# Automated Earth Observation Chain for Wildfire Management in Latin America and Caribbean

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Societal Applications: Risk, Resilience and Resource Monitoring

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# Outline

- Introduction to CopernicusLAC Services
- EO services and workspaces
- Development and demonstration phases
- Current users
- Conclusions

# CopernicusLAC Regional collaboration objectives

- Establishment of a Copernicus regional center in Panama, hosted by AIG
- Improve the resilience of the Latin America and the Caribbean (LAC) countries through the co-design of Earth Observation services for prevention and recovery before disasters and capacity development.
- Contribution agreement with DG INTPA – ESA as implementing partner
- Directed by a Steering Committee – DG INTPA, Government of Panama (Foreign Affairs Ministry, AIG, SENACYT), and delegations from DEFIS, UE, DG ECHO, JRC)


Global Gateway

EU-LAC PARTNERSHIP
opernicus
REPÚBLICA DE PANAMÁ
MINISTERIO DE RELACIONES EXTERIORES
AIG

# Land observation services for resilience before disasters

*The **CopernicusLAC Platform** provides easy access to Copernicus data for users of LAC countries and offers multiple tailored geospatial services addressing diverse natural disasters across the region.*

*EO services for the following thematic areas:*

- *Hydrometeorological*
- *Wildfires*
- *Geological Hazards*
- *Exposure*

More info at:

www.copernicuslac-panama.eu/pilot-thematic-services

# Wildfires: mapping events, danger and recovery

The CopernicusLAC Platform hosts 8 open-source EO services to map wildfire events, danger and vegetation recovery.

| # | EO service | Purpose | Scenario of operations | Developer |
|---|---|---|---|---|
| 1 | ***Burned Area Mapping*** | Wildfire detection and delineation | Systematic | Terradue |
| 2 | ***Fire Danger Mapping*** | Wildfire Preparedness | Systematic | Indra |
| 3 | ***Fire Recovery Mapping*** | Vegetation Recovery | Systematic | Indra |
| 4 | ***Burned Area Severity*** | Wildfire severity | On-demand | Terradue |
| 5 | ***NDVI Change Detection*** | Vegetation Loss | On-demand | Terradue |
| 6 | ***SAR Coherence and Intensity*** | Change detection | On-demand | Terradue |
| 7 | ***Co-located Stacking*** | Post-processing | On-demand | Terradue |
| 8 | ***Filter and Vectorize Discrete Raster*** | Post-processing | On-demand | Terradue |

Users will find results from EO services via two workspaces:

a. the ***Wildfire Results Explorer*** offering products derived from automated EO service chains
b. the ***Fire Desk Workspace*** where the user can submit EO data processing on demand.

### *Target users*

Agencies of forest fire management, fire brigades, Ministries of environment, climate change units

# Workspace for systematic EO services

The first workspace, the **Wildfire Results Explorer**, hosts results from automated processing chains of services 1, 2, and 3.

In this workspace the user can find all products **derived automatically by the platform** that can be seen on a map at full resolution with dedicated layers.

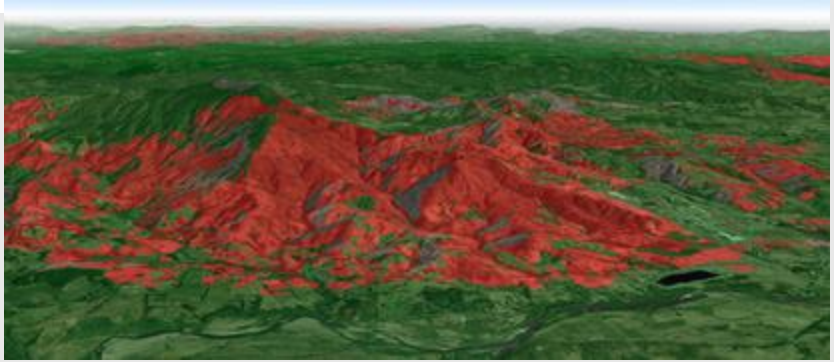
***Fire danger:*** mapping the danger of suffering a wildfire in the region

***Hotspots and Burned area:*** identification of hotspots and burned area mapping over ongoing wildfires

***Post Fire Vegetation recovery:*** evolution of the vegetation cover after a wildfire event

# Burned Area Mapping

Provides real-time detection and monitoring of fires, with the timely provision of hotspot and burned area maps. The service allows a multi-temporal monitoring of fire-affected areas at high-resolution. Hotspot and burned areas are automatically mapped via a synergic exploitation of Earth Observation data from multiple missions.



