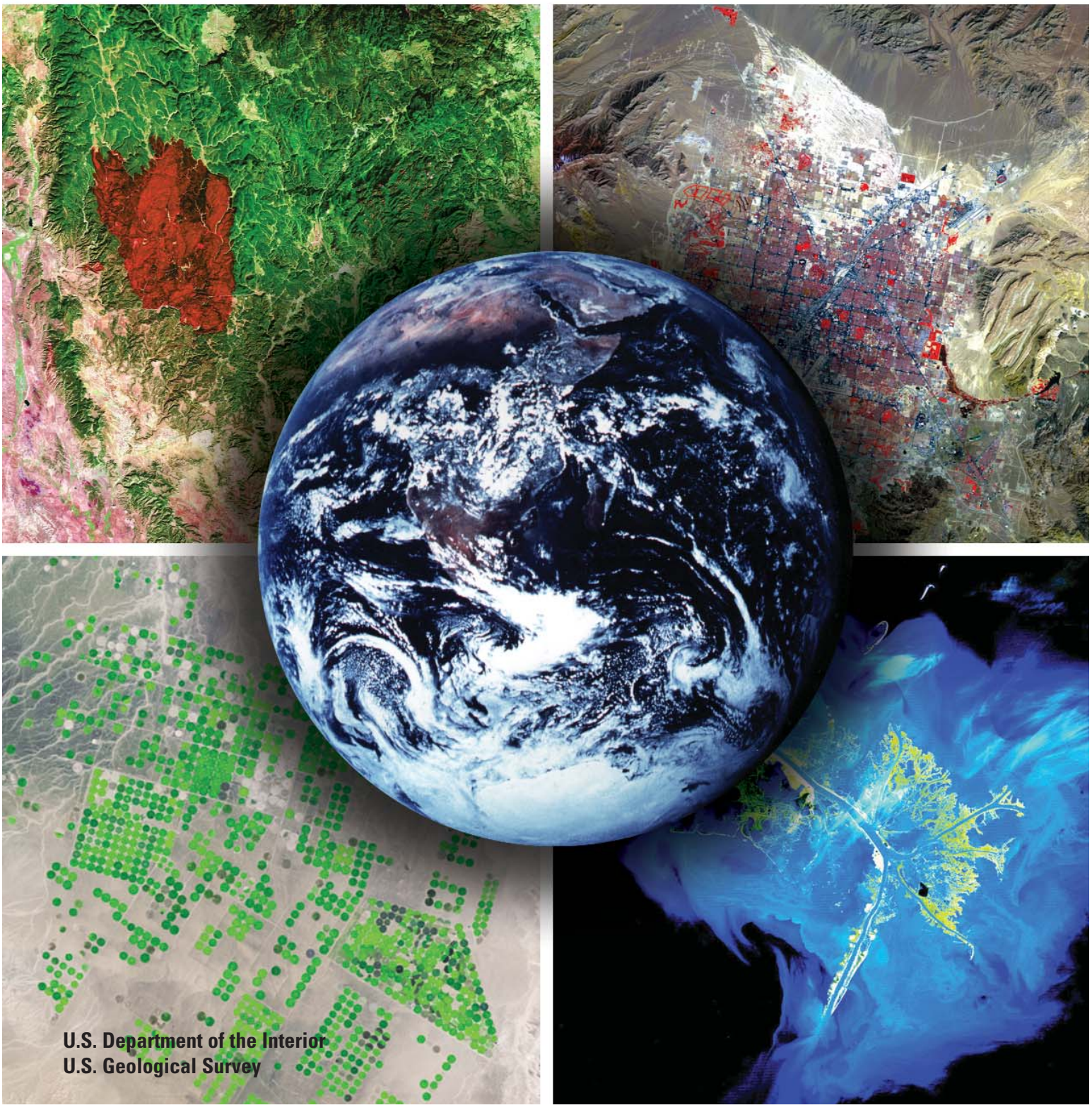
USGS
science for a changing world

EROS Data Center
Earth Images for Education

Tracking Change Over Time



U.S. Department of the Interior
U.S. Geological Survey

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Earth Images for Education

Tracking Change Over Time: A Classroom Activity

The Earth's surface is constantly changing. Continents shift. Seacoasts erode. Cities grow. Floodwaters cover one region while drought scorches another.

It's hard to see these changes from ground level. A much broader view is needed, together with a consistent record of change over time. Satellites that capture images of large areas of the Earth's surface at regular intervals can provide this view. By comparing satellite images from different times, it's possible not only to see changes, but to understand their effects.

