L'OCALYSE.
PUT YOUR LOCATION DATA TO WORK

Google

Name: Tuvia Alon and Yishai Lurie
Date: 16th of May 2024

Google Earth Engine

Sustainability-focused solution

Google Cloud

Earth Engine

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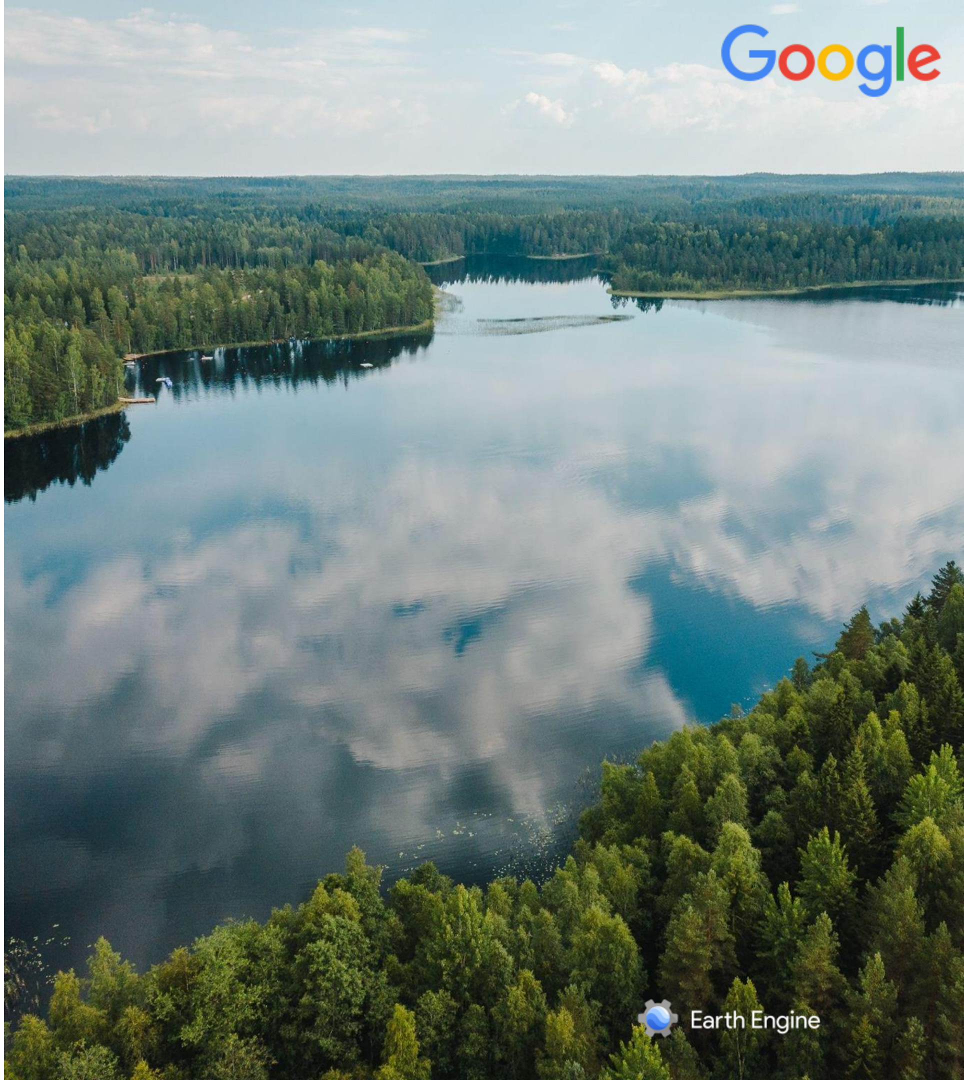
01

Earth Engine Narratives & Google Context



Google Cloud

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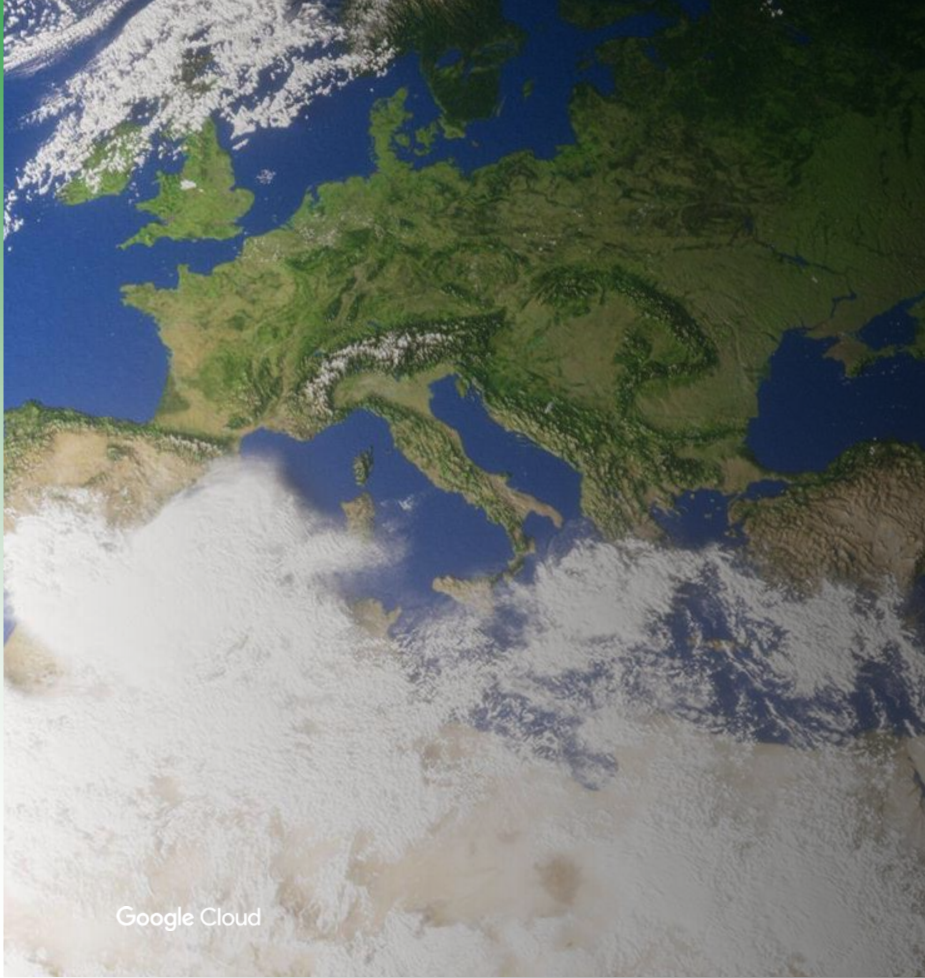

Earth Engine Mission

Build the leading geospatial analysis platform to advance planetary sustainability and resilience to climate change

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Sustainability is a critical board-level topic

- Consumers, investors and regulators are demanding sustainable products, operations and ESG transparency
- Organizations are leveraging cloud technology to power their business in a sustainable way
- Every industry has its own sustainability ambitions where better data, faster insights and smarter models can make a difference

CEOs embrace sustainability: 98% see it as their duty; accountability soars from 19% in 2013 to 75% in 2022.

