



# World Meteorological Organization Polar Space Task Group

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# 1. USGS Landsat Program

## Approaching Four Decades of Earth Imaging

- National Land Imaging Program
- National Space Policy – June 28, 2010 *Land Remote Sensing*

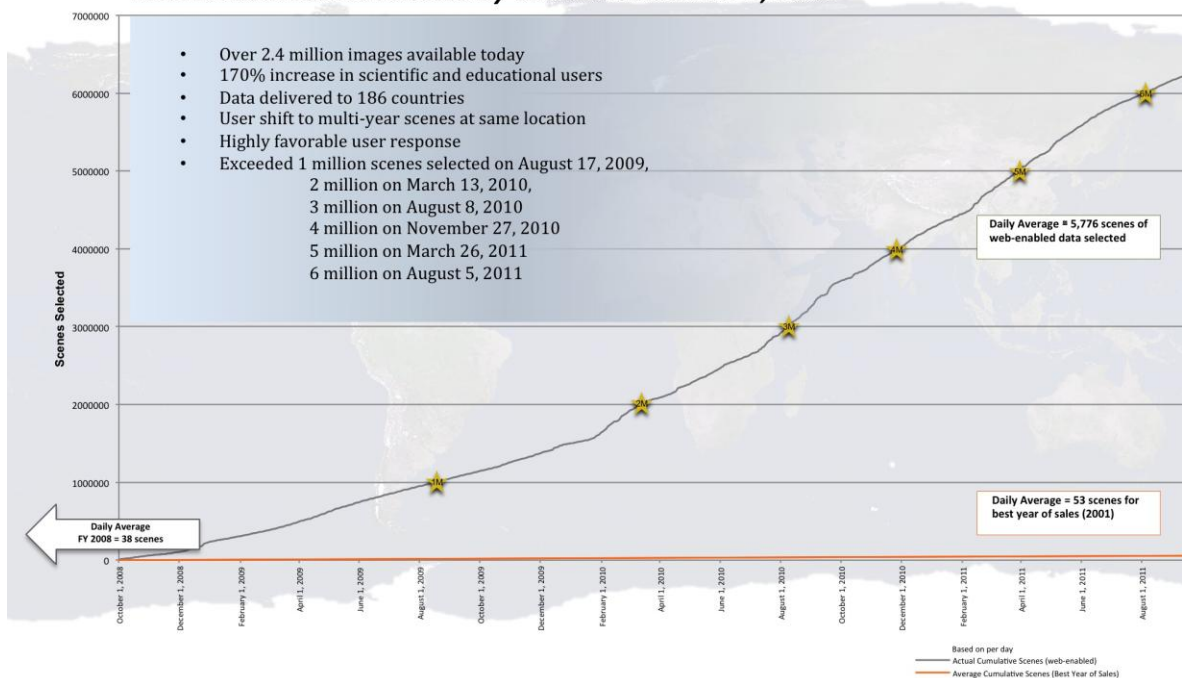
The Secretary of the Interior, through the Director of the United States Geological Survey (USGS), shall:

- o Conduct research on natural and human-induced changes to Earth's land, land cover, and inland surface waters, and manage a global land surface data national archive and its distribution;
- o Determine the operational requirements for collection, processing, archiving, and distribution of land surface data to the United States Government and other users; and
- o Be responsible, in coordination with the Secretary of Defense, the Secretary of Homeland Security, and the Director of National Intelligence, for providing remote sensing information related to the environment and disasters that is acquired from national security space systems to other civil government agencies.

In support of these critical needs, the Secretary of the Interior, through the Director of the USGS, and the NASA Administrator shall work together in maintaining a program for operational land remote sensing observations

## Landsat Web-Enabled Imagery

**Total Landsat Scenes Selected By Users Since October 1, 2008**



# Landsat Data Continuity Mission (Landsat 8)

## Mission Characteristics

- Orbit: Polar, 705km circular, sun-synchronous, Worldwide Reference System-2 (WRS-2), 98.2° inclination, mid-morning (10:00 am), 16-day repeat, +/- 82 degrees latitude
- Launch Date: December 2012; Launch Vehicle: Atlas V
- Mission Life: 5 Years (with consumables for 10 years)
- Data policy: no charge or restrictions

## Spacecraft

- Observatory mass of 3085kg
- Maximum power of 2130W
- 3TB Solid State Recorder
- 384 Mbps X-band downlink
- Off nadir +/- 15 degrees



