



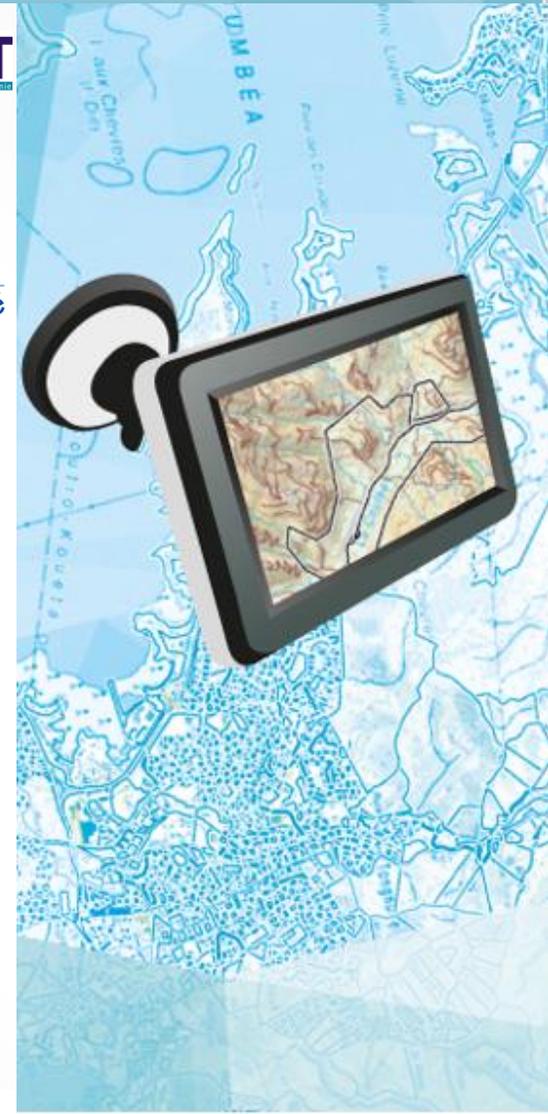
Digital Earth Pacific

Scaling access to Earth observation for a Resilient Pacific

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Programme Manager Digital Earth Pacific
Pacific Community



GISday
2025



Regional Challenges



**Disproportionate
Risks from
Climate Change
and
Environmental
Degradation**

**Geographical
Isolation**

**Limited
Resource
Availability**

**Small
Populations**

Pacific Community (SPC)

27

Member Countries and Territories

900+ staff

6 Regional campuses

8 Technical divisions



Fisheries, Aquaculture & Marine Ecosystems

Education Quality & Assessment

Human Rights and Social Development

Statistics

Public Health

Land Resources

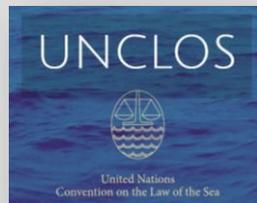
Climate Change & Environmental Sustainability

