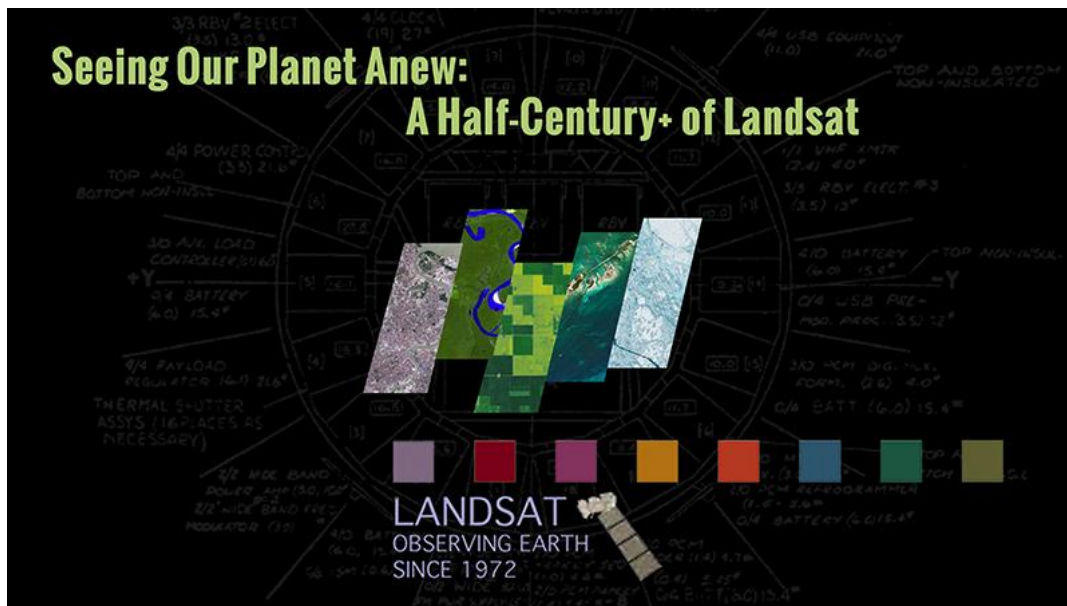


Seeing our Planet Anew: Half a Century of Landsat

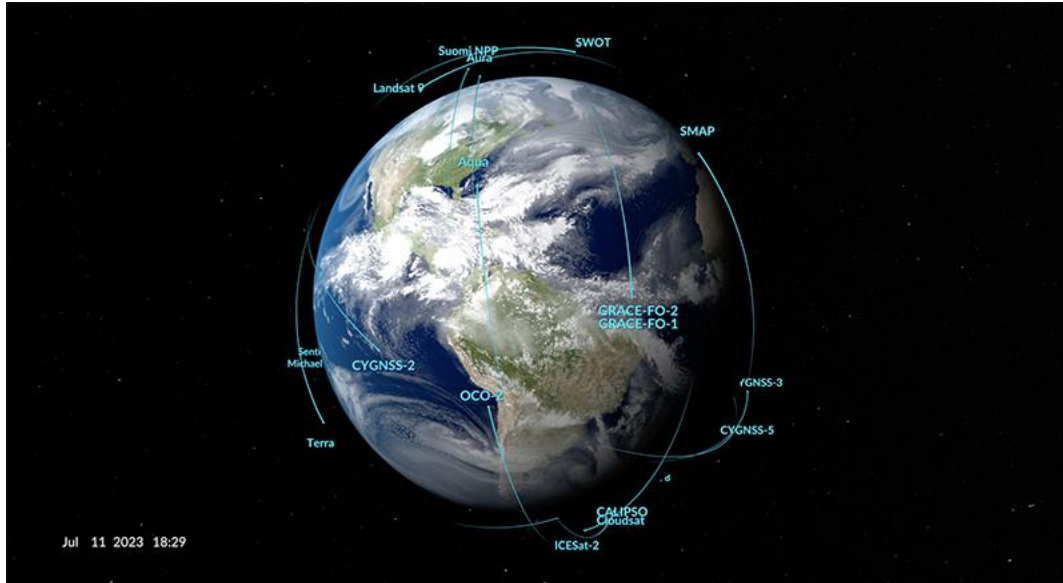
IGARSS 2023 - July 18, 2023



Hello and welcome to the NASA hyperwall. I hope everyone is enjoying the conference so far!