Source: UNGC-Accenture CEO Study 2022

Google Cloud

Earth Engine

Google has an ambitious 10-year strategy for climate action that goes far beyond our own operations

Leading at Google

Go beyond carbon neutrality for our operations

Supporting Partners

Empower partners (companies, nonprofits, researchers, policymakers, etc.) with the tech they need to scale up climate solutions

Enabling Everyone

Through our products (core products, consumer hardware), we offer helpful ways for everyone to be part of the solution

Watch more about Google's sustainability mission

Earth Engine combines the power of Earth observation data and with large-scale compute and analytics of Google Cloud

Earth Engine

10+ years of sustainability impact with NGOs, academics and researchers. Enabled first-of-its-kind publications and innovations and has an unparalleled engaged community.

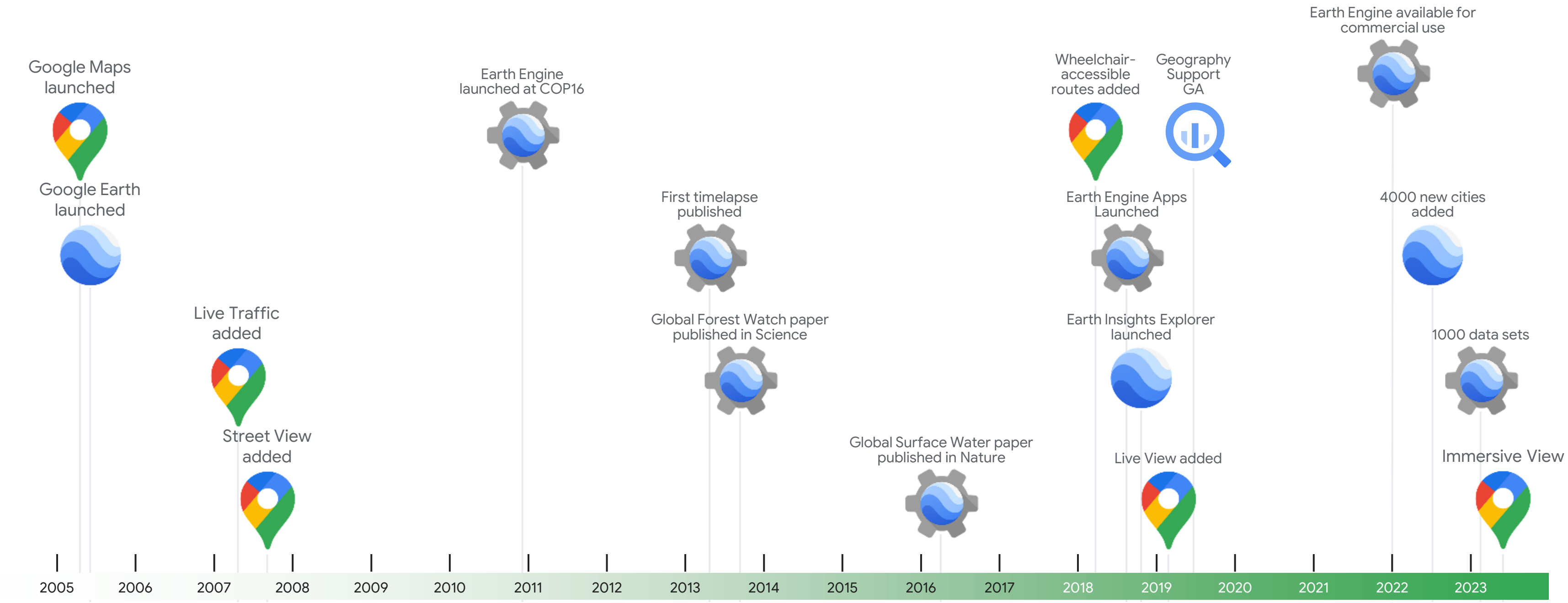
Bringing together sustainability transformation within the industry

Google Cloud

With a mission to accelerate every organization's ability to digitally transform, Google Cloud is enabling businesses to transition to carbon-free and sustainable systems.

Google has been a pioneer in geospatial for more than 15 years

Google Maps
Earth Engine
Google Earth
Big Query



Scientific credibility of Earth Engine

Google Earth Engine has been used for **ground-breaking science for over a decade**, powering **thousands of scientific publications** from the **world's leading researchers and institutions**, for **Earth Observation** of our **planet** - from **forests** and **land cover**, to **water** and **agriculture**, **oceans** and **emissions**.