**Frequency** - daily for hotspots and 5 days for burned area maps.

**Spatial coverage** - over a defined ROI in the LAC region.

**Temporal coverage** - hotspots are continuously detected. The burned area mapping instead stops when no more hotspots are detected.

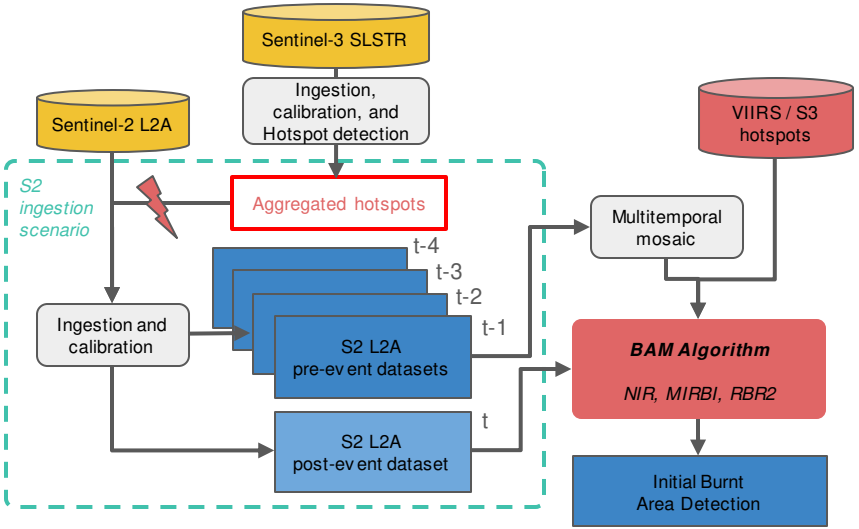
**Constraints** - availability of EO products from data providers (Copernicus Data Space Ecosystem, and NASA FIRMS service).

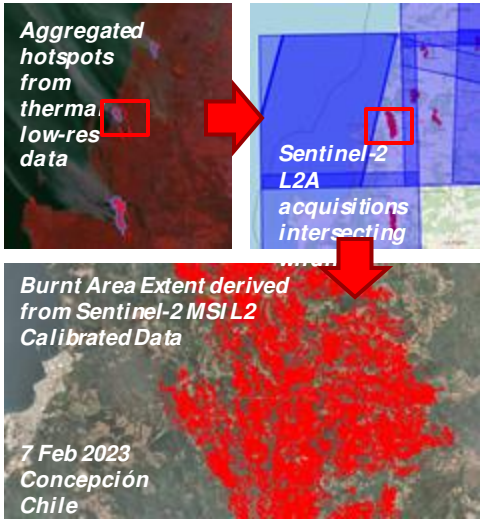
The **BAM** service enables efficient mapping of fire-affected zones, offering users geospatial products to assess wildfire impacts and guide decision-making.