My name is Laura Rocchio. I work with the Landsat outreach team based at NASA Goddard and I am a co-author of a book about Landsat's history (a book that can be freely downloaded if anyone is interested).

Today, I will be sharing some of the ways that Landsat has helped us better understand our home planet... and I am going to give you a brief preview of the upcoming Landsat Next mission.



As many of you know, we are currently in what has been referred to as a golden age of Earth Observation.

The undeniable value of a space-based planetary perspective has led to a growing suite of regularly collected data about Earth from space.

This animation shows the diverse fleet of civilian scientific satellites operated by NASA and its partners... including Landsat 8 and 9.

These satellites provide a record of our changing planet and together form a robust decision support system.



Landsat—a joint NASA-U.S. Geological Survey program—adds unparalleled longevity to the record of Earth’s land surface, stretching back more than 50 years.

The first Landsat was launched on July 23, 1972, and the latest, Landsat 9 shown in this animation, launched in September 2021.

Landsat provides freely available, comparable, [objective](#) data of the entire planet.

Many have likened Landsat to a “time-machine” for looking back at planetary change over the past five decades.

Landsat with its long data record, has become woven into the fabric of our planetary understanding... and today we are going to explore how...

But first, let’s jump back 300 years...



So, what, you may be asking, is Hooke’s 1665 observation of a flea doing in a talk about satellites?

The microscope and the telescope made the invisible visible...

Enabling humans to see previously hidden worlds.

This image transfixed its 17th century audience. The tiny black dot that was a flea... turned out to look like this otherworldly, hairy crustation.

New instruments like the microscope led to new perceptions, which led to new knowledge.

Likewise, Landsat, by virtue of being the first satellite to continuously look at Earth's land... has provided profound insights.

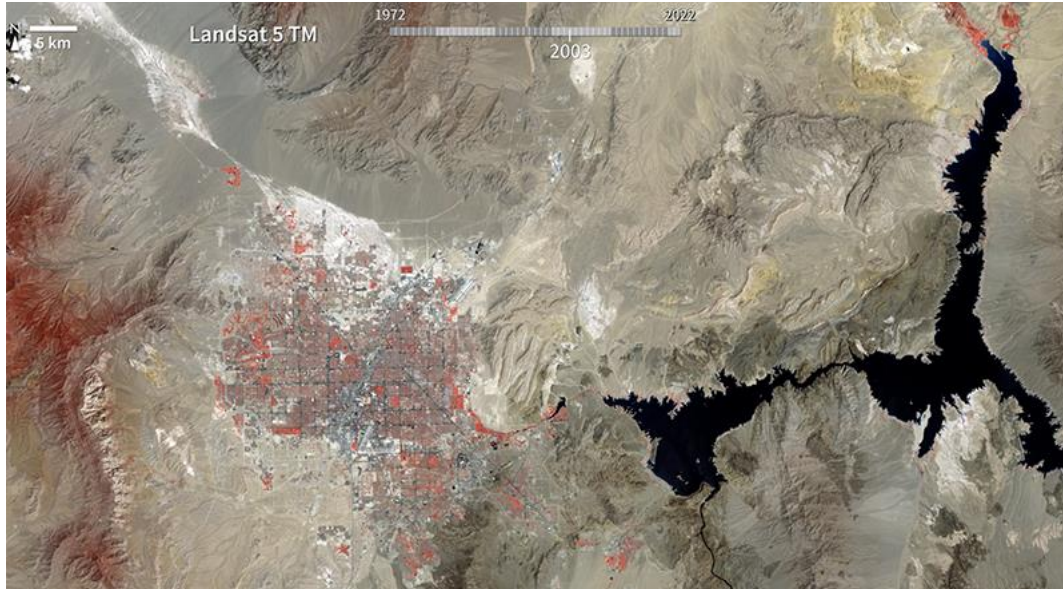
In his book, *Mapping the Next Millennium*, Stephen Hall wrote in “[b]y seeing in electromagnetic increments beyond the normal range of human vision, Landsat revealed whole new worlds hidden within the folds of a familiar world we thought we knew so well.”