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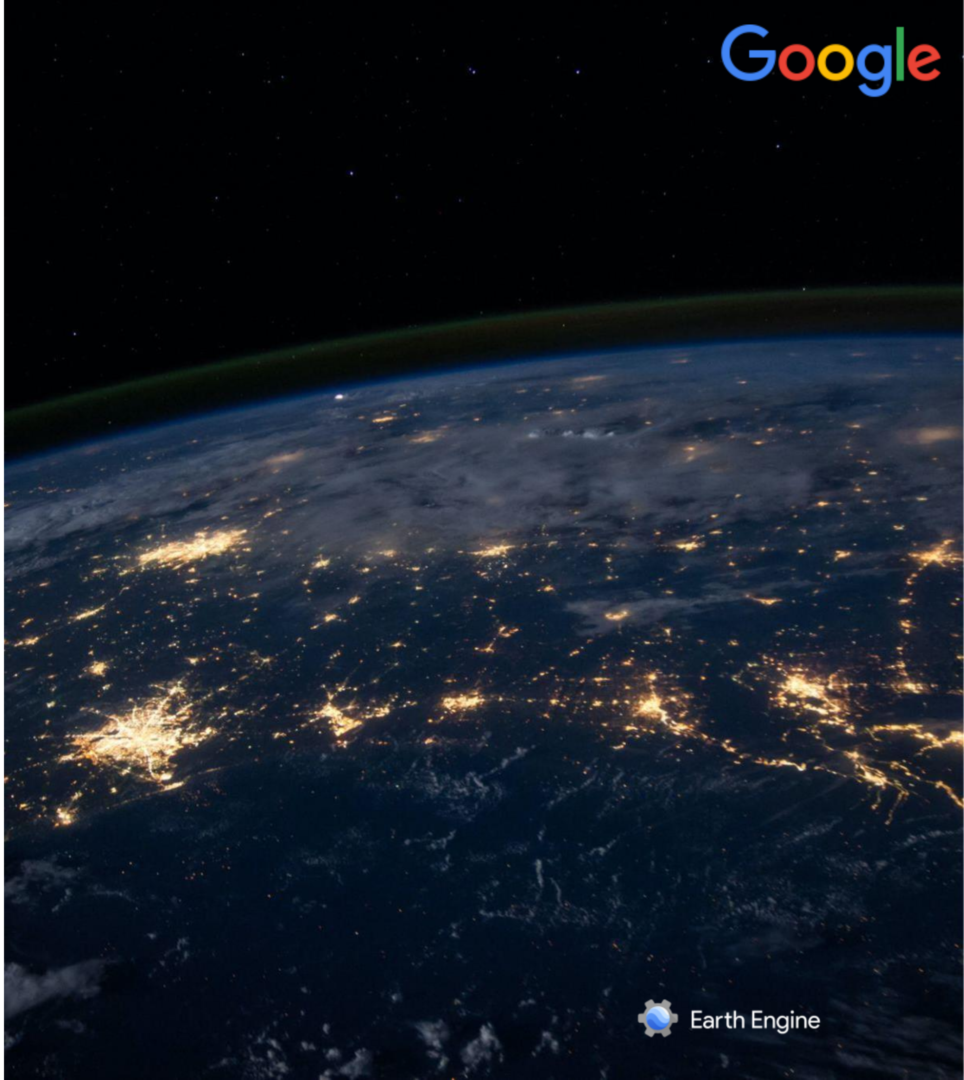
02

Solution overview

Earth Engine and Google Cloud

Google Cloud



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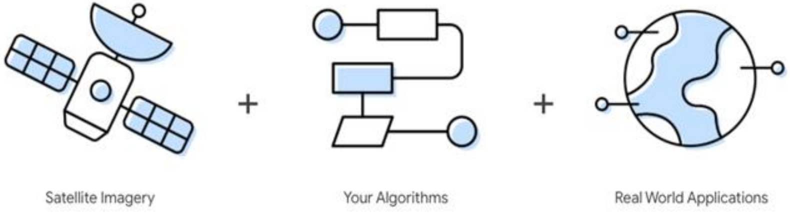
A planetary-scale platform for Earth science data & analysis

Powered by Google's cloud infrastructure

▶ Watch Video

Meet Earth Engine

Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities and makes it available for scientists, researchers, and developers to detect changes, map trends, and quantify differences on the Earth's surface.

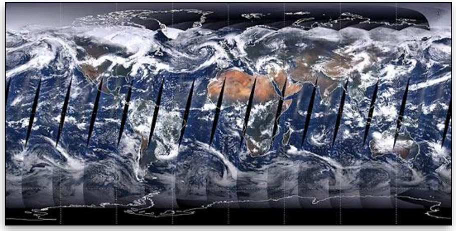


First launched in 2010
for non-commercial use

Google Earth Engine is a differentiated **spatial data and analytics platform** with a long history in enabling environmental and social impact

Data Catalog

The world's largest archive of open Earth data at your fingertips.

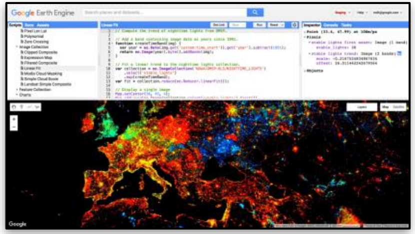


1000+ curated geospatial datasets, including near-real-time satellite imagery.

\+

Computation Platform

A powerful tool to analyze and visualize Earth data at scale.



Parallel processing for speed and scale, with machine learning built in.

\+

Collaborative Ecosystem

100,000 sustainability-focused MAUs (and growing).

A rich user community focused on sustainability, social and environmental impact

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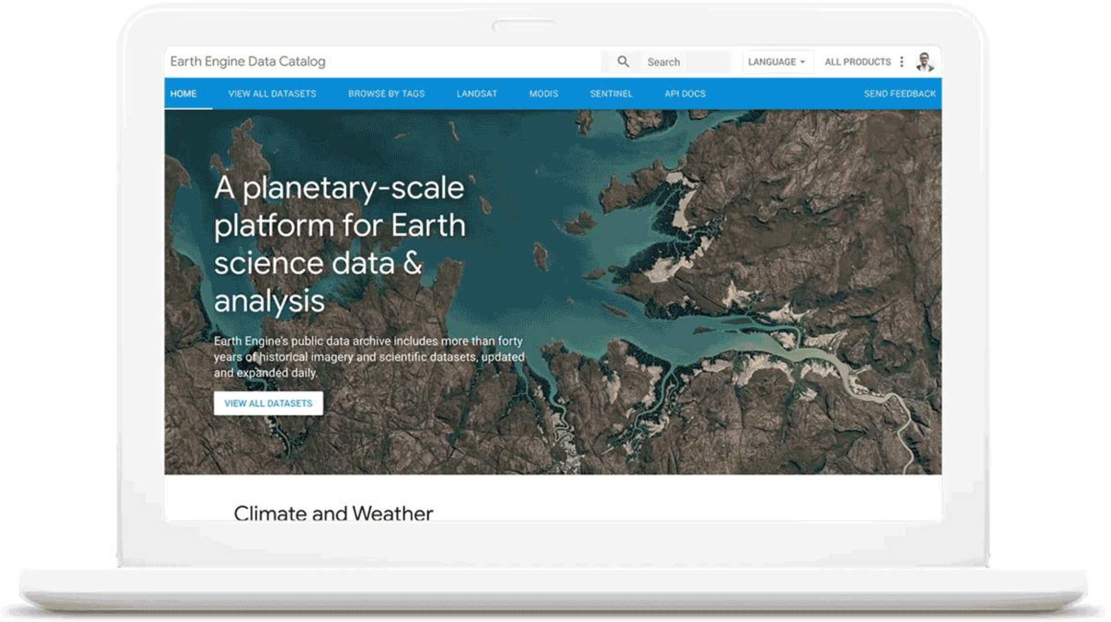
90+ Petabytes
Growing daily

