Landsat: Democratizing 50 Years of Earth Observation

AAAS 2023 – February 15-17, 2023.

Slide 1: Building on Landsat Legacy timeline graphic with talk title

My name is Allison Nussbaum and I'm an outreach coordinator with the Landsat Communications and Public Engagement team at NASA Goddard Space Flight Center. Today, I'm going to be talking to you about how the Landsat program has democratized Earth observation. Starting with the launch of Landsat 1 on July 23, 1972, the Landsat program, managed jointly by NASA and USGS, has made up the world's longest continuous space-based record of Earth's surface. Now, Landsat Next is on the horizon, set to launch in late 2030.

Slide 2: L9 launch video

The most recent Landsat satellite to launch from Vandenberg Space Force Base on September 21, 2021, Landsat 9, has continued this legacy. Today, we can access data with the click of a button, and anyone anywhere can use Landsat data for their science.

Slide 3: Las Vegas time series

But it hasn't always been this easy. Prior to 2008, Landsat data cost a lot and only people with the means to afford the data could use it. All that changed in January 2008 when Barb Ryan, the Associate Director for Geography at the U.S. Geological Survey, and Michael Freilich, NASA's Director of the Earth Science Division, signed off on a Landsat Data Distribution Policy that made Landsat images free to the public. Where 53 Landsat scenes had been leaving the archive every day when imagery had to be purchased, the number jumped to 5,775 scenes daily when the price tag was removed. A 2017 economic analysis of Landsat imagery determined it provided $2.06 billion in annual benefits to United States data users alone, and $3.45 billion worldwide.

Slide 4: Data products

After opening the archive to the public in 2008, the development of data products began and led to products like the National Land Cover Database (NLCD), OpenET, spectral indices, aquatic reflectance, snow cover, burned area, and many more.

Slide 5: OpenET video

This animation first shows a natural-color Landsat 7 image of center-pivot irrigation fields in Idaho, created using the visible bands acquired by the ETM+ sensor. The second image was created using Landsat 7's thermal band and shows relative surface temperature at the field level. The last image shows evapotranspiration, a measure of how water is moving from the land surface to the atmosphere via evaporation and transpiration. Landsat satellites are making it possible for farmers to track how productive their crops are, which necessary to feed an ever-growing population.

Slide 6: HLS NDVI

Landsat also works well with others! By combining the spatial resolution of Landsat with the temporal resolution of the European Space Agency's Sentinel-2 satellite, scientists created Harmonized Landsat/Sentinel-2 data products (HLS). The goal of the HLS project is to obtain seamless 2–3-day global surface reflectance overage at 30 meters. This animation shows a year of NDVI data of farm fields south of Columbus, Nebraska from 2022 where red is bare soil and

green indicated healthy vegetation. These data products will continue to improve with future Landsat technology.

Slide 7: Landsat Next
Landsat satellites have improved significantly since the early days of the program. We started with 4 spectral bands on Landsats 1-3 and have made our way up to 11 on Landsats 8 and 9. Landsat Next will have improved spectral resolution still, with 26 bands, making it what we call, "super-spectral" to support emerging user applications. Spatial resolution on Landsat Next will also improve. Five bands will go from 30 meters to 10 meters, thermal and atmospheric bands will be 60 meters instead of 100, and all other bands will be 20 meters. It will also go from a 16-day repeat cycle to a 6 day repeat cycle, making it easier to capture fast-changing processes like crop growth, floods, and algal blooms.

Slide 8: L9 satellite closing
Thank you so much for listening and please reach out if you have any questions! You can visit our website for Landsat news, data information, imagery, and more.