*Service owner:* TERRADUE Advancing Earth Science

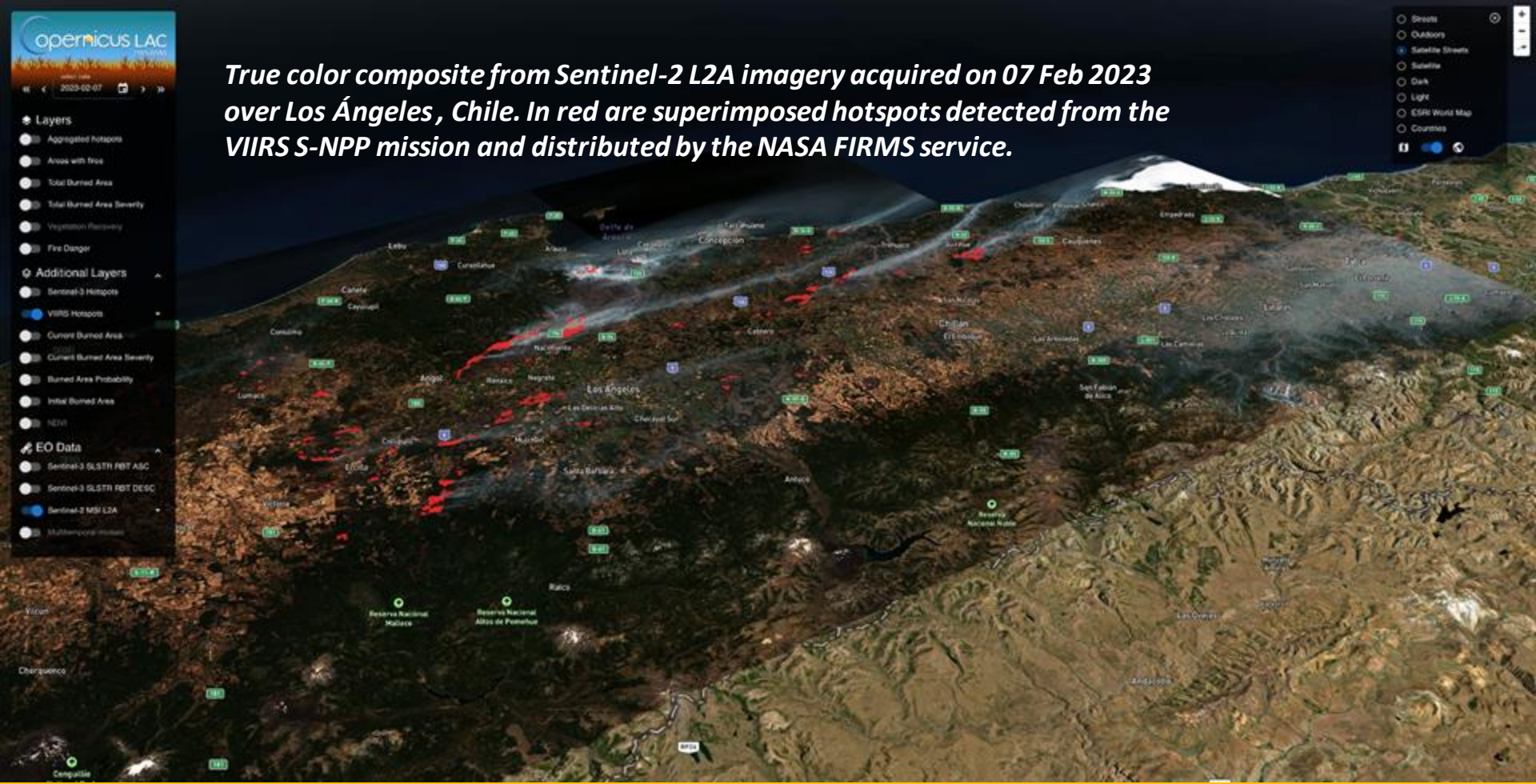
# Burned Area Mapping

Takes as input Sentinel-3, Sentinel-2 and VIIRS data and provides hotspots, burned area extent and probability products at multiple resolutions. The chain relies on an adapted version of the ESA CCI Small Fire Dataset algorithm (Roteta et al, 2021).