Geoscience, Energy & Maritime

Frameworks and Conventions



BASEL / ROTTERDAM / STOCKHOLM CONVENTIONS

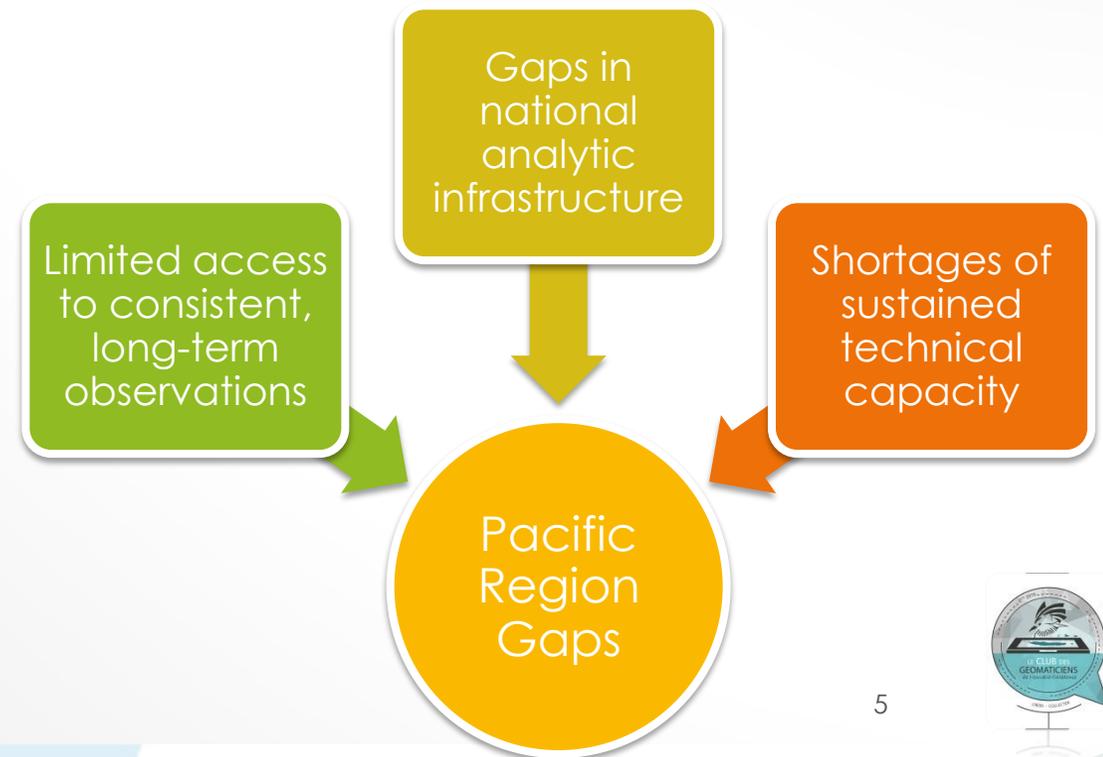
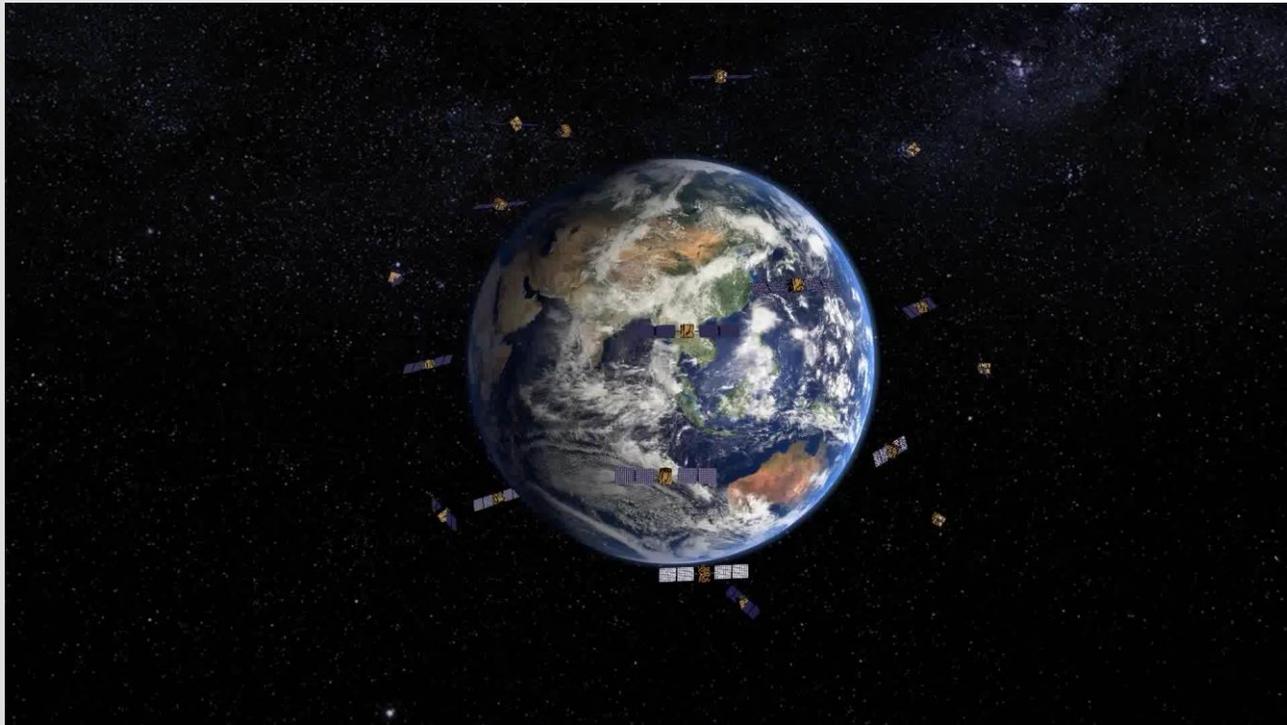


- Climate and Environmental Frameworks
- Multilateral Environmental Agreements (MEAs)
- Ocean and Marine Frameworks
- Sustainable Development & Human Rights
- Regional Conventions
- Regional and National Policies and Strategies

