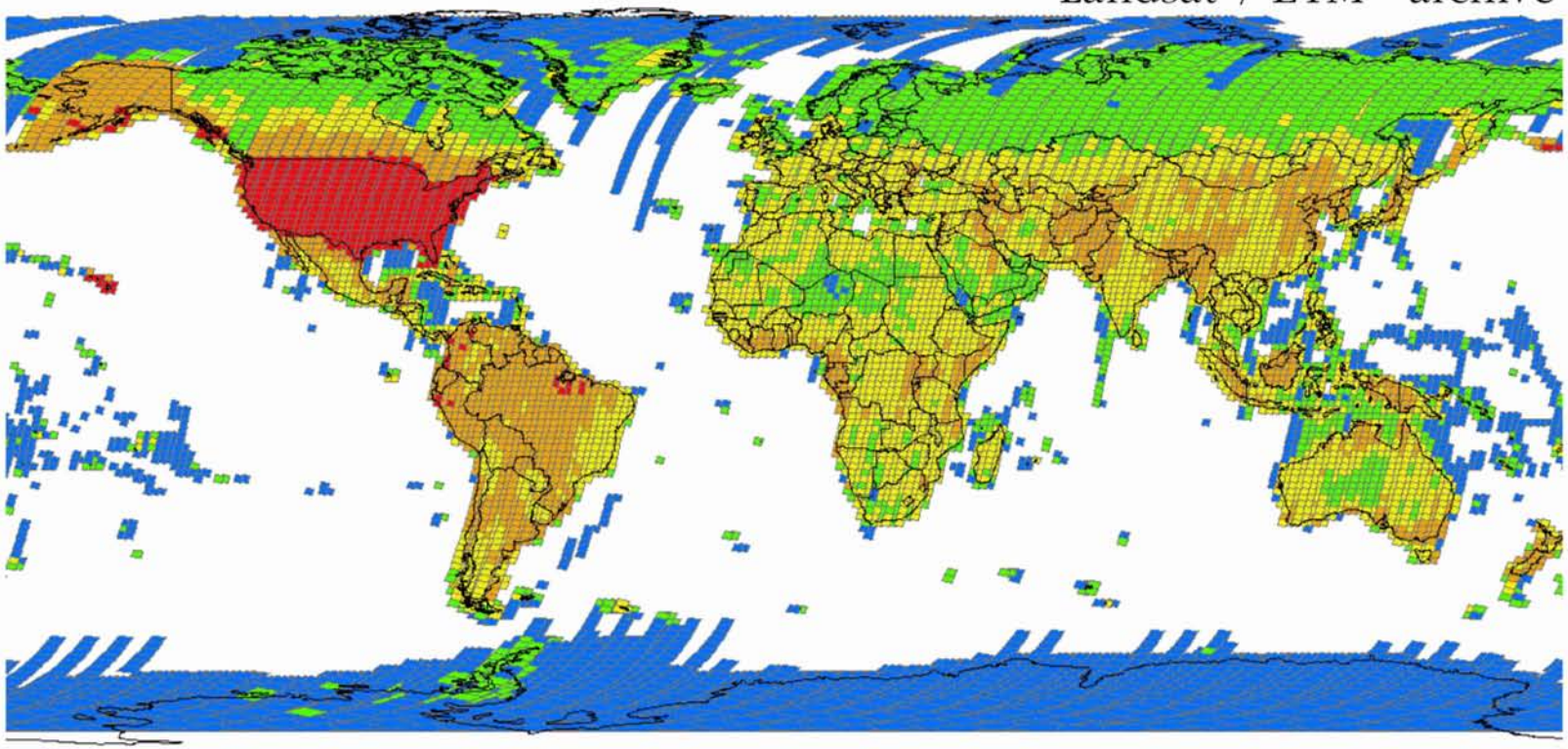
1973

1990

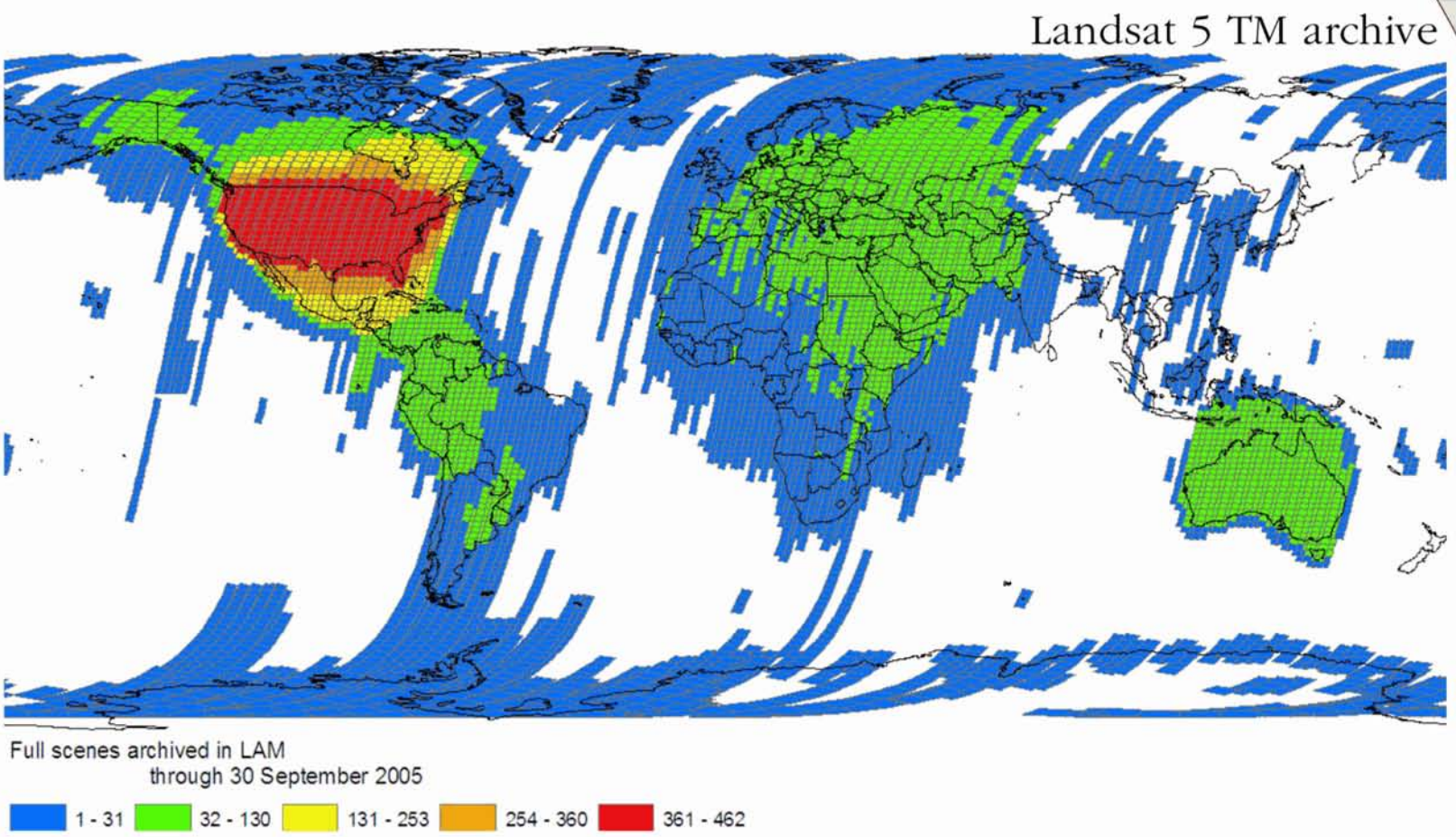
1999

Mt. St. Helens

Depth of the Landsat archive

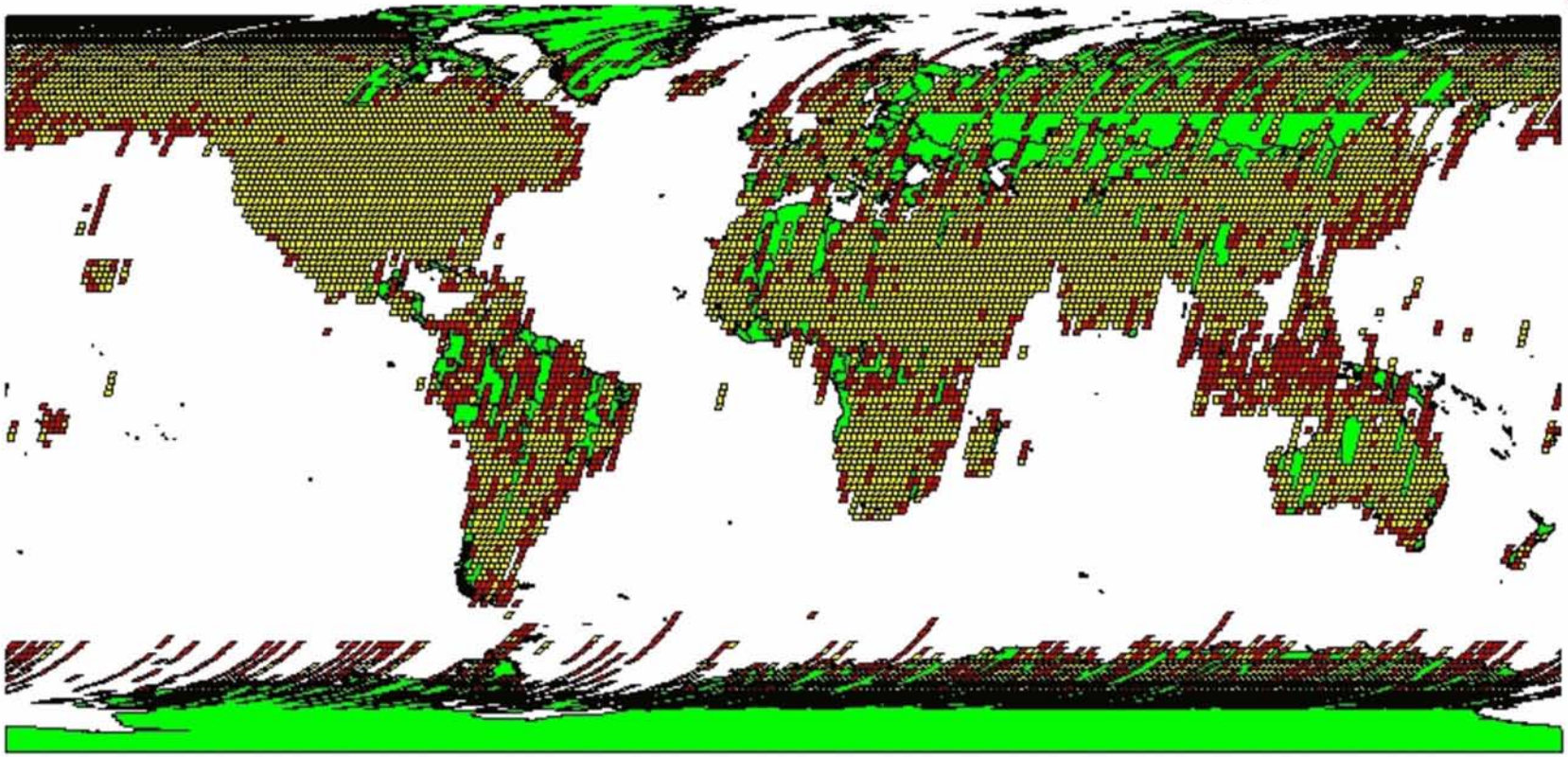


Depth of the Landsat archive



Depth of the Landsat archive

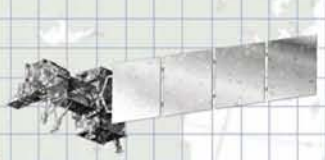
1973 MSS archive

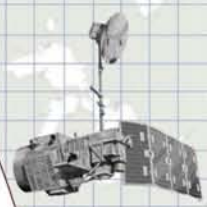


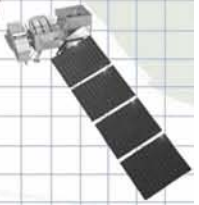
Landsat calibration standards

Landsat-7's rigorous calibration standards have made it the validation choice for many coarse-resolution sensors.