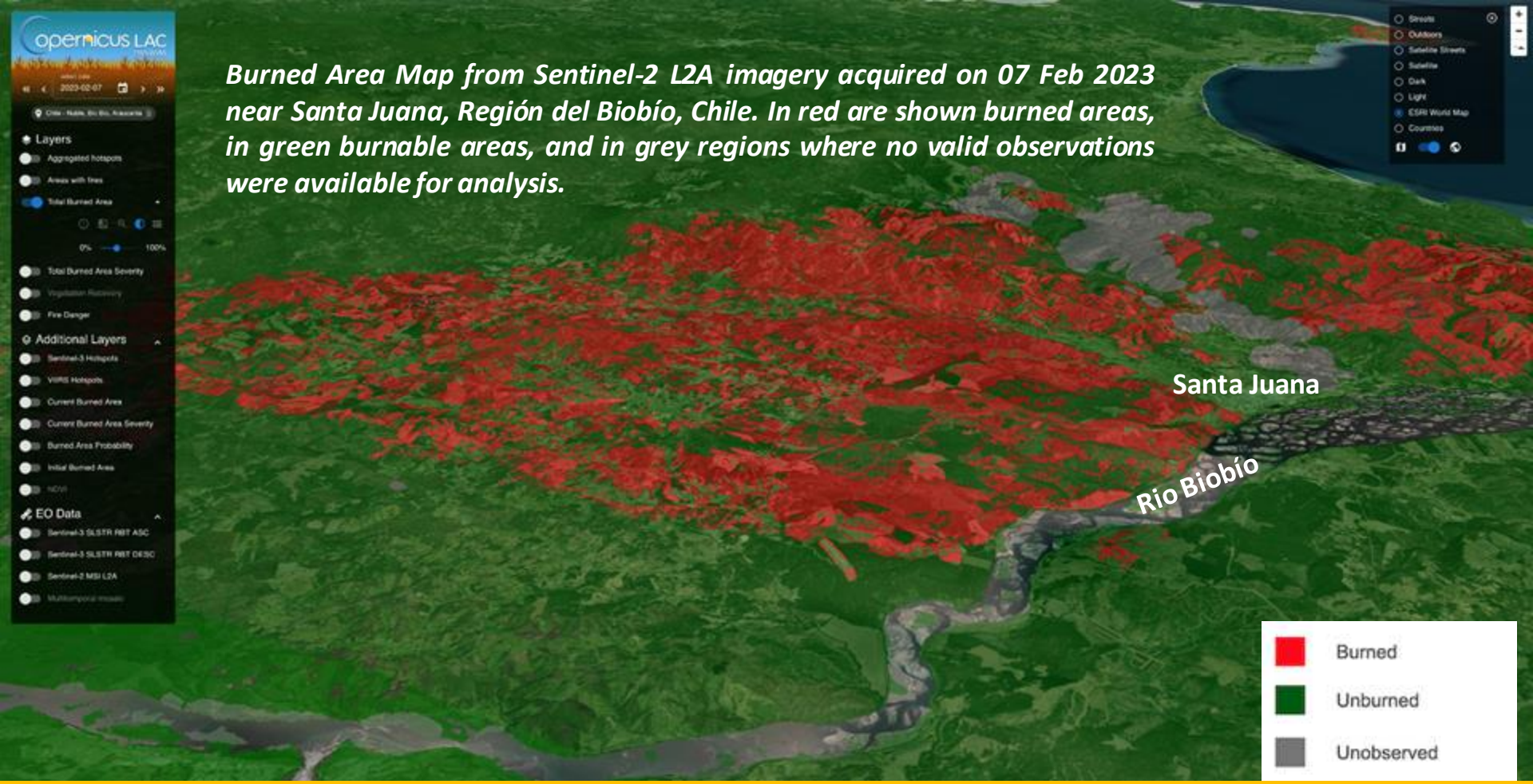



Find more information about the **BAM** service in the online **service specifications** and **tutorial**.