1 Petabyte
Monthly growth rate

1000+
Curated datasets

Continuously updated in near real-time



developers.google.com/earth-engine/datasets/

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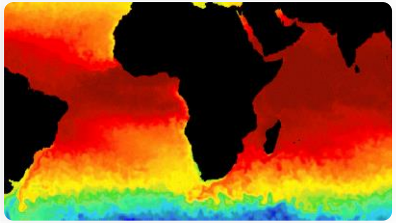
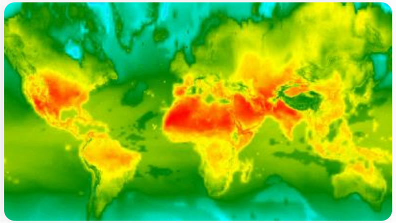
Proprietary + Confidential

Google Earth Engine provides more than 40 years of historical imagery and scientific datasets, updated and expanded daily

Climate and Weather



Surface Temperature



Climate

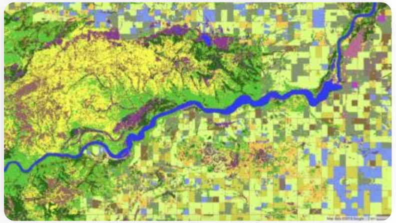
Imagery

Landsat

Sentinel

Geophysical

Crop land



Land cover

>1000+ datasets with the total size >90PB

Google Cloud

The classic remote-sensing work effort

Infra. / Data Prep

- Provision Infra.
- Download data
- Odd file formats
- Metadata
- Bad/missing data
- Clouds & shadows
- Atmosphere & haze
- Calibration

Google can do all this stuff once...

Data science

...so our users can focus on this.

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Better informed decision making with Geospatial cloud solutions

Support workflows at scale on tabular or imagery data

Pillars

- Tabular
- Imagery
- Data Assets

Platform capabilities

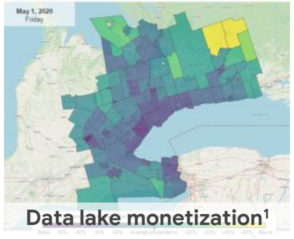
- ✓ Big data processing
- ✓ Image processing
- ✓ Geospatial data catalog
- ✓ Integrated AI on tables & images
- ✓ Mapping & data visualization
- ✓ Publishing & sharing
- ✓ Location experiences

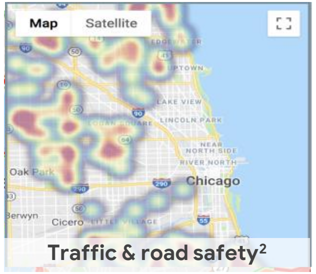
powered by

+ PARTNERS

Use cases unlocked


Land use change over time


Data lake monetization[1]



Traffic & road safety[2]


Air quality mapping[2]

[1] Image courtesy Telus
[2] Image courtesy Geotab

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Proprietary + Confidential

Google

Turning pixels into insights

Collect Data

Tabular Data

Earth Engine + BigQuery + Shapefiles

Row	point	name	iso_time	dist2land	usa_wind	usa_pressure
1	POINT(-54.4 12.8)	MARIA	2017-09-17 06:00:00 UTC	736	55	994
2	POINT(-55.0499 13.0573)	MARIA	2017-09-17 09:00:00 UTC	706	57	992
3	POINT(-55.7 13.3)	MARIA	2017-09-17 12:00:00 UTC	646	60	990
4	POINT(-56.3727 13.4575)	MARIA	2017-09-17 15:00:00 UTC	590	62	988
5	POINT(-57 13.6)	MARIA	2017-09-17 18:00:00 UTC	542	65	986

+

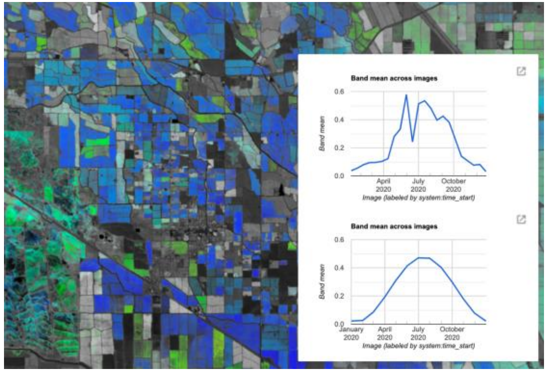
Raster (Imagery) Data

Earth Engine data + planet data + GeoTIFFs

Compute + Analyze

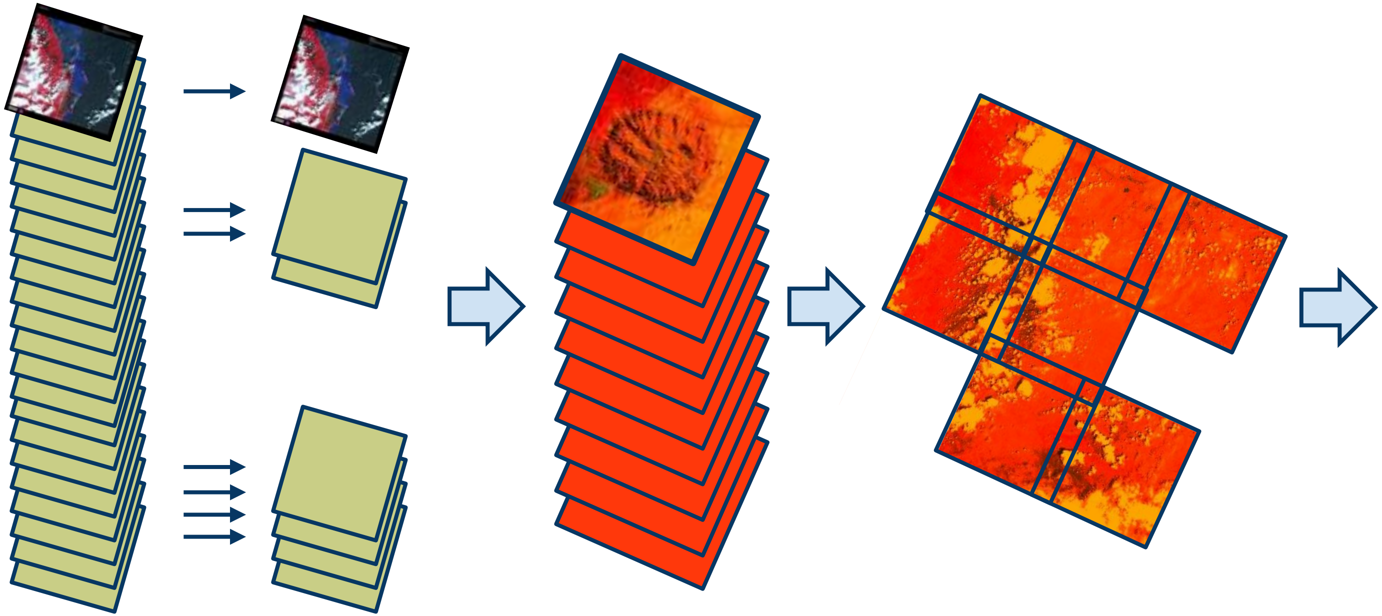
- Computations on images (per pixel)
- Machine learning
- Time series analysis