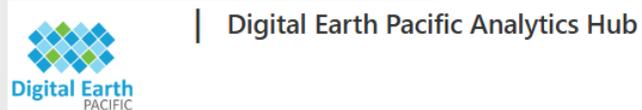
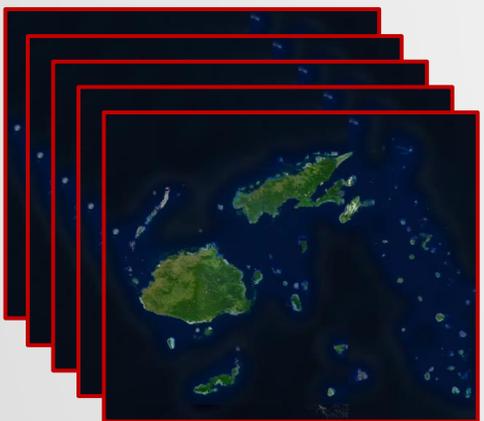


Digital Earth Pacific - Addressing the Gaps

Noting the advancement of Research and **Systematic Observations** is a cornerstone for informed climate action (*IPCC*)



Digital Public Infrastructure



Public-good Earth and Ocean
Observation System



Cloud native infrastructure with AI/ML
technologies - processes open-access
satellite data— into decision-ready
datasets



Ground truthing with local and traditional
knowledge

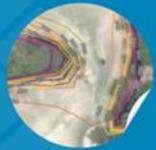


Generate consistent, comparable, and
long-term decision ready information
products



Invests heavily in co-creation and
capacity building

Decision Ready Products



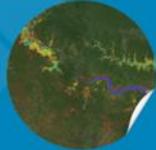
PACIFIC COASTLINE CHANGES (BETA)

Visualise over 20 years of coastline change data, highlighting areas of erosion and accretion. For instance, insights from Solomon Islands reveal how coastal areas have shifted over time, with some regions experiencing significant landward retreat while others remain stable.



PACIFIC MANGROVES CHANGE DETECTION (BETA)

Examine over 5 years of data on mangrove density changes, crucial for ecosystem accounting and loss & damage assessments. The impact of events like Tropical Cyclone Gita (2018) in Tonga can be observed through changes in canopy density, providing critical information for environmental management.



WATER OBSERVATIONS FROM SPACE (WOFIS) (BETA)

Utilise over 10 years of water body data to monitor droughts, floods, and overall water security. This data has proven essential in planning and responding to climate events, such as the 2015/2016 El-Nino drought in Papua New Guinea.



GEOMETRIC MEDIAN AND MEDIAN ABSOLUTE DEVIATIONS (GEOMAD) (ALPHA)

Consolidates multi-temporal imagery into an annual, cloud-free, representative dataset. The product enables reliable, consistent monitoring of land and marine environments across the Pacific region. GeoMAD also enables "on-the-fly" visualisation of critical indices around vegetation, water and moisture monitoring.



SATELLITE DERIVED BATHYMETRY (SDB) (ALPHA)

Provides critical depth data for shallow marine environments, reaching depths of up to 30 meters. This dataset supports a range of ocean and coastal management applications by delivering high-resolution bathymetric information in regions that are often difficult or expensive to survey using traditional methods.



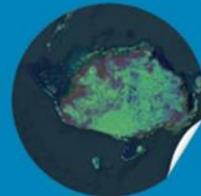
PACIFIC INTERTIDAL MODEL (ALPHA)

Maps the dynamic elevation, exposure, and tidal characteristics of the intertidal zone; the transitional area between the highest high tide and the lowest low tide. The product provides a consistent, regional-scale understanding of how these environments are exposed and submerged over time, offering crucial insights into coastal morphology and hydrodynamic processes.



FRACTIONAL COVER (ALPHA)

Routinely (almost weekly) explore changes from/to green vegetation, non-green vegetation and bare soil; useful for agriculture, drought, flooding, etc.



VEGETATION HEIGHT AND DEFORESTATION MONITORING (ALPHA)

Is using LIDAR-trained deep-learning on Sentinel-2 to detect vegetation height/cover up to 30m height, 10m/pixel, scalable across all PICTS, for change monitoring, and unprecedented deforestation tracking, above-ground biomass, habitat/restoration planning.



BENTHIC HABITAT MAPPING (ALPHA)

This product offers regional-scale coverage of 10 distinct marine habitat classes, including seagrass, tracked over a time series. The datasets are designed to complement global models of marine benthic habitats and are particularly relevant for Pacific Island countries and territories.