Now let's take a look at some of the foundational insights Landsat has given us.



People.

Fifty-one years ago, when Landsat 1 launched, global population stood at 3.8 billion, since then it has more than doubled to over 8 billion people.



Before Landsat, urban planners and regional decision makers often did not have up-to-date land use information.

This was especially true in developing nations where Landsat images were better than existing maps in many places.

Landsat, with its medium-resolution and repeat coverage, provided a never-before-known cadence of timely geographic information.

Here, we can watch the spectacular growth of Las Vegas with Landsat.



Importantly, Landsat is a global data set. This animation shows the growth of Shanghai.

Over the last five decades, [Landsat has transformed our understanding of city growth](#), recording urban expansion across the globe.

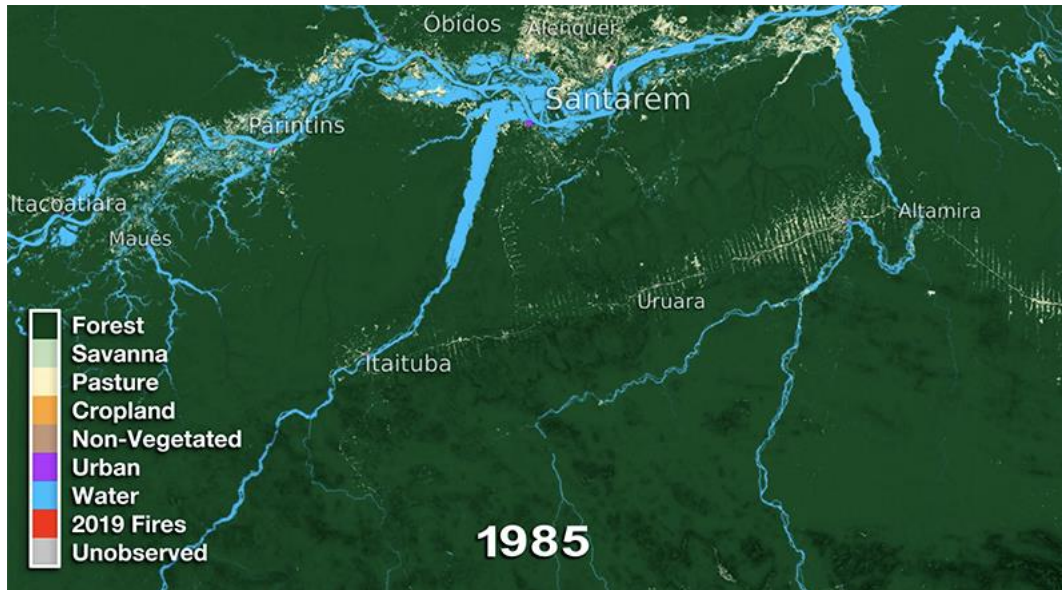
Modern global products like the [Global Human Settlement Layer](#) and the [World Settlement Footprint Evolution](#) rely on Landsat data to show historical urban growth trends.

And as climate continues to change, planners are more and more often turning to Landsat's thermal data to plan how to help city dwellers [in the hottest parts of a city](#) during extreme heat.



Plants. Human life is supported by plants. They provide food to feed us and fiber to clothe and shelter us, plus, a host of ecosystem services that make the planet hospitable to us.

Forests are called the “lungs of the planet,”
Wetlands are called “Earth’s kidneys.”