The images on these two pages were taken by Landsat satellites. The images span 30 years and are archived at the EROS Data Center. Satellite images are somewhat different than pictures taken with a camera. Satellite sensors record waves of light and heat energy coming off the Earth's surface. Different sets of these energy waves are called bands. Images are created by putting together several bands (usually three). Various combinations of bands make it possible to see certain types of things in a satellite image that you couldn't see in an ordinary photograph.

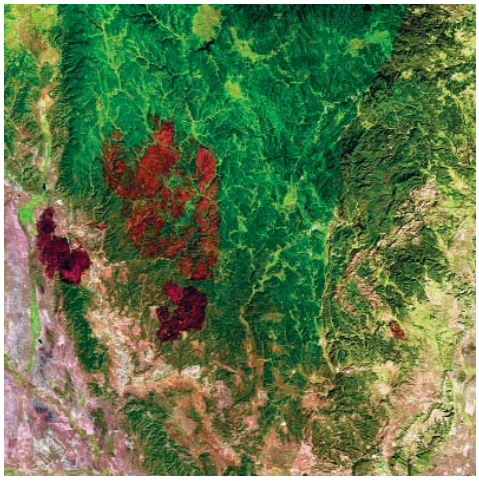
Scientists compare images like these in order to learn more about changes taking place in a region, across the country, and around the world. Compare the images in each set. What changes do you see? A detailed classroom activity can be built around these image sets using either the EDC Earth Images for Education: Tracking Change Over Time Lesson Plan and CD or by downloading the images directly from the Internet. To download the images, go to http://earthscience4kids.cr.usgs.gov; to manipulate the bands on the images, use MultiSpec (freeware), which is available at http://dynamo.ecn.purdue.edu/~biehl/MultiSpec/.

Black Hills, South Dakota

Fire can change a landscape tremendously in a very short time. In these satellite images of the Black Hills of South Dakota, healthy evergreen forests appear in shades of green. Forest fires leave "scars" on the landscape where trees and other vegetation have been burned away. Fire scars are clearly visible in shades of red in this series of satellite images, which spans four consecutive years.

