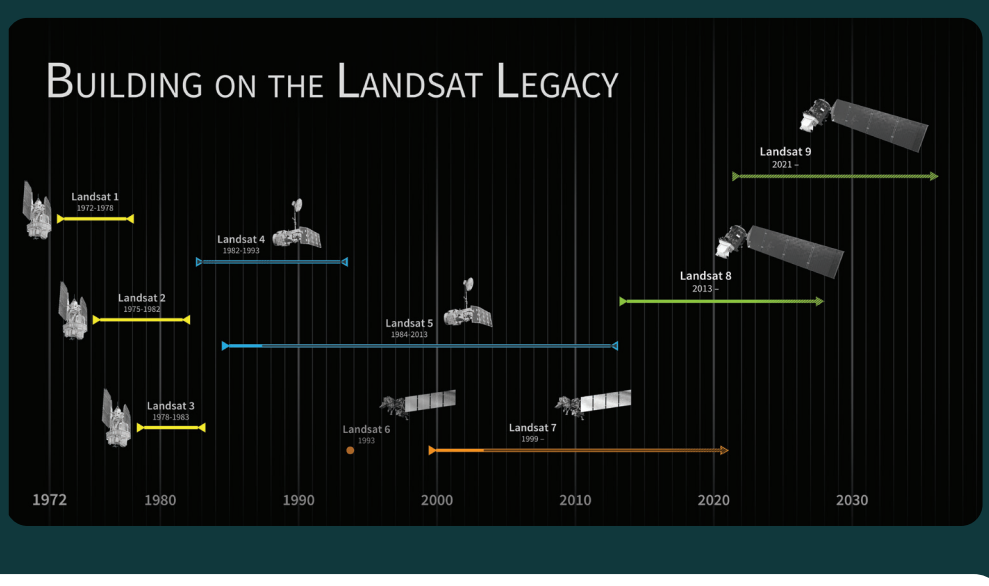
Landsat: A Half-Century of Data

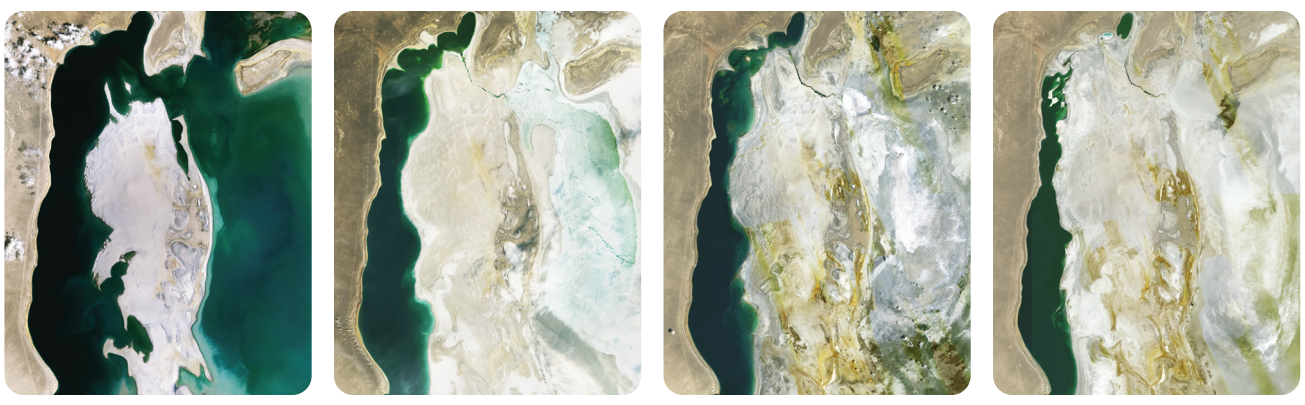
Since 1972, Landsat satellites have consistently gathered data about our planet for the benefit of the U.S. and the world. The Landsat data archive is the longest continuous remotely sensed global record of Earth's surface, with all the data free and available to the public. Land cover and land use are changing globally at rates unprecedented in human history. These changes bring profound consequences for weather, ecosystems, resource management, the economy, carbon storage and emissions, human health, and other aspects of society. Landsat datasets are a critical tool in monitoring and managing essential resources in a changing world. The Landsat satellite missions, jointly managed by NASA and the U.S. Geological Survey, are a central pillar of our national remote sensing capability and established the U.S. as a leader in land imaging.