Visualize + Report

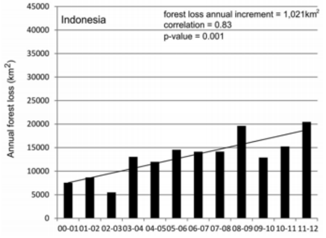


Parallel Geo Data Computation

Slicing & dicing, mapping & reducing, mathematical models, machine learning, statistics, and more!



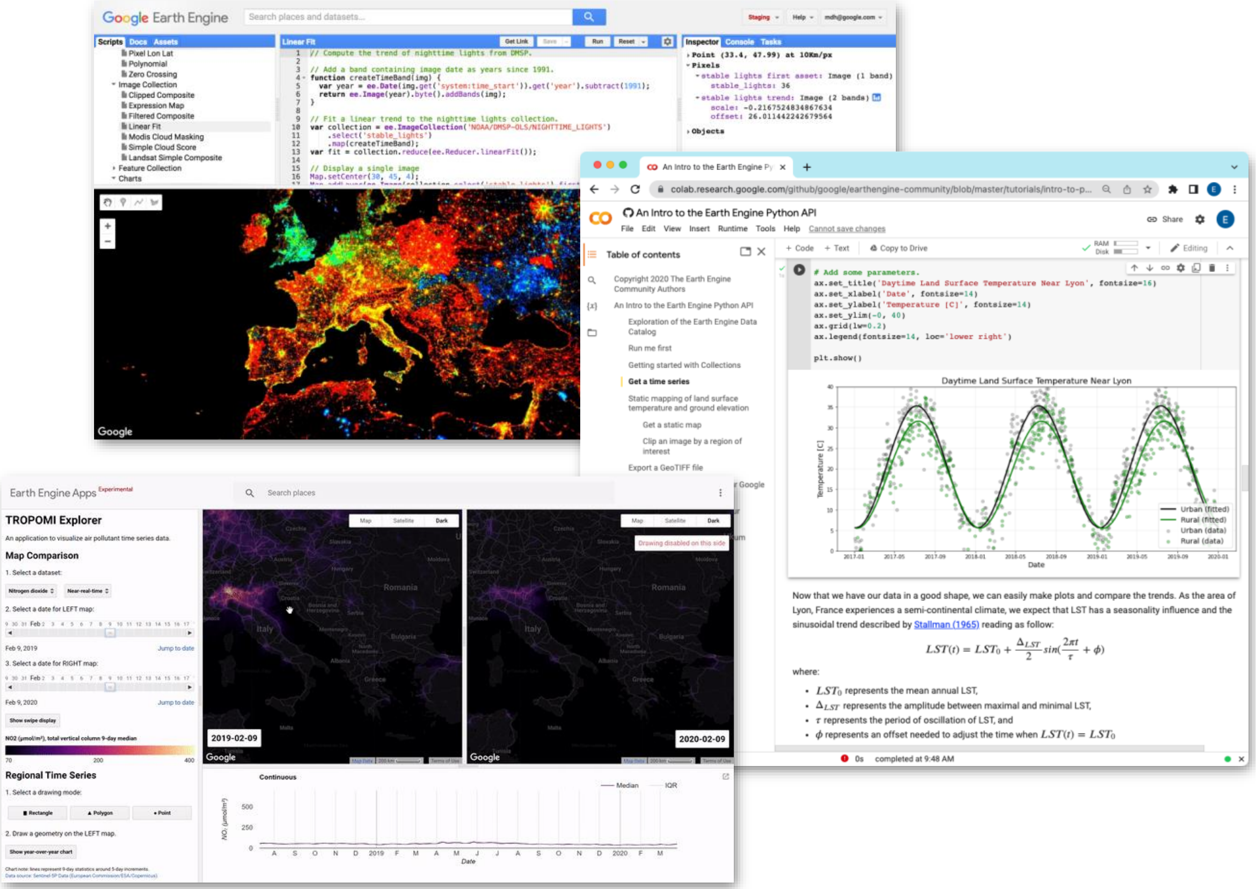
Gabon	1891	391	11898
Lithuania	1845	1226	40296
Cuba	1725	2271	68008
Mali	1694	0	1247103
Costa Rica	1653	382	11327
Czech Republic	1646	1331	46934
South Sudan	1635	38	460581
North Korea	1605	137	67695
Italy	1603	898	201331