Before the satellite age, globally consistent forest and land cover inventories didn't exist.

It was Landsat data that showed the first credible, verifiable rates of [deforestation in the Amazon](#).

And as this animation illustrates, forested regions are often converted into croplands.

From the beginning, Landsat satellites were designed with the ability to monitor crops in mind.

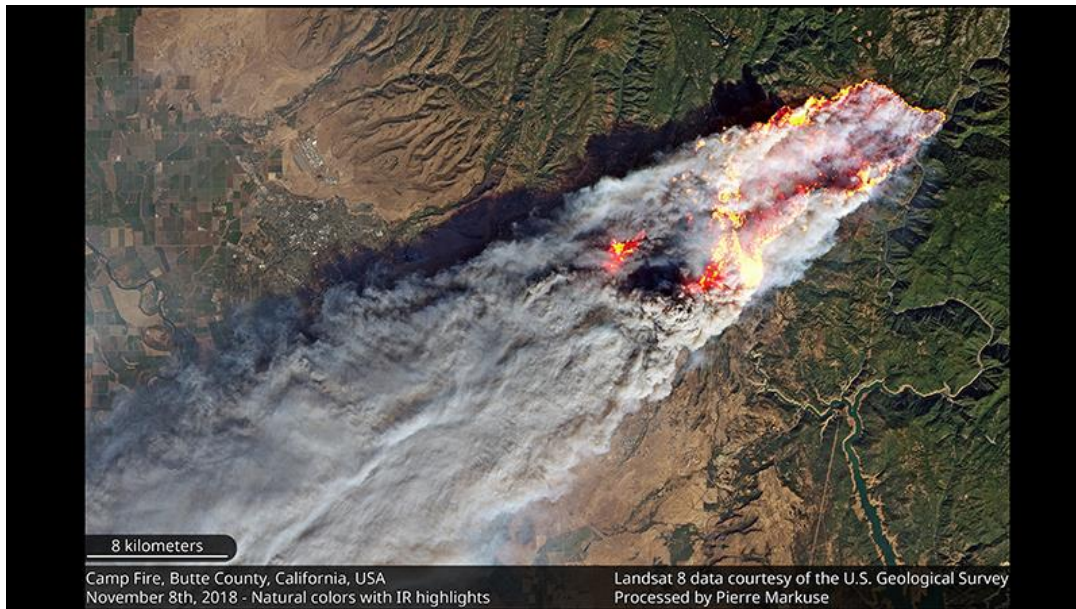
And many of today's satellite-based crop monitoring tools are [descendants of Landsat-based proof-of-concept experiments](#) from a half century ago.

Producing greater quantities of food as population expands and water supplies dwindle is a major challenge.

Satellites, have a key roll to play in data-driven management decisions.



Fire.
Climate change has landed us in a scorching new reality.



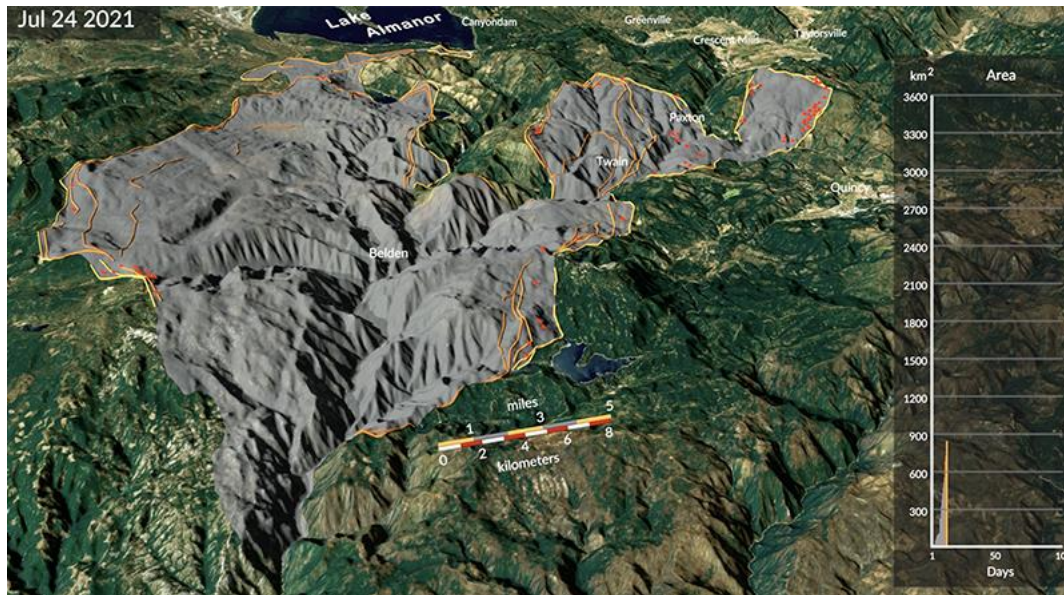
To me this Landsat image of the 2018 Camp Fire is haunting.