Assessing Extreme Weather Events: Mangroves

New Caledonia
2021/2022
Cyclone Season



2021



2022

Assessing Extreme Weather Events: Seagrass

Uvéea, Wallis and
Futuna

2020 4 tropical
depressions



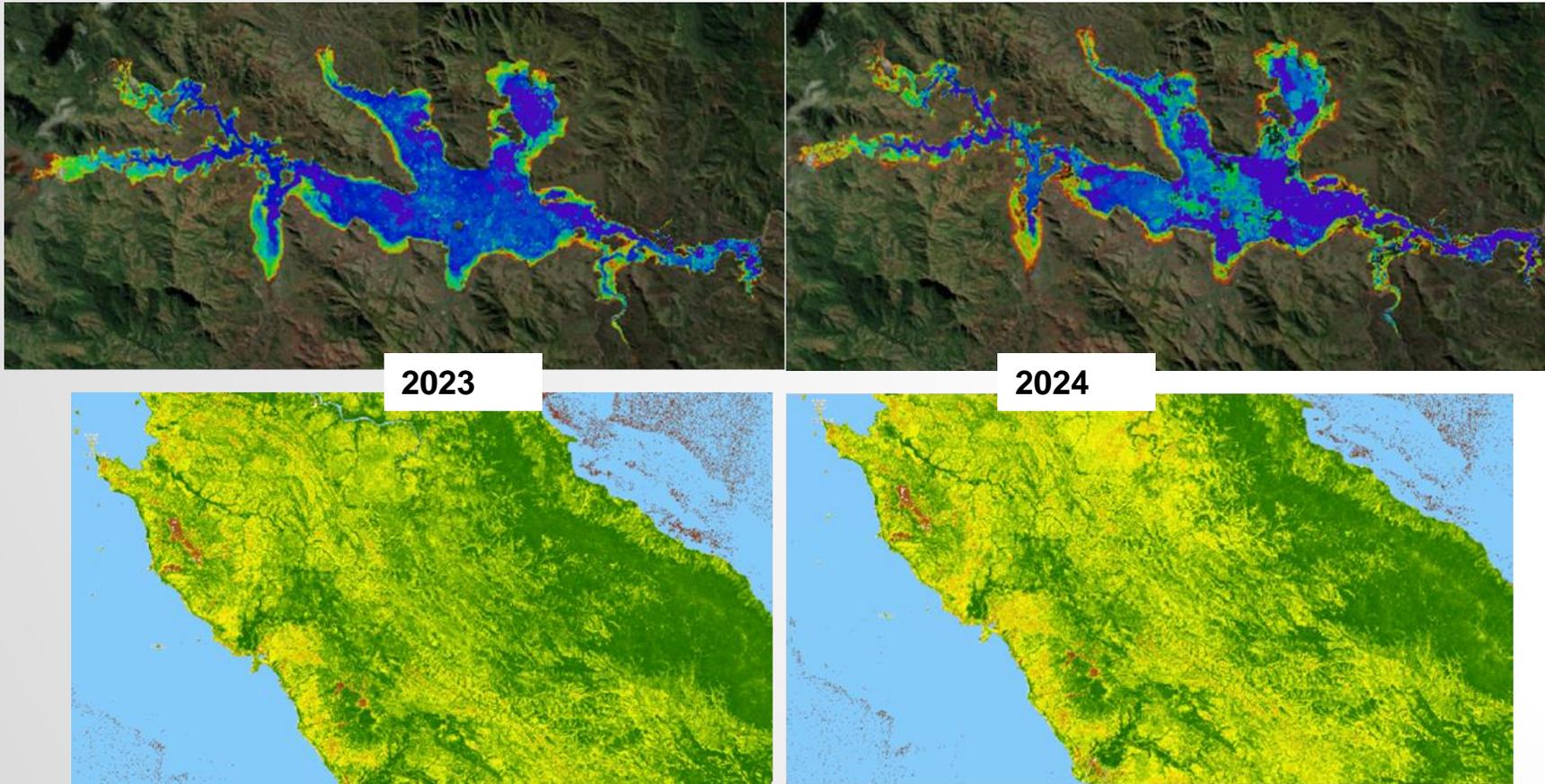
2020



2021



Assessing Extreme Weather Events (Floods & Drought)



In 2024 **New Caledonia** experienced **severe drought**, rainfall deficit of 40% - 51% between April and September.

- **Water Observations from Space (WOfS)** water level in Lake Yaté in 2023 (left) and 2024 (right).
- **NDVI Sentinel 2 -** Vegetation change in northwest of New Caledonia

Search for locations

Explore map data Upload

DATA SETS (2) Remove All Collapse All

WOfS annual summary (Beta) (copy)

IDEAL ZOOM ABOUT DATA

Opacity: 80 %

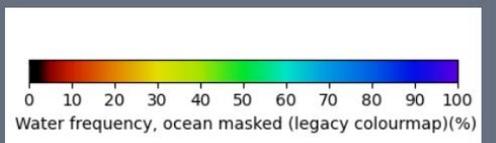
Left Both Right

Time:

2016

Styles:

Water frequency, ocean masked (le...)