Interactive Analysis and Visualization

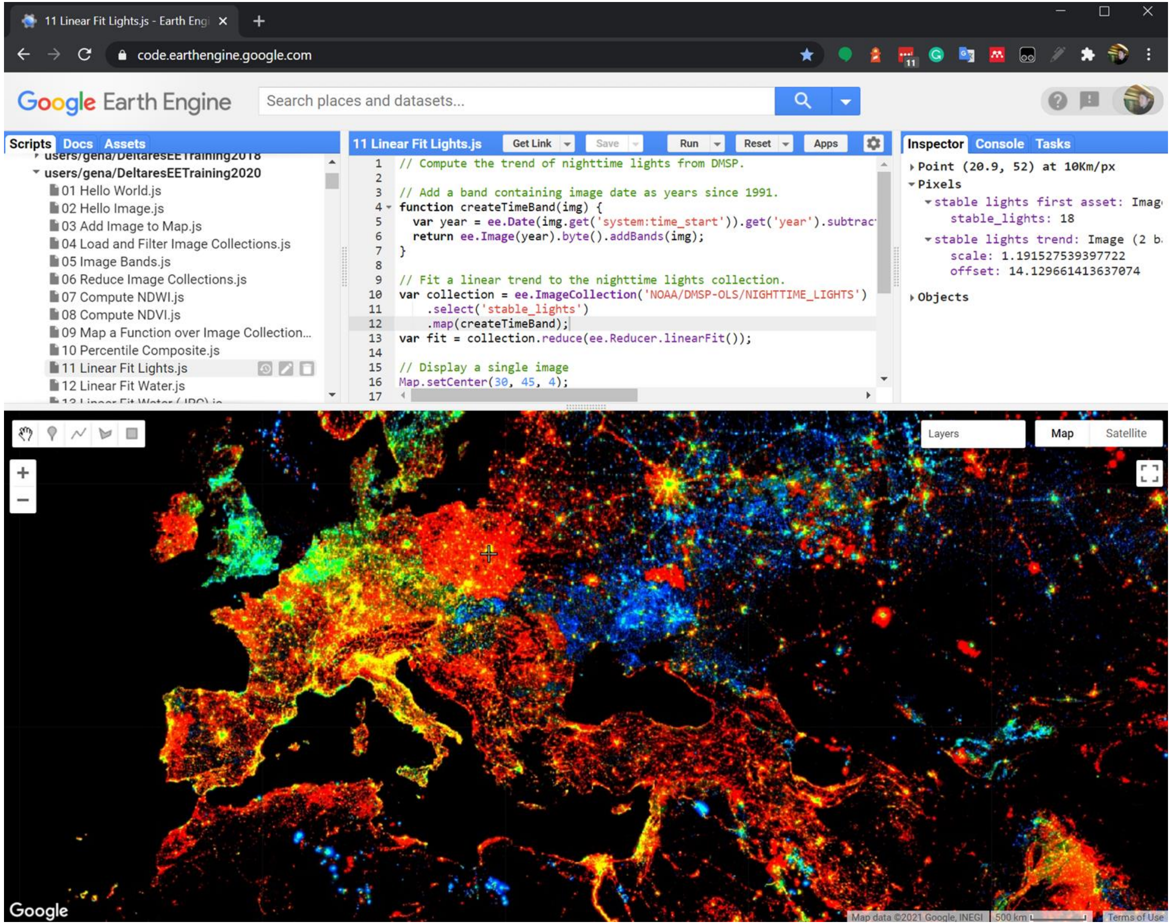
Slice & dice data, train and apply models, and visualize results.

- Client libraries in **JavaScript** & **Python**
- **Code Editor**: Easy interactive experimentation with one-click collaboration
- **Earth Engine Apps**: Wire up and share custom interactive dashboards
- **One Platform API** for direct integration via HTTP

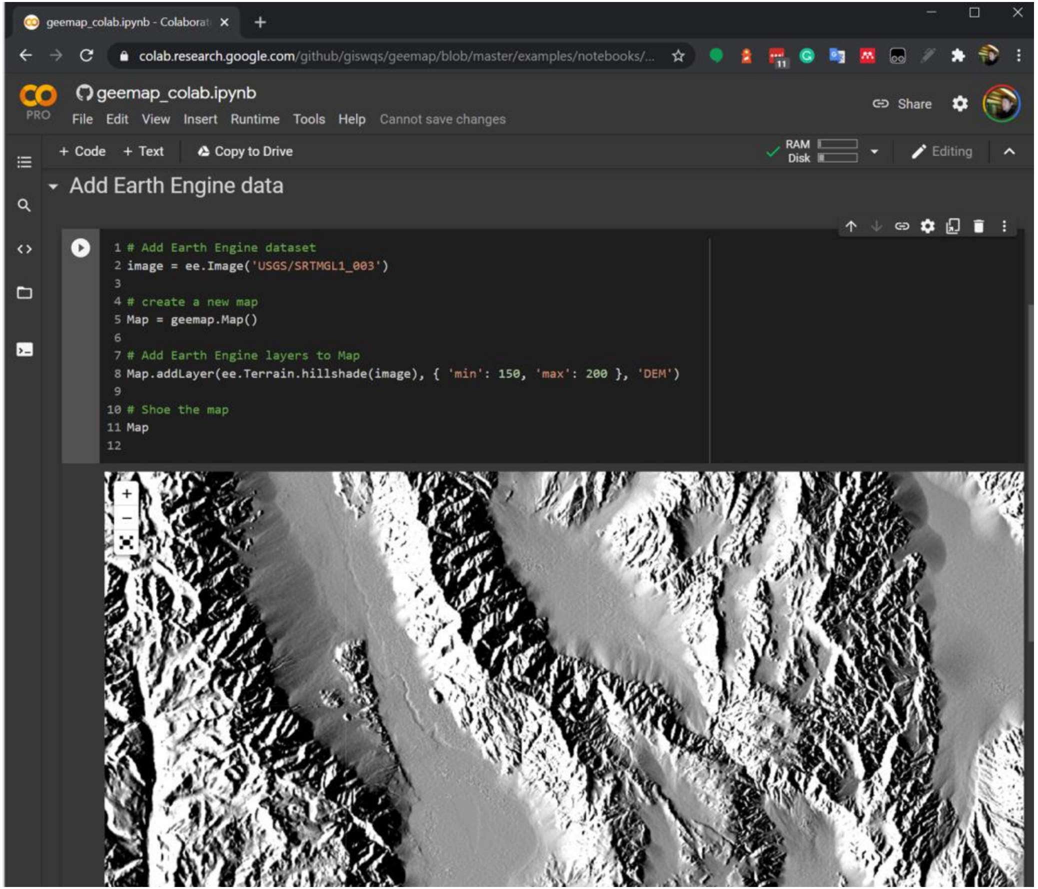


Google Earth Engine Code Editor (JavaScript)