Landsat 8 acquired this image on Thursday, November 8, 2018, at 10:45 a.m., just four hours after the fire started.

The Camp Fire became California's deadliest fire, killing more than 85 people and consuming 9 out of every 10 homes.

It was America's deadliest fire since 1918.

Sprawling urban fires that once regularly plagued civilization were thought to be a thing the past, but the Camp Fire let us know they are back.



Satellites are important management tools in our fiery new world.

Landsat is used to map fire perimeters,
monitor vegetation conditions,
Manage wildland fuels,
And help with post-fire recovery.

The interagency Monitoring Trends in Burn Severity program uses Landsat data to map burn severity and fire extent.

The trends show more extreme fires and more destructive fires.
That since 2000, wildfires are 4x larger, and 3x as frequent.
And that fires are burning at higher elevations than ever before.

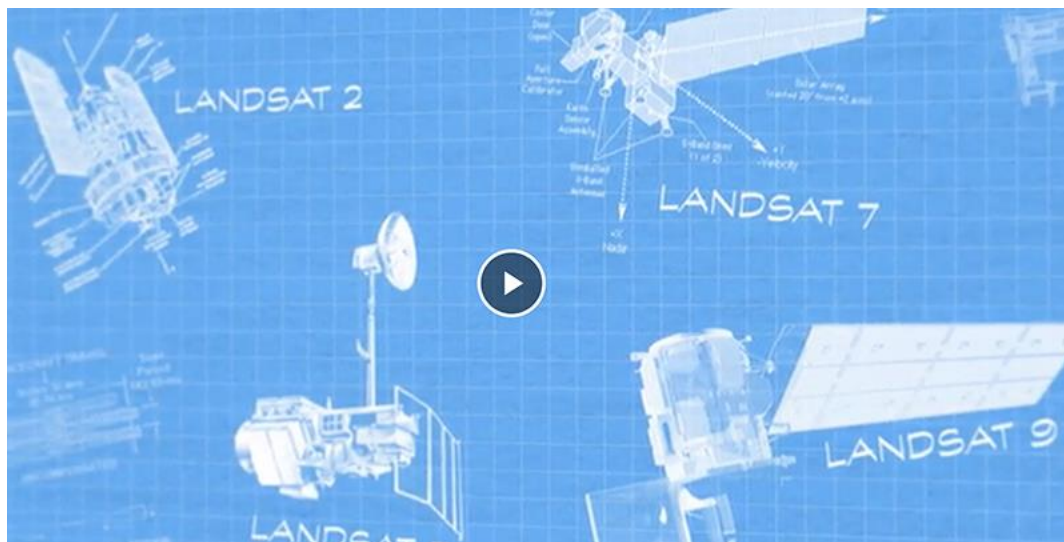
This animation, shows California's 2021 Dixie Fire. Landsat data is draped over the terrain and a VIIRS-based near-real time fire detection shows the progression of the fire.