WOfS annual summary (Beta)

IDEAL ZOOM ABOUT DATA

Opacity: 80 %

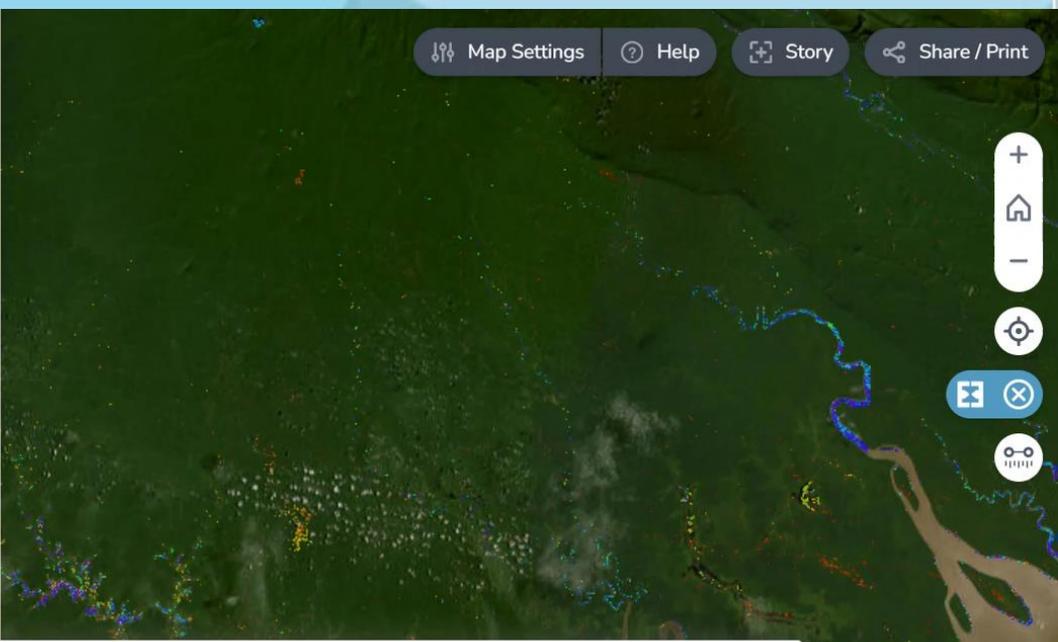
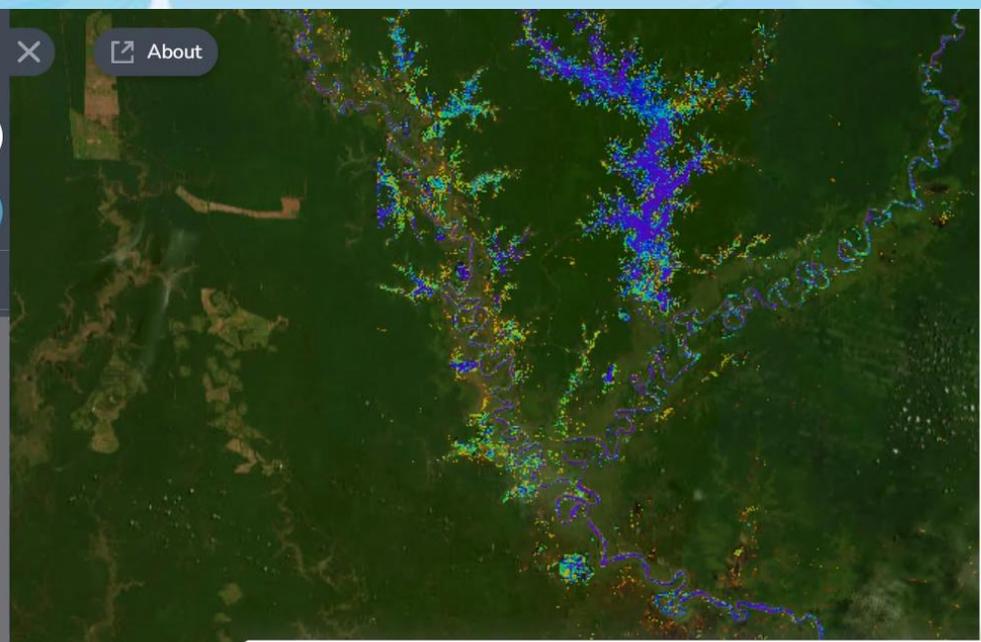
Left Both Right

Time:

2021

Styles:

Water frequency, ocean masked (le...)



Map navigation controls: zoom in (+), zoom out (-), home, location, full screen, and layers.