1999

2000

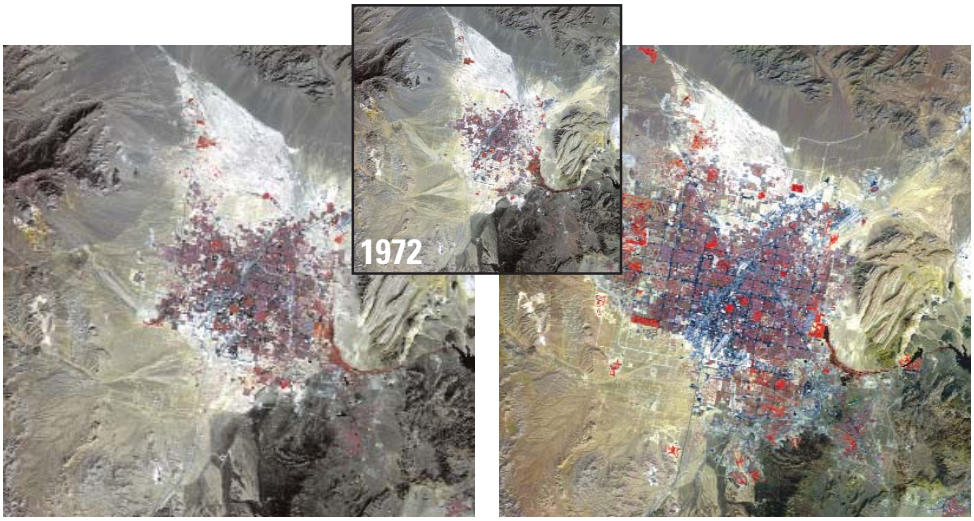


2001

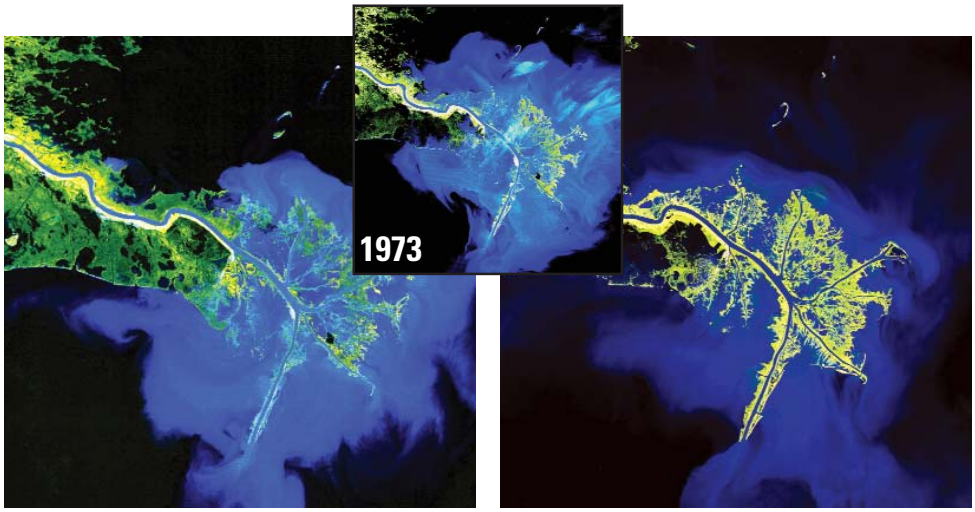
2002

Las Vegas, Nevada

Las Vegas is currently the fastest growing city in the United States. Back in 1950, the city's population was less than 25,000. Today it is more than one million, not including all the tourists! These three Landsat images show Las Vegas in 1972, 1986, and 2000, respectively.



1986 2000



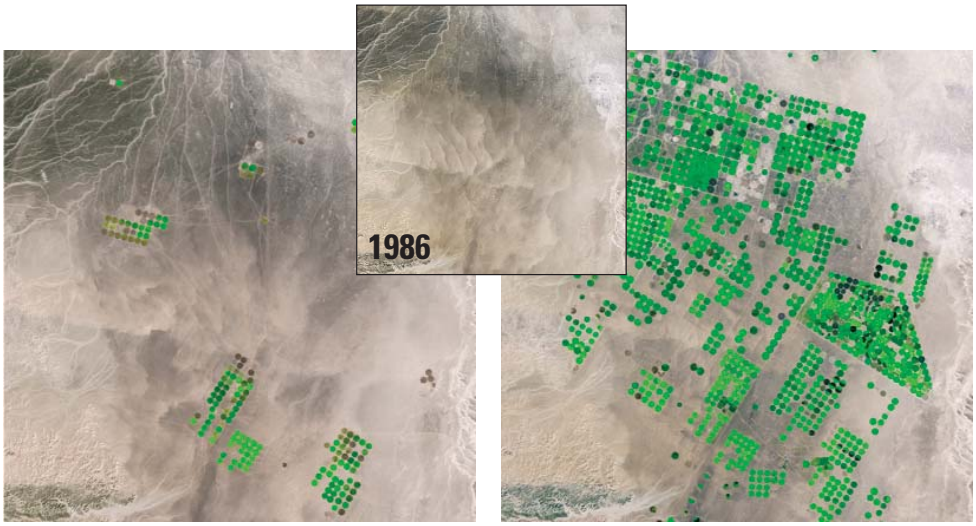
1989 2003

Mississippi Delta, Louisiana

This set of Landsat images shows three decades of change in the Mississippi River delta, where the river flows into the Gulf of Mexico near New Orleans, Louisiana. The delta changes shape and size over time. It is formed by sand and mud that have been carried downstream in the river water. When the Mississippi reaches the Gulf, it slows down and the sediments in the water settle to the bottom, creating the fan-shaped or "birds-foot" delta.