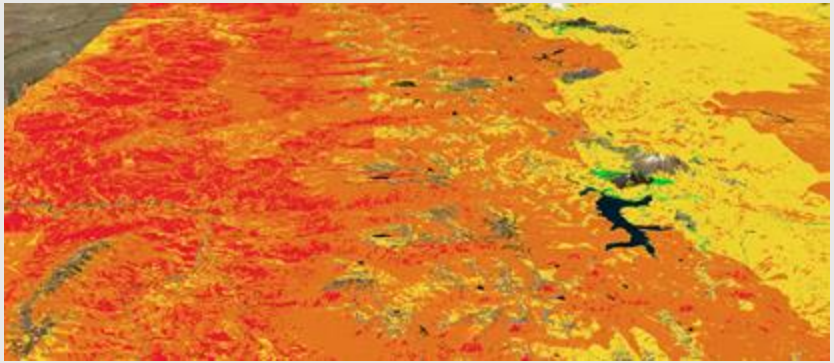



*True color composite from Sentinel-2 L2A imagery acquired on 07 Feb 2023 over Los Ángeles , Chile. In red are superimposed hotspots detected from the VIIRS S-NPP mission and distributed by the NASA FIRMS service.*


opernicus LAC
Layers
Aggregated hotspots
Areas with fires
Total Burned Area
Total Burned Area Severity
Fire Danger
Additional Layers
Current Burned Area
Burned Area Probability
EO Data
Sentinel-2 MSI L2A
Streets
Outdoors
Satellite Streets
Satellite
Dark
Light
ESRI World Map
Countries
Burned Area Map from Sentinel-2 L2A imagery acquired on 07 Feb 2023 near Santa Juana, Región del Biobío, Chile. In red are shown burned areas, in green burnable areas, and in grey regions where no valid observations were available for analysis.
Santa Juana
Rio Biobío
Burned
Unburned
Unobserved

# Fire Danger Mapping

Decision-support service that estimates the Fire Danger. The Fire Danger is calculated by integrating static and dynamic variables derived from Earth Observation data that provide a comprehensive characterization of weather conditions, topography, and vegetation, which are critical factors influencing fire danger.



**Frequency** - 7 days.

**Spatial coverage** - over a defined ROI in the LAC region.

**Temporal coverage** - maps are continuously produced. It employs historical data starting in 2017 to forecast data with a lead time of up to 10 days.

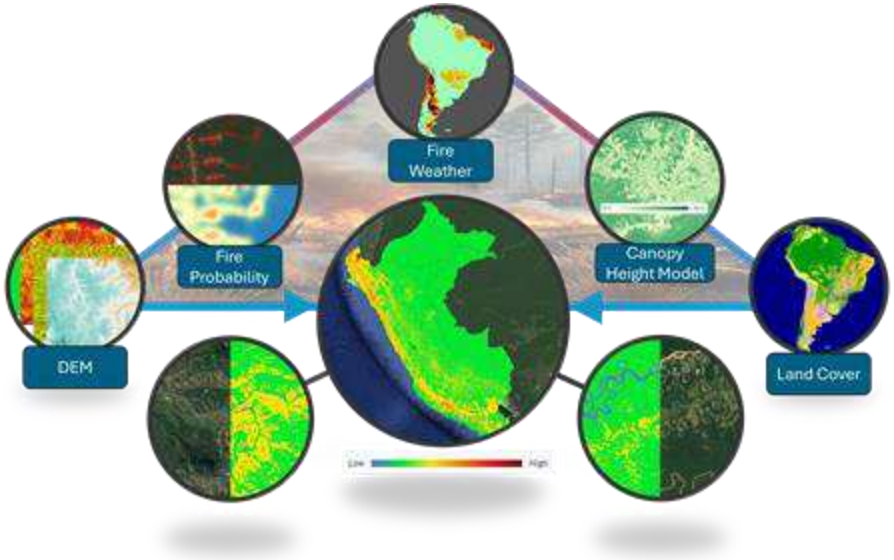
**Constraints** - availability of the Fire Weather Index (FWI) retrieved from the Global Wildfire Information System (GWIS).

The **FDM** service enable users to track recovery trends over time, identify areas with slower regeneration rates, and support decision-making for post-fire management and ecological restoration efforts.

Service owner: indra

# Fire Danger Mapping

Takes as input Sentinel-2 data, static geospatial layers, and daily Fire Weather Index from the GWIS and provides a fire danger map over a region of interest.