Featured Example: 2015–2016 Drought in Western Province, PNG

In PNG's Western Province, the low-lying floodplains between the Fly River delta and the Aramia River are dotted with freshwater lagoons. These water bodies are highly seasonal, expanding in the wet season and shrinking to isolated pools in the dry season. During normal years, this region experiences widespread seasonal inundation that supports local agriculture, fisheries, and ecosystems.

The WOfS dataset provides a clear visualization of how the 2015–2016 drought affected water availability in the region:

- In 2016, WOfS data shows a dramatic decline in both the extent and frequency of surface water detection across the Aramia floodplain.
- Compared to a typical year such as 2021, there is significantly less blue and a greater presence of dry or intermittently wet areas, confirming a landscape-wide drought impact.

Try it yourself:
Use the swipe/compare slider to contrast WOfS imagery from 2016 (left) with 2021 (right). Look for the reduction in dark blue zones and the expansion of yellow and orange areas, visual evidence of reduced water presence during the drought.

2 datasets enabled on map

Assessing Biodiversity and Ecosystem Loss & Damage

Tracking Mangrove Extent Change Over Time in Solomon Islands Using Digital Earth Pacific

Why Mangroves Matter in Solomon Islands?

Mangroves are deeply tied to life in Solomon Islands, from food security and climate resilience to traditional knowledge and cultural practices. These ecosystems protect shorelines, provide habitat for crabs and fish, and serve as important carbon sinks in the face of climate change.

Monitoring Mangrove Change with MACBLUE

As part of the MACBLUE project, SPC, SPREP and GIZ collaborated with stakeholders in Solomon Islands to assess mangrove ecosystems using satellite data from Digital Earth Pacific (DE Pacific). This is the country's first national-scale analysis of mangrove change over time, offering a powerful tool for coastal conservation and decision-making.



Drivers of Change in Solomon Islands

Drivers of gain	Drivers of loss
<ul style="list-style-type: none"> Community-led reforestation. Natural mangrove regeneration. Coastal conservation efforts. Traditional resource management. 	<ul style="list-style-type: none"> Logging and land clearance. Urban growth in Honiara and other centers. Coastal mining and infrastructure projects. Extreme weather and sea level rise.

Solomon Islands Mangrove Change Summary (2017–2024)

Time	Area (ha)
2017	76344
2018	83377
2019	86103
2020	92067
2021	94076
2022	101536
2023	89849
2024	96401

Impacts of Change in Solomon Islands

Positive impacts	Negative impacts
<ul style="list-style-type: none"> Restoration of fish and crab habitats. Strengthened community management systems. Coastal resilience and carbon gains. Ecosystem service recovery. 	<ul style="list-style-type: none"> Habitat degradation for key species. Increased risk of flooding and erosion. Loss of traditional livelihoods in mangrove areas. Lower food security in impacted communities.

Building Capacity for Long-Term Monitoring

The Earth and Oceans observation team along with partners GIZ, delivered a national workshop for Solomon Island participants at the King Solomons Hotel in April 2025. There were 19 participants from 7 agencies, and they trained in:

- Mapping and analysing mangrove change with QGIS
- Using Digital Earth Pacific tools for environmental monitoring
- Estimating carbon stock for blue carbon reporting
- Collecting field data using QField to ground-truth satellite analysis

These tools and skills now support national agencies and communities in sustainable coastal ecosystem management.



Seagrass Papua New Guinea (2018 / 2024)

Tracking Seagrass Change Over Time in Papua New Guinea (PNG) Using Digital Earth Pacific (2018 - 2024)



Why Seagrass Matter in PNG?

Papua New Guinea's seagrass meadows are vital coastal ecosystems that stabilize sediments, support fisheries, absorb carbon, and provide food and shelter for marine life. They serve as nurseries for commercially and culturally important fish species, buffer wave energy, and improve water quality, making them essential for biodiversity, climate resilience, and sustainable livelihoods in coastal communities.

Monitoring Seagrass Change with MACBLUE

Under the MACBLUE project, the Pacific Community (SPC), SPREP, and GIZ partnered with agencies in PNG to assess seagrass ecosystems using satellite data from Digital Earth Pacific (DE Pacific). This marks the first consistent, national-scale seagrass change analysis over time for PNG.



Building Capacity for Long-Term Monitoring

The Earth and Oceans observation team along with partners GIZ, delivered a national workshop for Papua New Guinea participants at the Holiday Inn Hotel in March 2025. There were 25 participants from 12 agencies, and they trained in:

- Accessing and analysing satellite data using Digital Earth Pacific
- Mapping seagrass extent and change with Jupiter Notebooks
- Estimating carbon stocks for national reporting in QGIS
- Field data collection using QField

This training empowers PNG's government agencies to continue tracking and protecting coastal ecosystems using free, open-source tools.