Landsat Since 1972

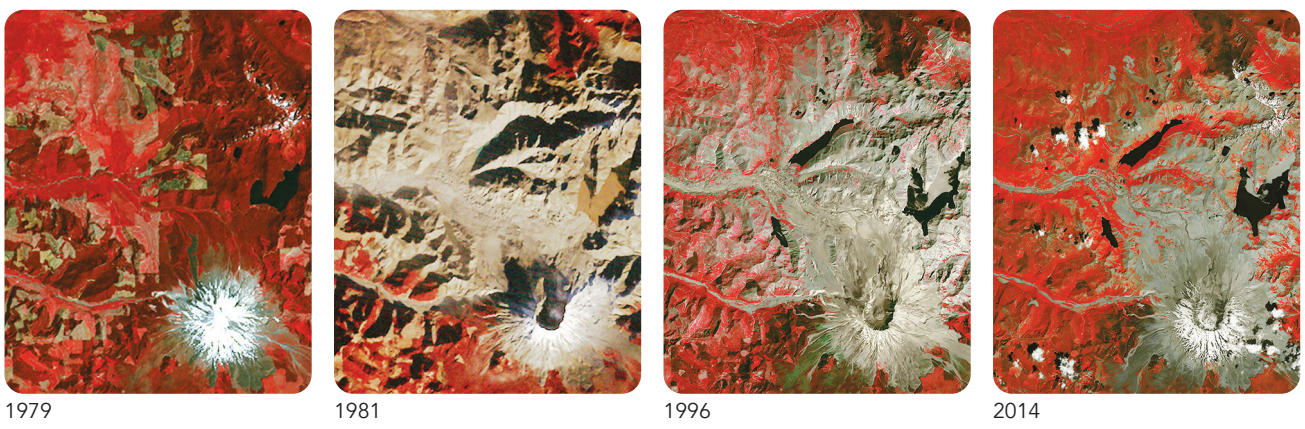
The Landsat program offers the longest continuous global record of the Earth's surface. Landsat sensors have a moderate spatial-resolution. You cannot see individual houses on a Landsat image, but you can see large man-made objects such as highways. This is an important spatial resolution because it is coarse enough for global coverage, yet detailed enough to characterize human-scale processes such as urban growth, deforestation, agriculture water use, and more.

Landsat 9 is the newest satellite in the program, and will add more than 700 scenes a day to this invaluable archive. As Earth's population approaches 8 billion, Landsat 9 will extend our ability to detect and characterize land surface changes, and will do so at a scale where researchers can differentiate between natural and human-induced change.