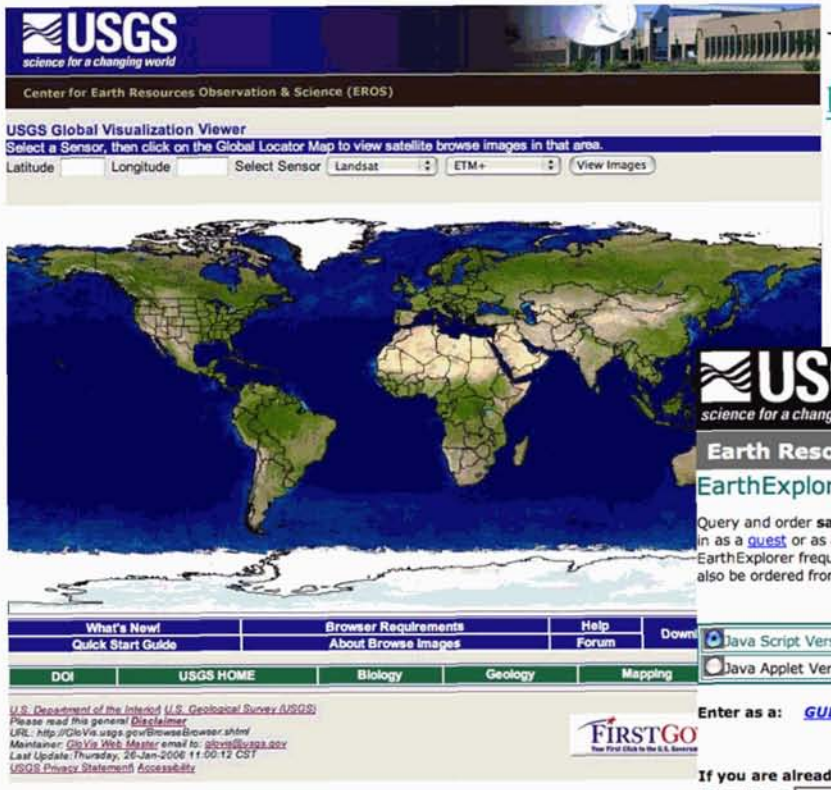
Where?







Ordering Landsat data



USGS Glovis

http://glovis.usgs.gov

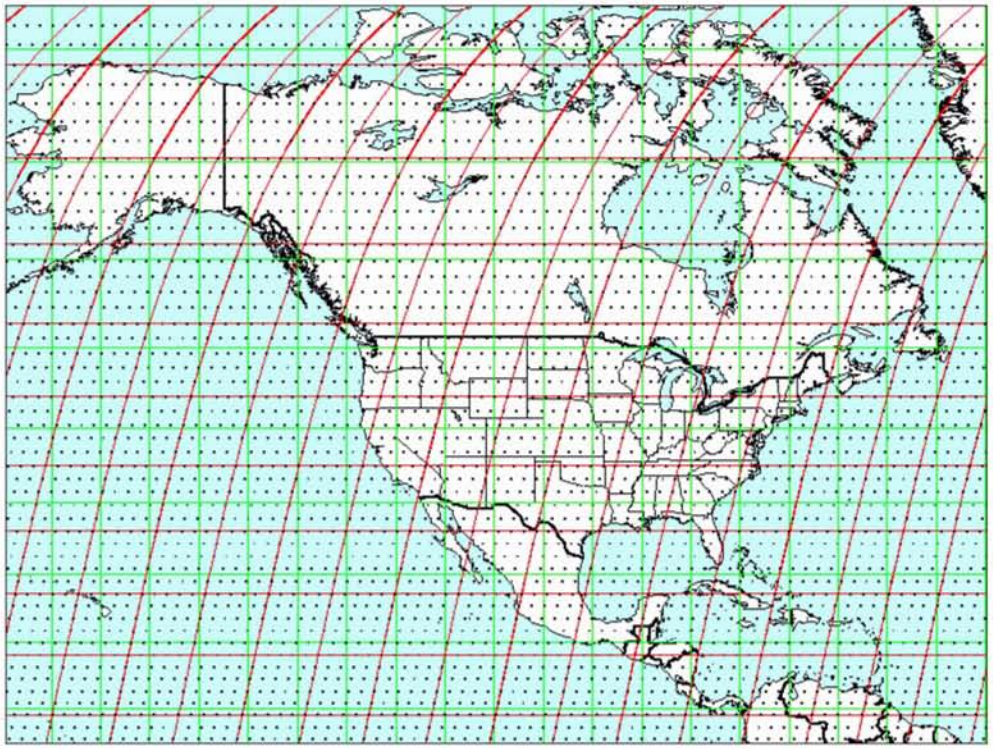
USGS
science for a changing world

USGS EarthExplorer

http://earthexplorer.usgs.gov

WRS and Landsat data policy

- Data Policy: Cost Of Fulfilling User Request (COFUR)
- Each scene has a unique WRS Path/Row locator



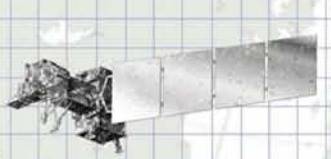
Each red line indicates a Landsat orbital **Path**
Each dot indicates a scene center, denoted as **Row**

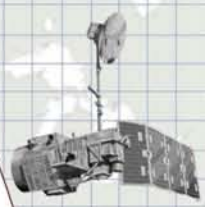
Reduced cost Landsat data

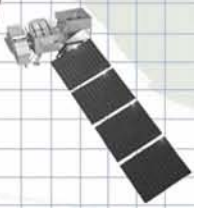
http://glcf.umiacs.umd.edu/index.shtml

- Because of Landsat's data policy there are a number of websites that provide Landsat data for a reduced cost or free.
- The University of Maryland's Global Land Cover Facility is one of the best.
- GLCF has all of the orthorectified GeoCover scenes

How?