## Operational Land Imager (OLI)

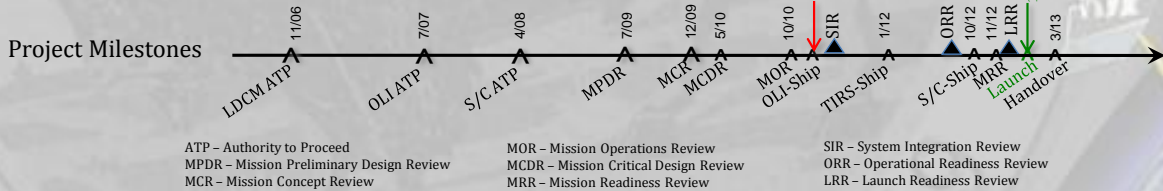
- 9 spectral bands (including new blue and cirrus bands)
- 30m resolution for VIS/NIR/SWIR, 15m for PAN
- 185km swath width
- Collect 400 WRS-2 scenes/day; 700 TB/5 years

## Thermal Infrared Sensor (TIRS)

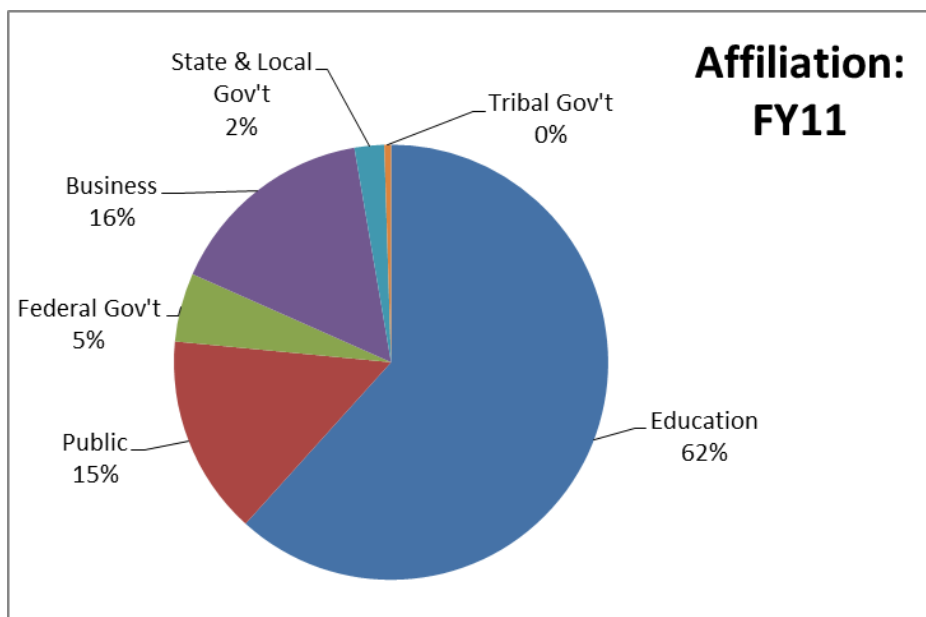
- Developed by NASA
- Approximately 100m resolution in 2 bands
- 185km swath width

## Data Products

- Full resolution browse
- Scene-based reformatted raw (LORp) all bands
- Scene-based orthorectified (L1T) all bands
- Surface reflectance & ECV, defined by Landsat Science Team