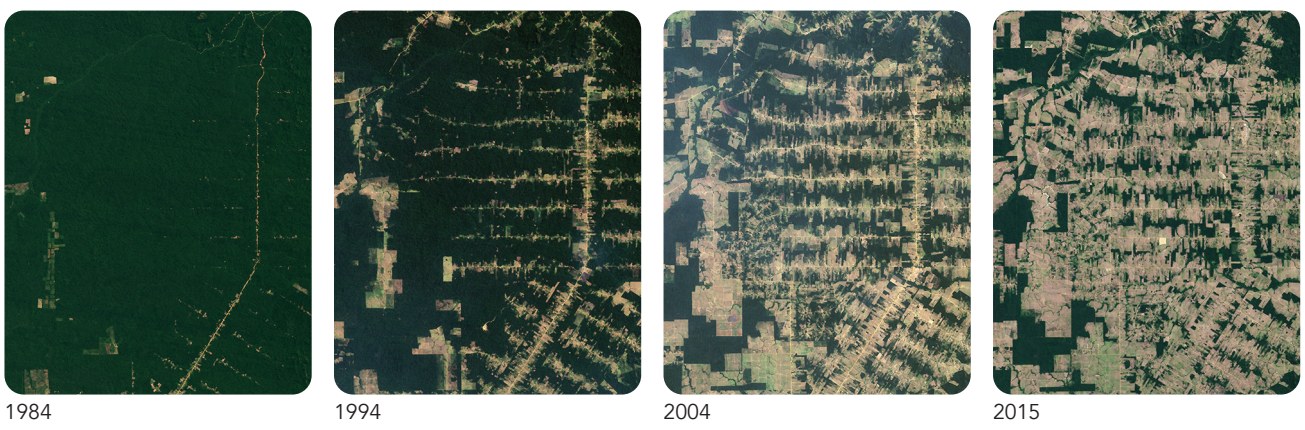



2000 2010 2014 2021

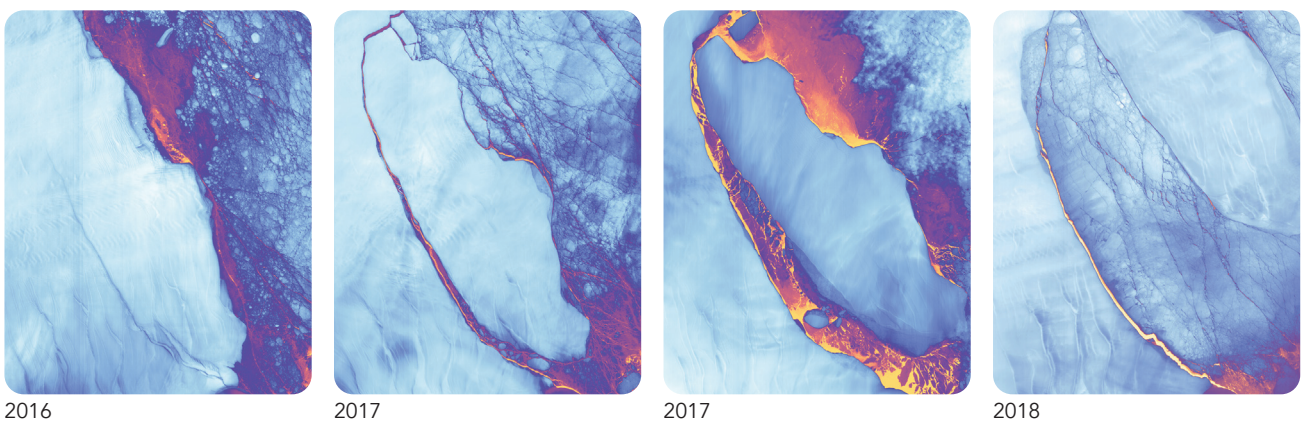
The **Aral Sea** has been shrinking since the 1960s, when two rivers that fed it were diverted for agriculture. A dam built in 2005 has conserved the northern extent of the lake, but what was once a large freshwater lake is now just a fraction of its original size. The local agriculture and fishing industries have collapsed. Without the moderating effect of this large water body, the local climate has changed and dust storms spread polluted sediment from the exposed lakebed.


1979 1981 1996 2014

Mount St. Helens erupted with a cataclysmic collapse, avalanche, and explosion in 1980. As the first eruption in the continental United States in the era of modern scientific observation, it has given scientists an unprecedented opportunity to witness the intricate steps through which life reclaims a devastated landscape. The scale of the eruption and the beginning of reclamation in the Mount St. Helens blast zone are documented in this series of images captured by the Landsat series of satellites between 1979 and 2014.


1984 1994 2004 2015

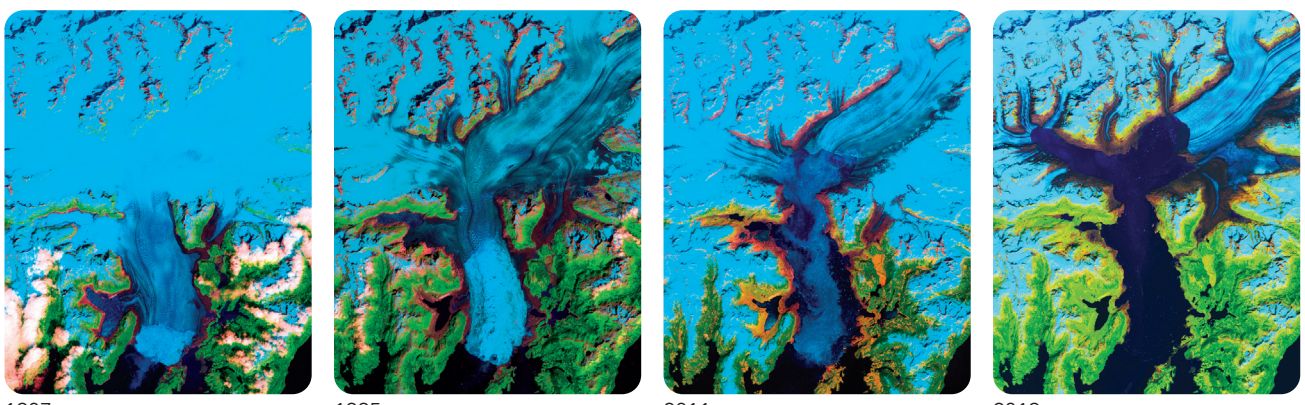
The conversion of tropical rainforests to pasture and cropland is having dramatic effects on the environment. Particularly intense and rapid deforestation is taking place in the state of **Rondônia, Brazil**, part of which is shown in this series of Landsat images. The deforestation starts along roads and then fans out to create the "fishbone" pattern, which begins to show in the eastern half of the 1984 image. About 30% of the world's tropical forests are in Brazil. The estimated average deforestation rate from 1978 to 1988 was 15,000 km^2 per year.