The Dixie Fire has the dubious distinction of being the first fire in recorded history to crest the Sierra Nevadas. It started in the Sierra's western foothills, burned up and over the mountains and down into the eastern valleys.



As we've seen, the Landsat data record enables novel insights.
It is an invaluable resource....
And keeping that record going is essential.

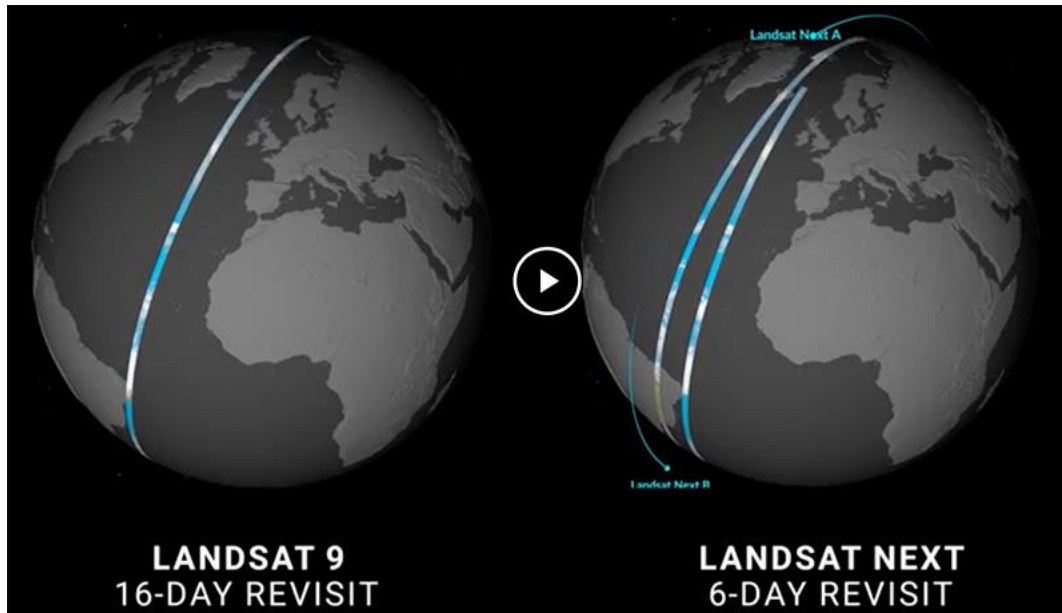
So, today, I am very excited to tell you a bit about Landsat Next.



Landsat Next, expected to launch in late 2030, will keep the Landsat data record going.

But that's not all...

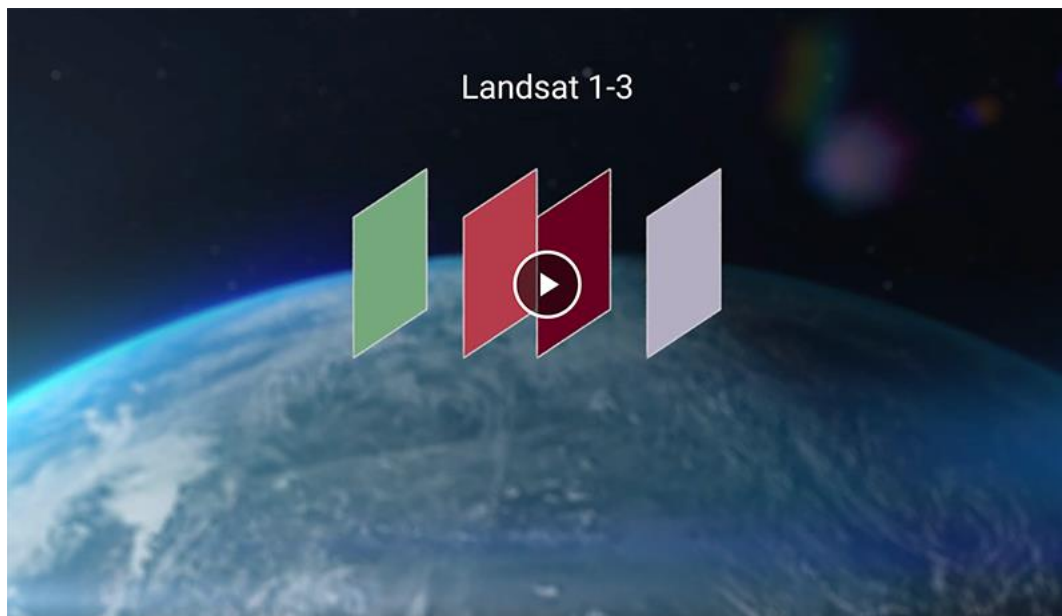
Landsat Next represents a quantum leap forward in Landsat measurement capabilities.