**Fire danger**

**Low**: minimal fire risk.

**Moderate**: fire conditions may ignite under certain circumstances

**High**: increased likelihood of fire ignition and spread.

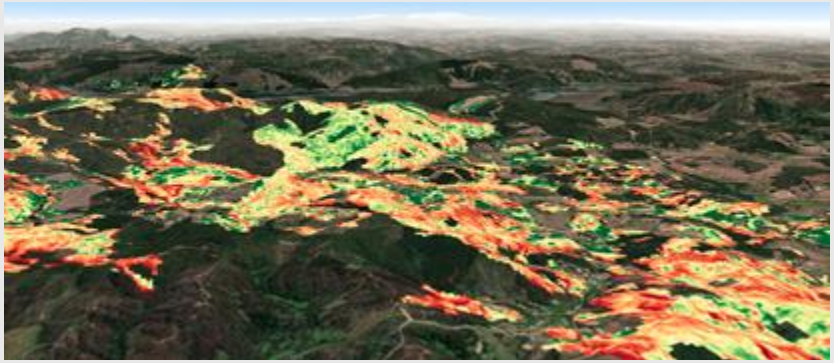
**Very High**: fires can start and spread rapidly.

**Extreme**: exceptional fire danger; rapid and intense fire propagation is expected.

Find more information about the FDM service in the online **service specifications** and **tutorial**.

# Post Fire Vegetation Recovery

Service is activated at the end of a wildfire event once hotspots are not anymore detected over a monitored area. This service monitors post-fire vegetation regeneration using spectral data



**Frequency** - 15 days.

**Spatial coverage** - only over burned perimeters identified in the ROI.

**Temporal coverage** - regularly provides vegetation recovery from 15 to 380 days after the end of the wildfire event.

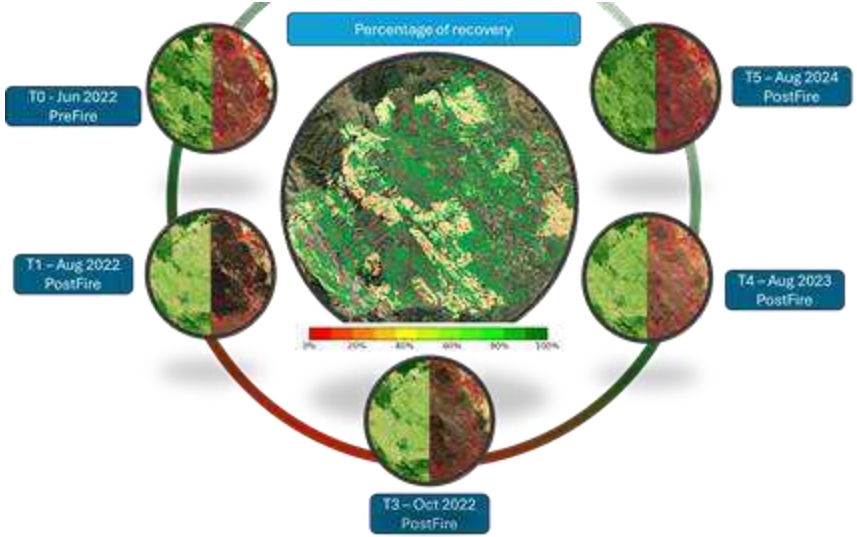
**Constraints** - Sentinel-2 data availability. Data gaps or delays due to persistent cloud coverage.

The service enable users to track recovery trends over time, identify areas with slower regeneration rates, and support decision-making for post-fire management and ecological restoration efforts.

Service owner: indra

# Post Fire Vegetation Recovery

Service takes as input Sentinel-2 imagery and the burned areas detected from the BAM service and provides post-fire NDVI composite and vegetation recovery rates at a 15-days frequency.




The percentage of recovery process is derived using NDVI composites and cumulative recovery rasters generated at regular time intervals.

The figure highlights the progression from pre-fire conditions (T0) to post-fire recovery (T1–T5), demonstrating spatial and temporal variations in vegetation regeneration.

Find more information about the FRM service in the online **service specifications** and **tutorial**.