2016 2017 2017 2018

Landsat 8's Thermal Infrared Sensor observed the calving of a massive iceberg from the **Larsen C Ice Shelf** in Antarctica in 2016. Thermal imagery is able to show where colder ice ends and "warm" water of the Weddell Sea begins – even in the Antarctic winter. In a few weeks of observations, the passage widened between the main iceberg and the front of the shelf. This slow widening occured after an initial back-and-forth movement in July, 2017 broke the main berg into two large icebergs, later named A-68A and A-68B. Landsat continued to track the movement of these bergs in 2018.


1986 2002 2008 2021

The city of **Dubai**, in the United Arab Emirates, has transformed from a small fishing and pearl-diving village into a modern metropolis. The population has grown from just over 100,000 residents in 1972 to an estimated 2.9 million residents in 2022. The images are shown in false color infrared where areas appearing red show healthy vegetation. A dramatic change can be observed from the first image in 1973 (very little vegetation and urbanization) to 2022 with many areas of red far from the water.


1987 1995 2011 2019

The **Columbia Glacier** descends from an icefield 10,000 feet above sea level, along the Chugach Mountains, and into a narrow inlet that leads into Prince William Sound in Southeastern Alaska. It is one of the most rapidly changing glaciers in the world. The terminus has been retreating to the north since the 1980s and has contributed to global sea-level rise, mostly through iceberg calving. Because of the Landsat satellite series, scientists have been able to monitor the rate of change of the Columbia Glacier for the last 50 years.


1987 1993 2006 2017

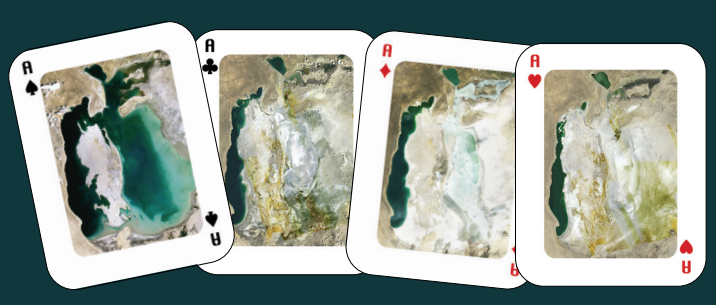
In a swampy area in Southern Louisiana, new land is forming at the deltas of the **Wax Lake Outlet** and the **Atchafalaya River**. This land formation process is being captured through time by multiple Landsat satellite missions. Both deltas are being built by sediment carried by the Atchafalaya River. Geologists first noticed mud deposits building up in Atchafalaya Bay in the 1950s. Then in 1973, new land first rose above the water line after a severe flood and scientists from Louisiana State University calculated that the deltas have grown by 2.8 km^2 per year.

AmericaView's Earth Observation Day

AmericaView is a nationwide network of educators that advances the use of remote-sensing data and technology through education, outreach, and workforce development. Earth Observation Day (EOD) is a STEAM outreach event sponsored by AmericaView to celebrate the Landsat mission, a joint effort of USGS and NASA. EOD introduces students to Earth observations in a stimulating and dynamic way using the tools and technology of geospatial science. Enjoy the beauty of Earth captured by satellite and explore images used to solve some of Earth's most perplexing issues. The EOD web site (https://americaview.org/earth-observation-day/) provides information on how to engage students in the use and analysis of free remote sensing imagery.

Landsat Change-over-Time Game

Calling all Earth observation detectives! Test your skills in identifying land cover change-over-time in a series of Landsat satellite images. In this interactive game you will explore satellite images from various locations throughout the world and identify specific features of land cover, such as deserts, cities, rivers, lakes, farms, etc. Each location will display four different snapshots and you will prove your skills as an Earth observation detective by discovering how the land has changed through time.



More about Landsat

Celebrating 50 Years Landsat 1972-2022

Download the poster at:

landsat.gsfc.nasa.gov/ESW2022

For more images and information about Landsat, visit:

landsat.gsfc.nasa.gov

usgs.gov/landsat

eros.usgs.gov/image-gallery/earth-as-art

earthobservatory.nasa.gov

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