The number one request of Landsat data users was more frequent data collects.

Landsat Next will satisfy that request by using trio of smaller satellites.

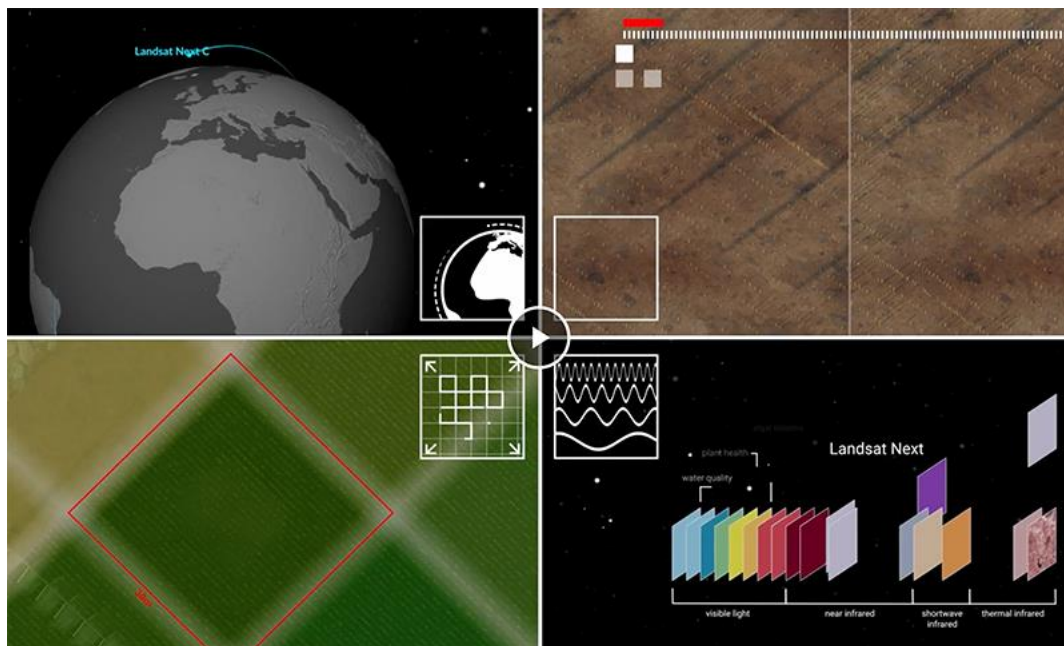
This animation compares Landsat 9's orbit and its 16-day repeat cycle to Landsat Next with its triplet satellite architecture that provides a combined 6-day revisit.



Spectrally speaking, Landsat Next will more than double the bands on the current Landsats 8 and 9 satellites.

Landsat Next will have 26 spectral bands....
Including red edge bands, five thermal bands....
And new bands to support emerging applications.

The spatial resolution will increase to 10 to 20 meters for the visible, near infrared, and shortwave infrared bands, and will be 60 meters for thermal and atmospheric bands.



With higher temporal, spatial, and spectral resolutions, Landsat Next will expand the Landsat data record....

And support an array of new applications...
to help us live well on our changing planet.

We look forward to seeing the new ways you will use Landsat data...

Thank you.

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