https://code.earthengine.google.com/

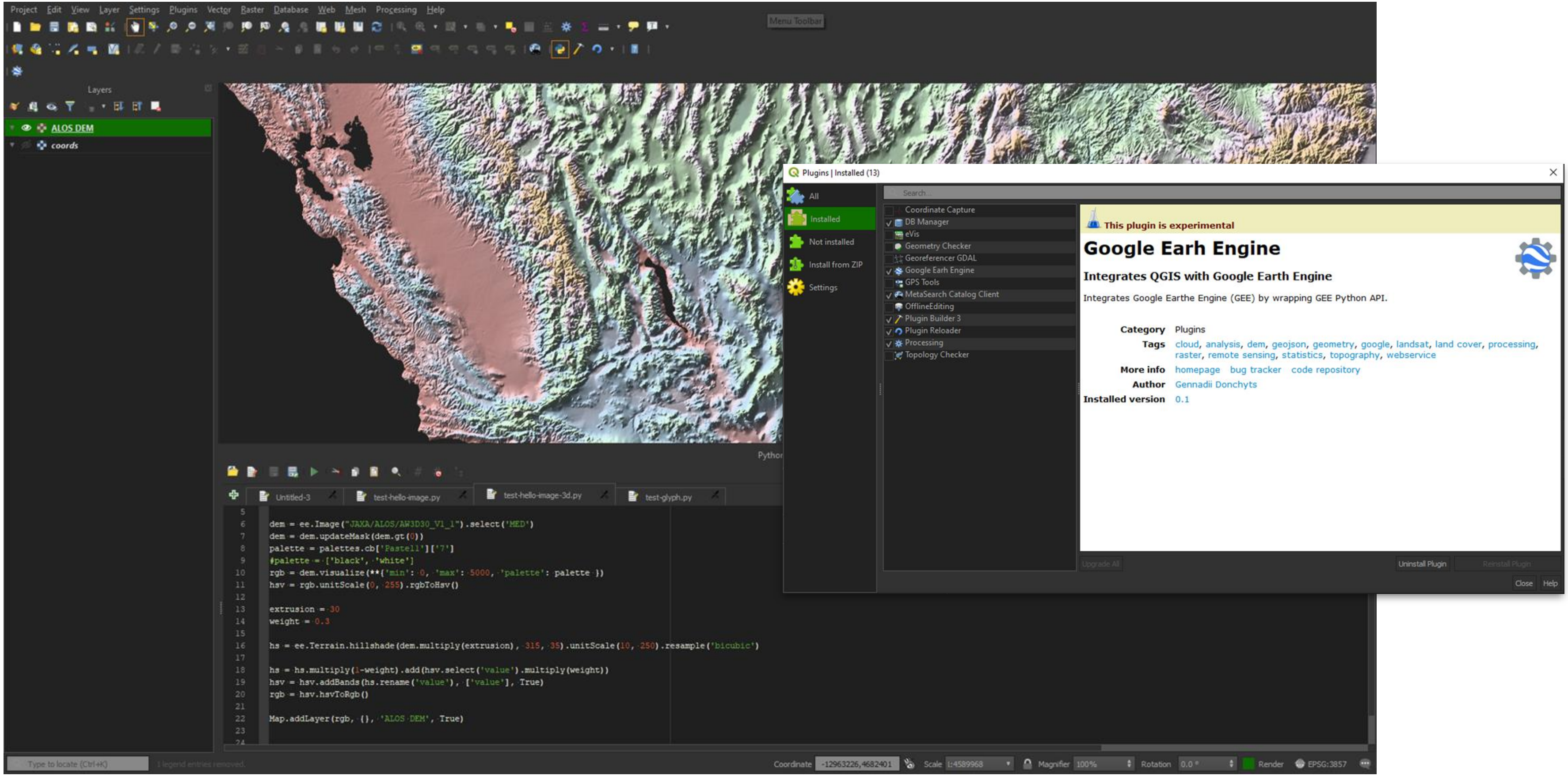


Google Earth Engine from Python (Colab)



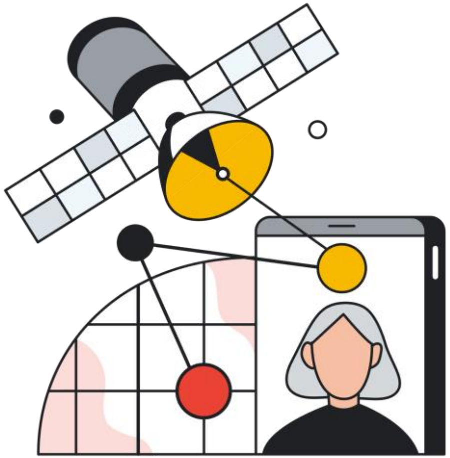
https://github.com/giswqs/geemap

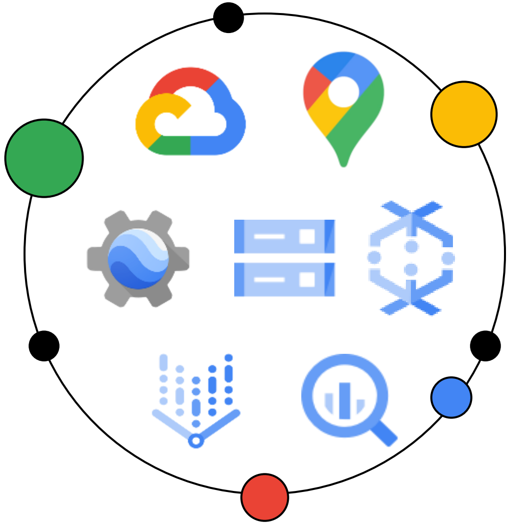
Google Earth Engine from QGIS (Python)

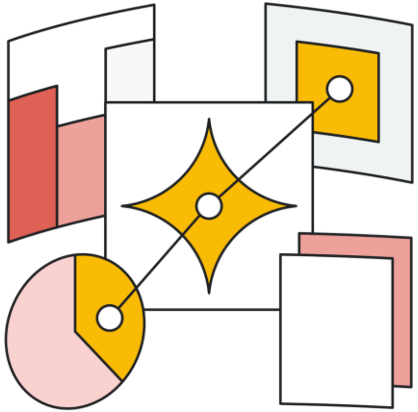


https://gee-community.github.io/qgis-earthengine-plugin/

Answering complex sustainability questions







Aggregate

Google Earth Engine aggregates and harmonizes planetary data from multiple sources including customer data

→

Apply Data Science

Customer or partner applies climate data science and machine learning turning pixels into insights

→

Analyze, Visualize, Report

Customer or partner APIs deliver insights that can be analyzed, reported and visualized

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03

Use Cases

Google Cloud

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A wide range of customer use cases can be unlocked with geospatial imagery

1. Sustainable sourcing

Enable global supply chain transparency and traceability.

Industry: Retail / CPG / Manufacturing

2. Climate risk and disaster response

Understand climate risk exposure for operations from flood, wildfire, drought, etc. Map damage from extreme events in real-time, respond with greater efficiency, and support post-event recovery efforts.