Carbon Stock Calculation Based on Seagrass Ecosystem

Seagrass meadows are powerful blue carbon sinks, storing carbon both above ground (in leaves and stems) and below ground (in roots and sediments). Accurate carbon stock estimates are essential for national reporting and climate mitigation strategies. Under the MACBLUE project, PNG's seagrass carbon stocks were estimated using satellite-derived extent data and field-based biomass measurements.

Carbon Pool in 2024	Estimated Total (Mg C)
Total carbon stock	8,786,382
Equivalent CO2 stocks	32,216,734.0

Drivers of Change in PNG

Positive Drivers	Negative Drivers
Community-led conservation efforts.	Pollution and sediment runoff.
Natural expansion of seagrass beds.	Coastal development projects.
Improved marine protected area policies	Boating and fishing damage.
	Sea level rise and turbidity.

PNG Seagrass Change Detection

Year	Area (Km2)
2018	769.80
2024	714.34
Gain of seagrass	-55.46

Year	PNG Seagrass (ha)	Total Carbon Stock (based on SOC 0-100cm = 93Mg C/ha)	CO2 stocks (TCS* (44/12))
2018	76,980	9,468,540	34,717,980.0
2019	66,627	8,195,121	30,048,777.0
2020	65,303	8,032,269	29,451,653.0
2021	68,613	8,439,399	30,944,463.0
2022	63,286	7,784,178	28,541,986.0
2023	66,784	8,214,432	30,119,584.0
2024	71,434	8,786,382	32,216,734.0

These figures highlight the importance of protecting and restoring seagrass meadows not only for biodiversity and fisheries but also for their crucial role in carbon cycle regulation and climate change mitigation through long-term carbon storage.

Impacts of Change in PNG

Positive Impacts	Negative Impacts
Enhanced carbon sequestration.	Loss of habitat for endangered species.
Improved fish nursery habitats.	Decline in fish stocks.
Increased biodiversity.	Reduced water quality.
Greater resilience to coastal erosion.	Less carbon storage and climate buffer.