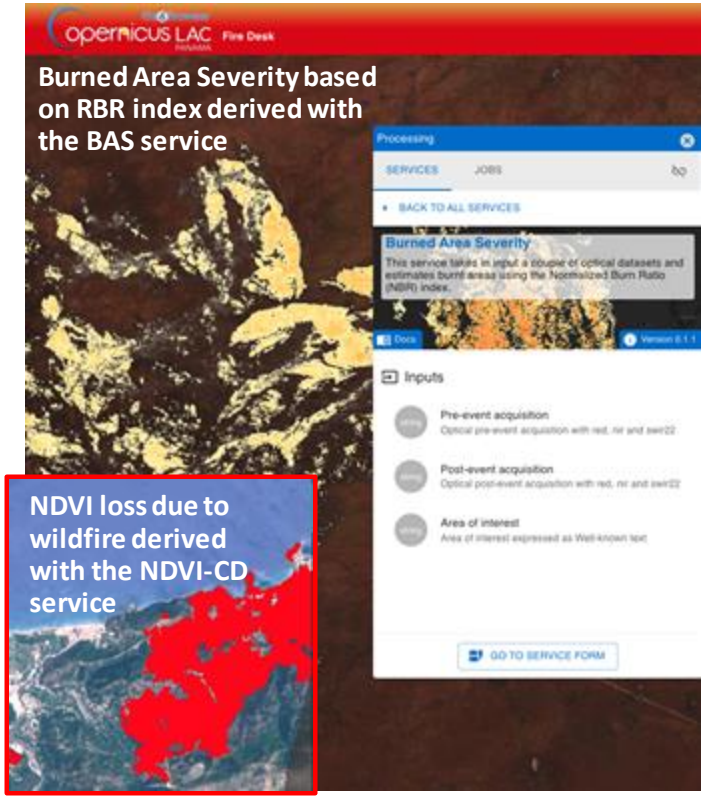
# Workspace for on-demand EO services

The **Fire Desk workspace** offers instead services 4, 5, 6, 7, and 8.

In this workspace the user can access to a processing service panel where it will be possible to submit EO services on-demand by filling-in all required input parameters. Once the processing is successfully accomplished, users can visualize products on a map at full resolution.

***Change detection:*** detect vegetation loss with NDVI from co-registered EO data. Evaluate changes over land using SAR coherence and intensity.

***Post-processing:*** derive co-located image stack of results, perform band arithmetic, filter and convert to vector discrete rasters.

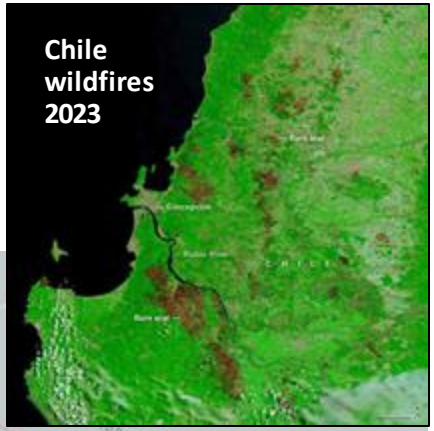


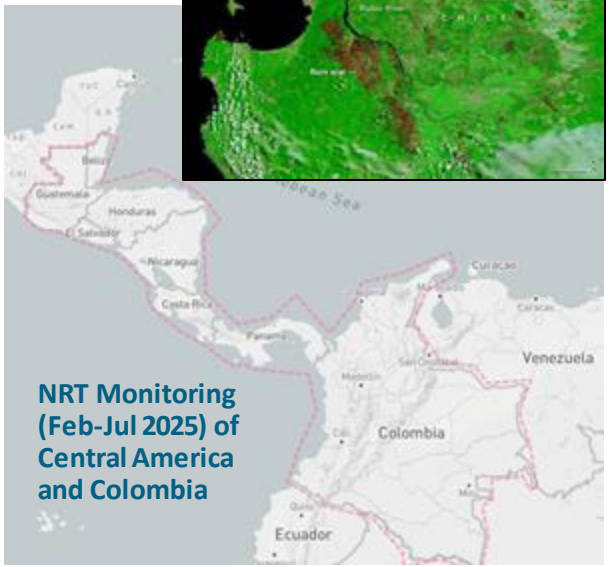
# About development and demonstration phases

