

# Landsat Brings Understanding to the Impact of Industrialization

*“A vision to observe Earth for the benefit of all...”*

Interior Secretary  
Stewart Udall, 1966

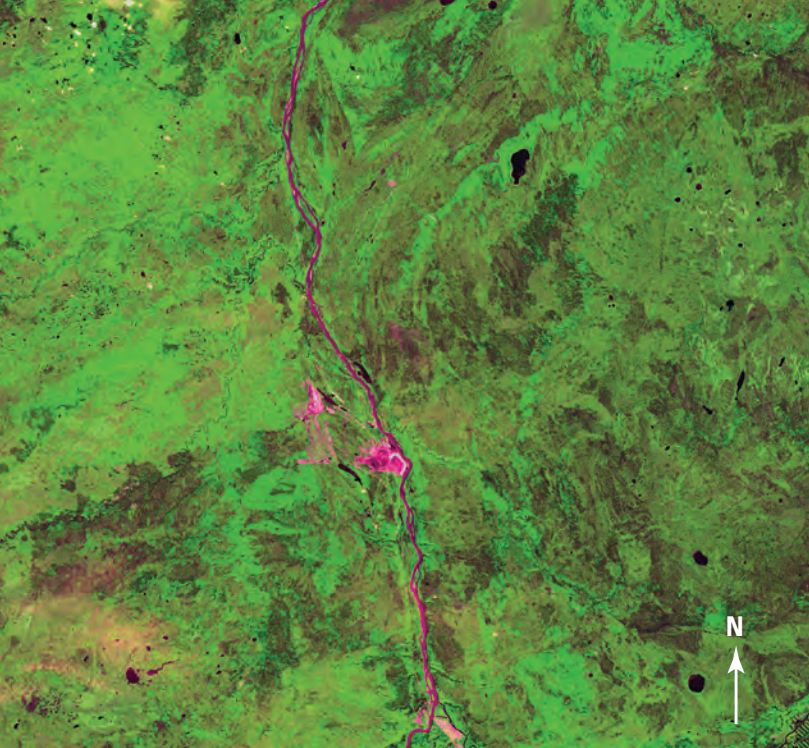
In his 1963 book, “The Quiet Crisis,” former Interior Secretary Stewart Udall lamented what he called the decline of natural resources in the United States under the advancements of industrialization and urbanization.

The United States “... stands poised on a pinnacle of wealth and power,” Udall wrote. “Yet we live in a land of vanishing beauty, of increasing ugliness, of shrinking open space, and of an overall environment that is diminished daily by pollution and noise and blight.”

For the first time, the planet seemed increasingly finite to Secretary Udall and others in the environmental movement. They argued that the United States needed to start managing its resources better. Udall eventually advocated to turn U.S. remote-sensing technology towards Earth to better understand and document the consequences of the spread of humanity.

In fact, 56 years later in 2019, Landsat satellites do exactly that.”





**Figure 1.** Landsat 1 (left image) on August 20, 1974, shows minimal open-pit mining activity near Fort McMurray, Alberta, Canada. Landsat 8 (right image) shows the dramatic difference on October 1, 2015, as open-pit mining is widely evident where oil is being extracted from tar sands and shipped by pipeline to the United States.

From 438 miles above Earth, Landsat satellite sensors collect data that help verify a central tenet of industrial growth across the world—the changing use of land to increase its economic output. Landsat satellite sensors capture industrialization data as Brazilian tropical forests are repurposed for soybean fields, and as open-pit mining in the tar sands of northern Alberta lays open the landscape to send oil flowing to the United States (fig. 1).

In this country, where farmers in the South now transform marginal farmland into value-added loblolly pine plantations, Landsat captures the planting of the trees as seedlings. If needed, Landsat satellite sensors can capture light readings from leafy canopies, providing data that can inform farmers about when to fertilize or put herbicides on their crops. When the trees have matured somewhere between 15 and 25 years, and are harvested and shipped off to the paper and wood pulp industries, Landsat again notes the circle of forest life.

Curtis Woodcock, a Boston University professor and chair of the U.S. Geological Survey (USGS) Landsat Science Team, said these examples illustrate how Landsat contributes to understanding humanity’s impact on the planet. For one thing, the ability of the satellite to monitor land use continuously over time provides a valuable baseline for tracking historical change. But equally important, indicates Woodcock, is how Landsat actually enables a global effort to change the way resources and land are used.

As part of the United Nation’s Framework Convention on Climate Change, almost 200 countries have indicated a willingness to reduce greenhouse gas emissions from burning fossil fuels and land-use change within their borders. Success in reducing greenhouse gases can earn a country monetary rewards, so using no-cost Landsat data to monitor progress, especially when it comes to deforestation, is beneficial and economical.

Trees capture large amounts of carbon emissions in their leaves, trunks, and roots. In the United States, forests make up between 80 and 90 percent of the carbon sink in the Nation, and forests sequester between 10 and 15 percent of its carbon dioxide emissions, according to the U.S. Forest Service. Using Landsat satellite data, the United States and other participating countries demonstrate carbon reduction efforts using remote-sensing data that quantifies how much forest cover each country has, how much forest is being degraded, and how much forest is being replanted.

Quantifying carbon reduction efforts would be difficult without the historical records from Landsat satellites, which allow for comparisons through time. In essence, Landsat has become the equivalent of the Earth’s free press, according to Woodcock, providing objective information on how the good and bad of industrial growth—from mining to deforestation to any other land-use change—is affecting the condition of the planet.

At the very least, Landsat has helped to take the quiet out of the conservation crisis Udall once lamented. More than a half century later, the advancements of humanity are forcing a vigorous global conversation about industrial and environmental consequences to the planet. To Secretary Udall’s credit—and because of the enduring commitment by the U.S. Geological Survey and the National Aeronautics and Space Administration—Landsat is part of that discussion.

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