Industry: Financial Services / Transportation / Logistics / Real Estate / Public Sector

3. Agriculture

Precision agriculture, increased yield, improved visibility of the food supply chain.

Industry: Ag-Tech / Digital Natives

4.Protecting natural resources

Enable sustainable forest management and monitor land cover change.

Industry: Public Sector

5. Environmental impact

Monitor environmental impact and take action eg. methane detection

Industry: Agriculture / Public Sector / Oil & Gas


1984
0%
Surface Water
% Change

Use Case 1: **Sustainable Sourcing**

Problem

Measuring environmental impact of commodity sourcing is complex, requiring clear reporting standards, based on measurable, objective, and internationally recognized data linking every step in the supply chain to deforestation, forest degradation, and changes in the world's forest cover. Obtaining this data is only possible at scale with innovative technology.

Solution

Using Earth Engine, the location of sourcing activities can be geolocated to indicate ownership and land-use designation, and extraction processes and methods. To promote transparency, businesses can monitor deforestation, land use changes, and environmental degradation in the regions where their raw materials are sourced. This information can help businesses identify potential risks and ensure that their sourcing practices are aligned with their sustainability commitments.

Customer Example

Determined to break the link between palm oil and deforestation, **Unilever** worked with Google to track and trace their supply chain.

Partner Solution

TraceMark, a first-mile sustainable sourcing solution built by Google Cloud Ready - Sustainability partner, NGIS, using Earth Engine, BigQuery, and Analytics Hub. It addresses a wide variety of EUDR-impacted commodities including palm, coffee, cocoa, soy, and paper. See door opener, demo and video.

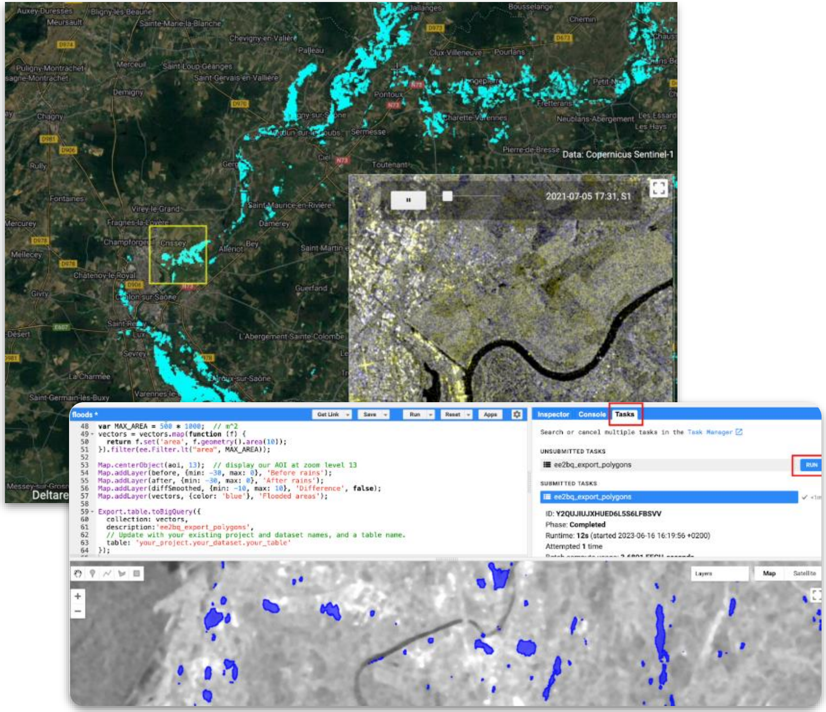
Flood risk mapping

Remote sensing data plays a pivotal role in mapping historical flood zones and producing spatial maps of flood events that can be used to guide response efforts (Oddo and Bolten 2019). Accurate flood maps need to be created and delivered to disaster managers within hours of image acquisition. Computationally efficient approaches are required to reduce latency.

Earth Engine can be used to identify areas most vulnerable to flooding and for the development of flood warning systems, evacuation plans, and land-use planning policies. Sentinel-1 SAR GRD: C-band Synthetic Aperture Radar to capture extreme flood events. JRC Global Surface Water Mapping Layers, optical multispectral Landsat and Sentinel-2 data for surface water mapping and monitoring long term changes.

Using the `Export.table.toBigQuery()` function to combine raster data in Earth Engine with tabular data in BigQuery can also help to give a more complete picture to determine for example specific road segments affected by a flooding event.

EU 2021 Flood Map



Determine specific road segments affected by a flooding event, using the Earth Engine-BigQuery connector

Problem

Global demand for food is predicted to increase 60% by 2050, while the impacts of climate change are putting a strain on agricultural production, resulting in a plateau of food yields, severe depletion of natural resources and deterioration of biodiversity. To build towards a higher yield, lower impact food system, growers and businesses reliant on agricultural outputs need insights into crop health, productivity, and water consumption.

Solution

Since agricultural products are physical assets which can be observed from satellites, near real-time satellite imagery and analytics are particularly helpful. Earth Engine, combines a vast data catalog of satellite imagery, all in one place, along with the ability to store and analyze massive volumes of data about the planet and how it is changing. Earth Engine is uniquely positioned for agricultural analytics thanks to its ability to run complex pixel-level analyses at large scale, enabling precise and regenerative agricultural practices bringing higher yields with reduced environmental impact.

Partners

Woolpert: a premier partner and leading provider of state-of-the-art geospatial services.

NGIS: Australia-based, premier partner has extensive experience leveraging Earth Engine for agriculture, covering producers, nutrition, protection and agronomy.

SIG: Have been providing data creation, cultivation and related decision support tools for the global agriculture industry since early 2000s

Problem

Understanding the complex interactions within ecosystems and the long-term consequences of resource use can be challenging. This necessitates robust scientific research, data collection, and monitoring to inform effective management strategies.

Solution

Earth engine enables scientists, conservationists, and policymakers to monitor, manage, and conserve natural resources, and protect the planet's biodiversity with greater efficiency and effectiveness. Typical activities include sustainable forest management, and monitoring of land ownership and land cover change (see example datasets for these activities in the following slides).

Customer Example

Using Earth Engine, the **Forest Service** has built new products, workflows, and tools that help more effectively and sustainably manage natural resources. US Forest Service, US Geological Survey, NASA, and numerous universities have collaborated to develop a Landscape Change Monitoring System (LCMS), a remote sensing-based system for mapping and monitoring landscape change across the United States. See blog.

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Agenda

1

Solar API

2

Air Quality API

Pollen API

3

Resources