*The Wildfire Pilot Service is the first EO service developed for the CopernicusLAC Panama Centre platform. Institutions from Colombia, Honduras, and Guatemala were involved in the development of this service to better tailor related EO application to their needs.*

*The demonstration phase of the wildfire service has covered critical months of the 2024-2025 wildfire season over* ***Central America and Colombia****. Products were also generated for the* ***Chile 2023 wildfire event****.*

*Multiple institutions across the Latin America and Caribbean (LAC) region are currently accessing the Wildfire Results Explorer workspace of the CopernicusLAC Panama Centre platform where they can engage with the tools, provide feedback, and contribute to the ongoing refinement of the services.* Find more at: www.copernicuslac-panama.eu/




NRT Monitoring (Feb-Jul 2025) of Central America and Colombia

# Users

*More than 140 from national agencies and ministries of Belize, Colombia, Ecuador, Guatemala, Honduras, Panama, Peru, República Dominicana, and the Caribbean and from UN organizations*

***ACOFOP***
***Área Metropolitana de San Salvador***
***Armada de Colombia***
***CENAOS-COPECO***
***Centro Nacional de Prevención de Desastres (Cenapred)***
***CODEM***
***CONAP***
***CONRED***
***COPECO***
***EEAS-BOGOTA***
***Finagro: Fondo para el financiamiento del sector agropecuario***
***Fondo de Adaptación***
***FONAFIFO Costa Rica***
***Fuerza Aerospacial***
***FUNDAECO***
***GEFF-LAC***
***ICF***
***IDEAM***
***IDIGER***
***INAB***
***Iniciativa Global Gateway del Equipo Europa en Petén***
***Instituto SINCHI***
***JRC***
***Linea de Emergencia***
***MAGA***
***MARN***
***Mercycorps***
***Ministerio de Agricultura***
***Ministerio de Ambiente Colombia***
***Ministerio de Ambiente y Recursos Naturales***
***National Emergency Management Organization Belize***
***National Meteorological Service Belize***
***Oficina Asesora de Gestión del Riesgo de Popayán***
***Operations - Wildfires Emergency Response Coordination Centre – ERCC***
***PACUNAM***
***Parques Nacionales Naturales***
***Policia Nacional***
***PREVENCIÓN-COPECO***
***Programa Grandes Bosques de Mesoamérica***
***RED FORESTAL***
***sistema Nacional de monitoreo de Bosques, en el ministerio del Ambiente Agua y Transición Ecológica del Ecuador***
***UAEGRD***
***UNGRD***
***Unidad de gestión ambiental***
***Unidad Nacional para la Gestión del Riesgo de Desastres UNGRD - Colombia***
***Universidad Autónoma del Estado de México***
***Universidad de cundinamarca***
***Universidad del Tolima***
***Universidad Sergio Arboleda***
***University of Chile***

# Conclusions


Wildfires pose a significant threat to the Latin America and Caribbean (LAC) region, with widespread impacts on ecosystems, public health, and economic stability.

The integrated approach of the CopernicusLAC Platform showcases the potential of Earth Observation (EO) services in advancing wildfire management from preparedness to response and recovery.

Integrating data from Sentinel-2, Sentinel-3, and VIIRS satellites, the platform offers near-real-time monitoring and analysis tools. On-demand services allow also change detection and post-processing.

After the engagement with multiple institutions across the LAC region, the wildfire EO services have been tested by users from the LAC region.

Future work will focus on further tailoring EO services to the needs of users from the LAC, strengthening regional resilience with the offering of a scalable model for wildfire management.

**CopernicusLAC Platform**

www.copernicuslac.terradue.com

**Online docs**

docs.copernicuslac.terradue.com

*Check out latest news from CopernicusLAC Panama Centre website at*

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