Al Isawiyah, Saudi Arabia

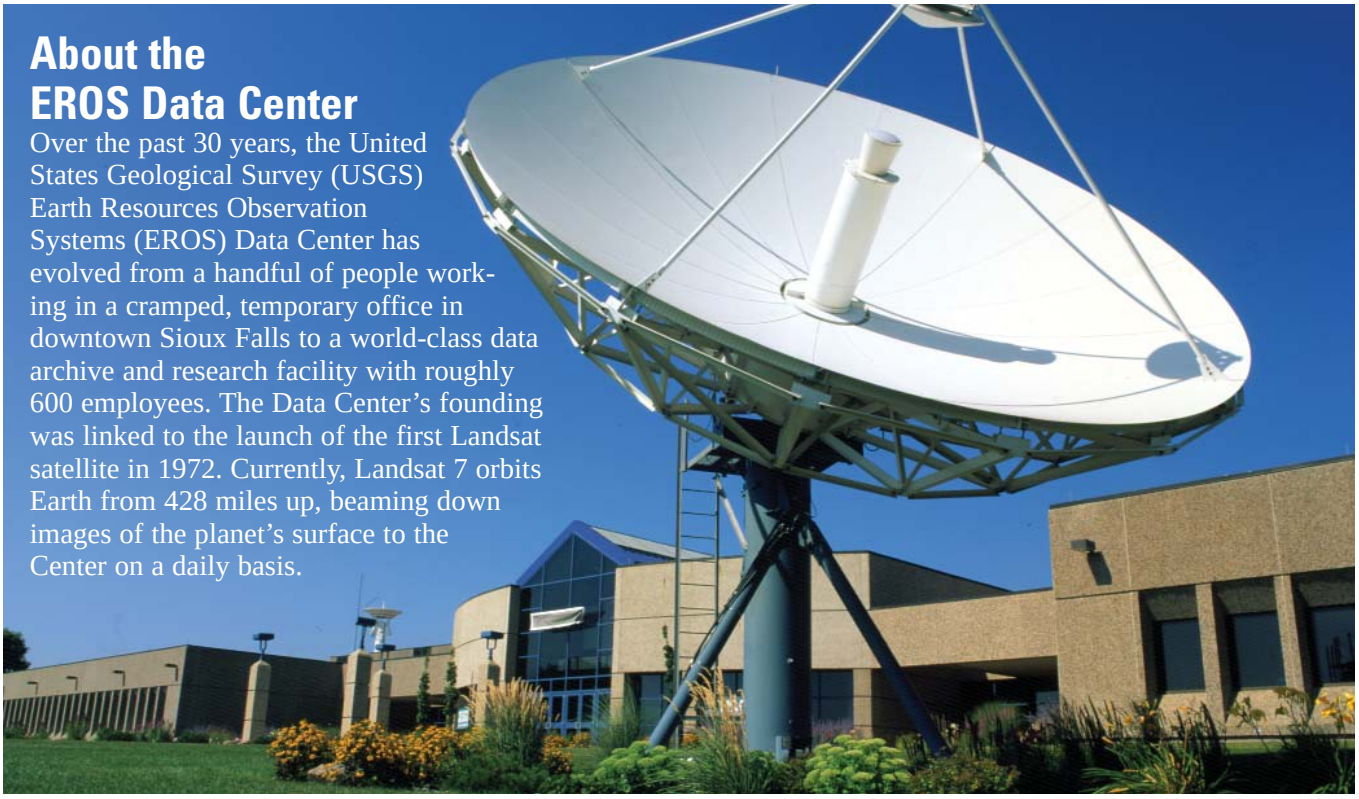
Saudi Arabia is an arid country in the Middle East. Although Saudi Arabia is rich in oil reserves, water is scarce. To meet a growing demand for wheat, the government used money from the oil industry to install center pivot irrigation systems in agricultural areas. These three satellite images show a desert-like region near the Saudi Arabian village of Al Isawiyah in the far north of the country, near its border with Jordan. They were taken before, during, and after the introduction of center pivot irrigation systems. The green circles in the images are irrigated fields.



1991 2000

About the EROS Data Center

Over the past 30 years, the United States Geological Survey (USGS) Earth Resources Observation Systems (EROS) Data Center has evolved from a handful of people working in a cramped, temporary office in downtown Sioux Falls to a world-class data archive and research facility with roughly 600 employees. The Data Center's founding was linked to the launch of the first Landsat satellite in 1972. Currently, Landsat 7 orbits Earth from 428 miles up, beaming down images of the planet's surface to the Center on a daily basis.



In August 1973, the Mundt Federal Building was completed 16 miles northeast of Sioux Falls to house the Data Center and its growing archive. That growth continues today. EROS maintains one of the largest collections of remotely sensed images of the Earth's land surface. Most come from Landsat and other civilian satellites, including weather satellites and NASA's Terra, Aqua, and EO-1 satellites. The Center also houses an extensive collection of aerial photographs. All told, the archive contains more than 28.5 million remotely sensed images. The total number grows by roughly 9.8 million every year.

The EROS staff manages and distributes archived images to scientists, policy makers, and educators worldwide who use them in the study of natural hazards, environmental change, economic development, and conservation issues. Researchers at EROS also use powerful computer systems to process and analyze satellite data in new ways. Every advance enhances our understanding of the Earth, how it changes over time, and the implications of those changes for people and ecosystems worldwide.

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