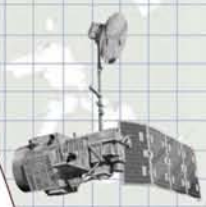


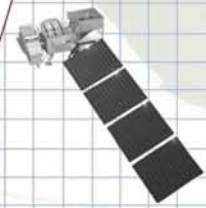




Landsat applications

- Land cover classification
- Land cover change
- Estimation of irrigation water use
- Wildlife habitat mapping
- Burn severity mapping
- Rangeland management





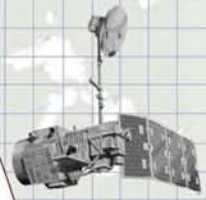
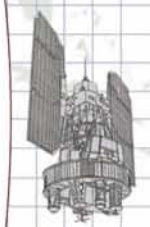
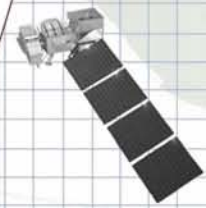
Analyzing Landsat Data

Image processing software:

- RSI ENVI
- PCI Geomatics
- ERDAS Imagine
- MultiSpec (see resource page)
- ArcGIS extensions: Image Analysis

Common analysis methods:

- Band ratios: NDVI, VI, BARC
- Supervised classification
- Unsupervised classification

Landsat data in ArcGIS

Many people use Landsat data and a Geographic Information System (GIS) together

Center for Biodiversity and Conservation
American Museum of Natural History

A tutorial by
Ned Horning
American Museum
of Natural History

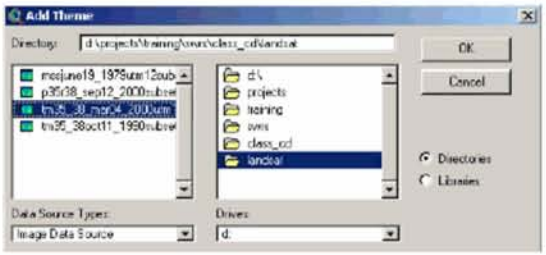
Loading and enhancing Landsat images in common geospatial software

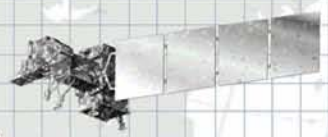
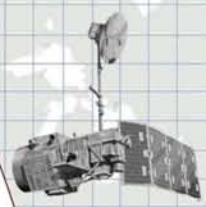
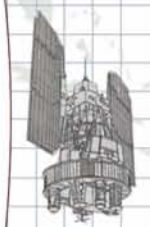
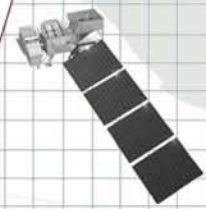
There are several GIS and Remote Sensing software packages that are commercially available. Each of these programs is capable of loading and enhancing satellite images, but there are differences in the way that these images are handled. Below are some practical guides to loading and enhancing Landsat imagery in three commonly used, commercially available GIS and Remote Sensing software packages.

ArcView 3.x

1. In an open ArcView project, open the extensions list by choosing *Extensions…* from the *File* drop down menu. Make sure that *Spatial Analyst* and *TIFF 6.0 Image Support* are selected to work with tif images and raster data.

2. To add an image to the project, use the add theme button. Find and select the image that you would like to view. ArcView 3.x is able to view satellite image data in tif, erdas img, esri grid and bil formats. Be sure to set the *Data Source Type* to *Image Data Source* to view the available image files.



Landsat Resources

Landsat NASA website landsat.gsfc.nasa.gov
Landsat USGS website landsat.usgs.gov
Landsat 7 Data Users Handbook
ltpwww.gsfc.nasa.gov/IAS/handbook/handbook_toc.html
USGS Glovis glovis.usgs.gov
USGS Earth Explorer earthexplorer.usgs.gov
Global Land Cover Facility glcf.umiacs.umd.edu/index.shtml
Center for Biodiversity Conservation RS Guide
geospatial.amnh.org/remote_sensing/training
/workshop_material/monitor_lcc/presentations.html
MultiSpec http://dynamo.ecn.purdue.edu/~biehl/MultiSpec/