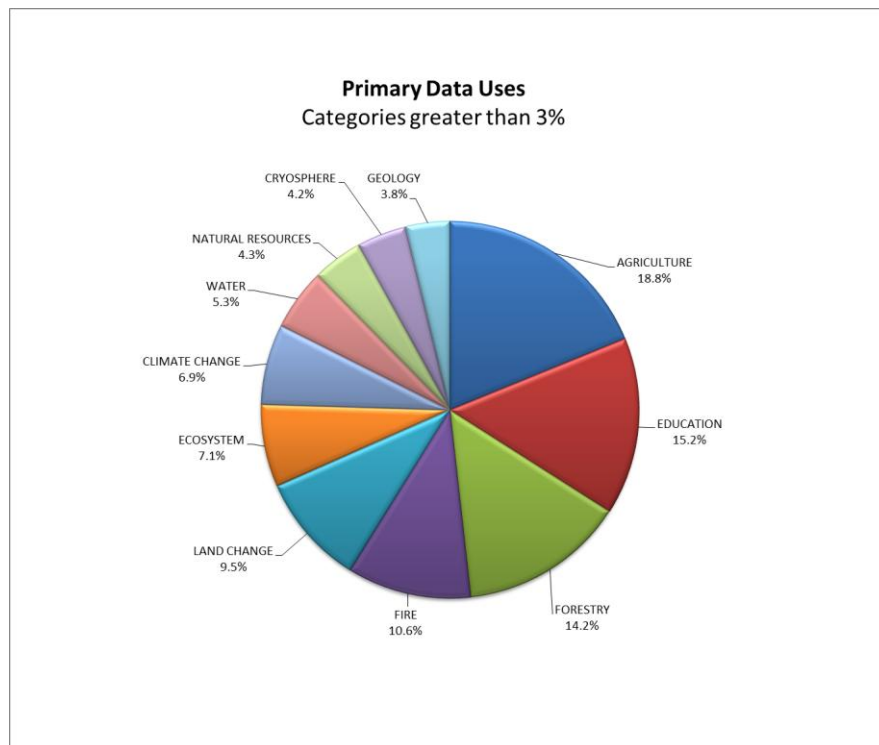


## Use by Affiliation FY-2011



Slide courtesy of Rachel Hadley, EROS

## Primary Data Users



*Slide courtesy of Rachel Hadley, EROS*

## 2. Satellite Image Atlas of Glaciers of the World

In 1978, the USGS began the preparation of the 11-chapter USGS Professional Paper 1386, "Satellite Image Atlas of Glaciers of the World." Between 1979 and 1981, optimum satellite images were distributed to a team of 70 scientists, representing 25 nations and 45 institutions, who agreed to author sections of the Professional Paper concerning either a geographic area (chapters B–K) or a glaciological topic (included in Chapter A). The scientists used Landsat 1, 2, and 3 multispectral scanner (MSS) images and Landsat 2 and 3 return beam vidicon (RBV) images to inventory the areal occurrence of glacier ice on our planet within the boundaries of the spacecrafts' coverage (between about 82° north and south latitudes). Some later contributors also used Landsat 4 and 5 MSS and Thematic Mapper, Landsat 7 Enhanced Thematic Mapper-Plus (ETM+), and other satellite images. In addition to analyzing images of a specific geographic area, each author was asked to summarize up-to-date information about the glaciers within each area and compare their present-day areal distribution with reliable historical information (from published maps, reports, and photographs) about their past extent. Because of the limitations of Landsat images for delineating or monitoring

small glaciers in some geographic areas (the result of inadequate spatial resolution, lack of suitable seasonal coverage, or absence of coverage), some information on the areal distribution of small glaciers was derived from ancillary sources, including other satellite images. Completion of the atlas will provide an accurate regional inventory of the areal extent of glaciers on our planet during a relatively narrow time interval (1972–1981).

- Completed volumes – Antarctica, Greenland, Europe, Turkey-Iran-Africa, New Zealand and Irian Jaya, South America, North America and Alaska.
- Volumes to be completed – Iceland and Asia.
- <http://www.glaciers.er.usgs.gov>

## **2.1 Coastal-Change and Glaciological Maps of Antarctica:**

Changes in the area and volume of the two polar ice sheets in Antarctica and Greenland are intricately linked to changes in global climate, and could result in sea-level changes that could severely affect the densely populated coastal regions on Earth. Melting of the West Antarctica part of the Antarctic ice sheet alone could cause a sea-level rise of approximately 6 m. The potential sea-level rise after melting of the entire Antarctic ice sheet is estimated to be 73 m. In spite of its importance, the mass balance (the net volumetric gain or loss) of the Antarctic ice sheet is poorly known; it is not known whether the ice sheet is growing or shrinking. As a result, measurement of changes in the Antarctic ice sheet has been given a very high priority in recommendations by the Polar Research Board of the National Research Council, by the Scientific Committee on Antarctic Research (SCAR), and by the National Science Foundation's Office of Polar Programs. USGS uses Landsat 1,2,3 and Landsat 4,5,7 to determine coastal change in the Antarctic coastline. The project consists of 23 maps at 1:1,000,000-scale.

## **3. United States Board on Geographic Names – Advisory Committee on Antarctic Names**

### **3.1 Antarctic Geographic Coordinates from Satellite Imagery**

- The US has 13,000+ approved Antarctic geographic names.
- Coordinates selected from 1:500,000-scale maps are proving to be inaccurate with today's high resolution satellite imagery.
- New high accuracy coordinates are being produced from satellite imagery.
- New coordinates will be coordinated internationally with national naming authorities.

## 3.2 Webpages

1. LIMA: <http://lima.usgs.gov>
2. US Board on Geographic Names/Advisory Committee on Antarctic Names: <http://geonames.usgs.gov>
3. US Antarctic Resource Center: [www.usarc.usgs.gov](http://www.usarc.usgs.gov)

## 4. Antarctic Aerial Photography

- USGS Earth Observation and Science Center (EROS) has digitized the Antarctica film stored at the USGS/EROS Center. It has been scanned at 25 micron (1,000 dpi) and is accessible as no cost downloads through EarthExplorer (EE) for either the earlier 400 dpi files and the new 1,000 dpi products digitized.
- On March 15, 2011, USGS/EROS shipped 4,776 Antarctica original aerial film negatives to the National Archives and Records Administration (NARA) in College Park, MD as a formal records transfer of vinegar syndrome film for cold storage and preservation. The final shipment of all USARC Antarctica film to NARA will occur in fiscal year 2012
- British Antarctic Survey Antarctic Aerial Film - In November 2010 BAS shipped 127 rolls of Antarctica film to EROS for scanning at 1,000 dpi to create browse, medium, and high resolution files consistent with the USARC film collection. As of the end of August 2011, that activity is 70% complete. EROS will ship the original BAS film back to Cambridge on or before March 31, 2012. BAS and USARC data reside in the same EarthExplorer collection.