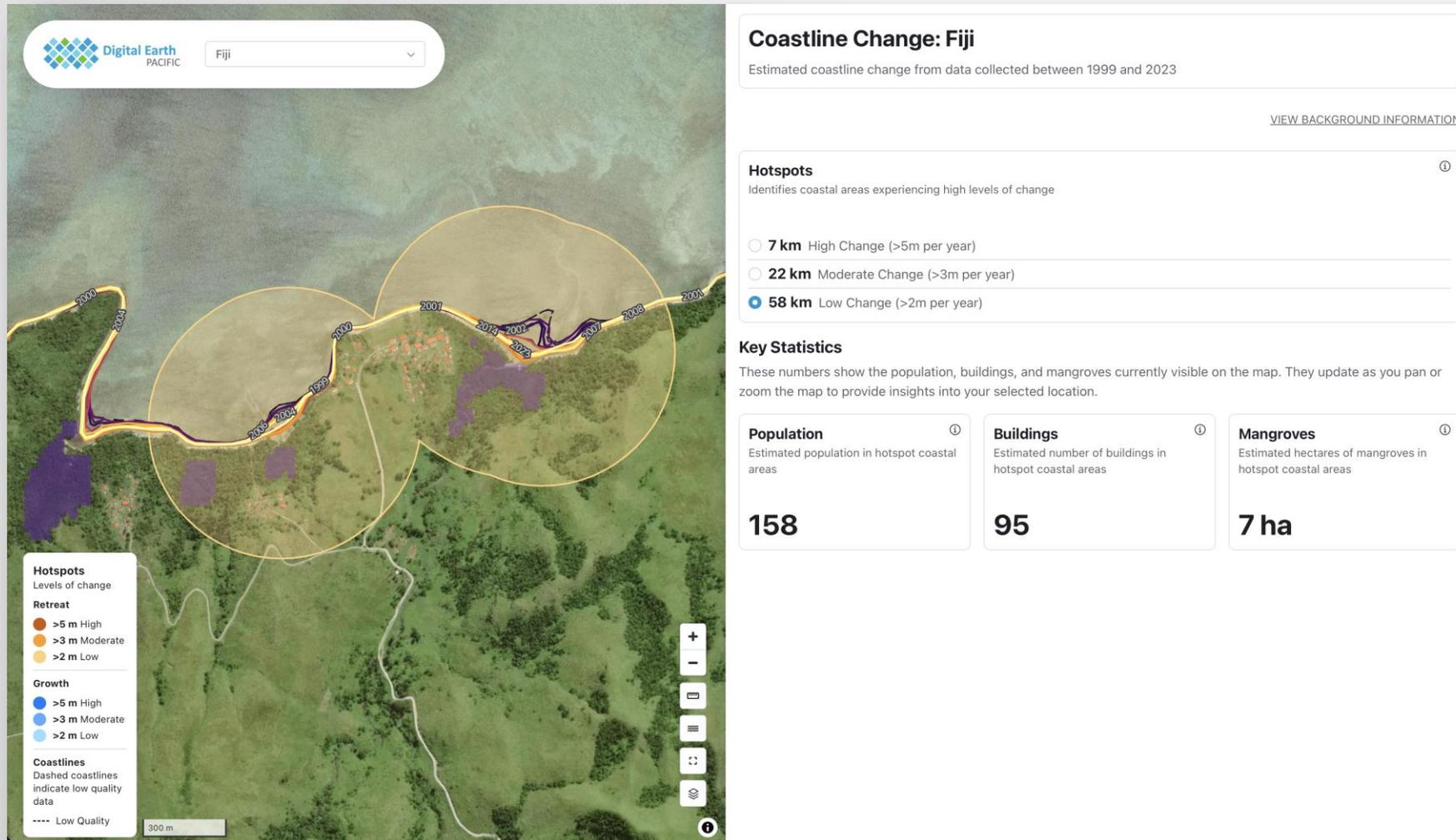


www.macblue-pacific.info www.digitalearthpacific.org

Mangroves: Solomon Islands (2017 - 2024)

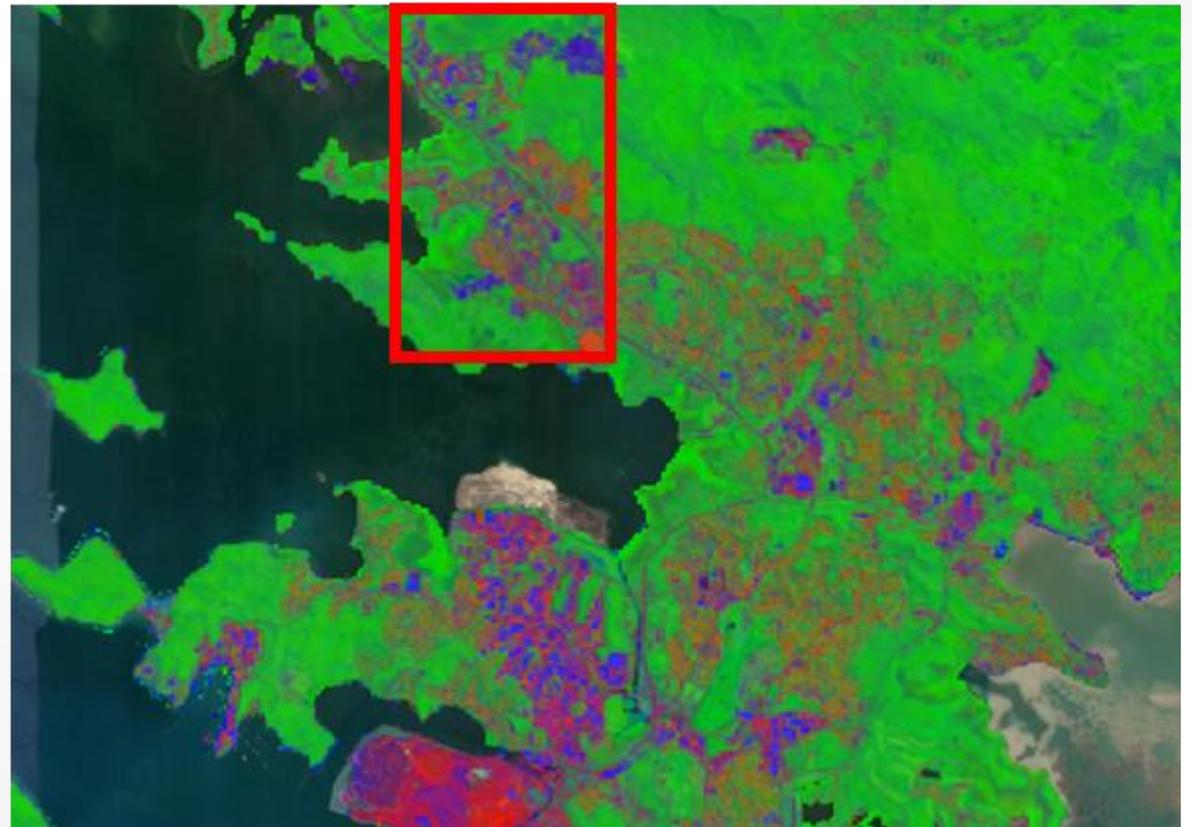
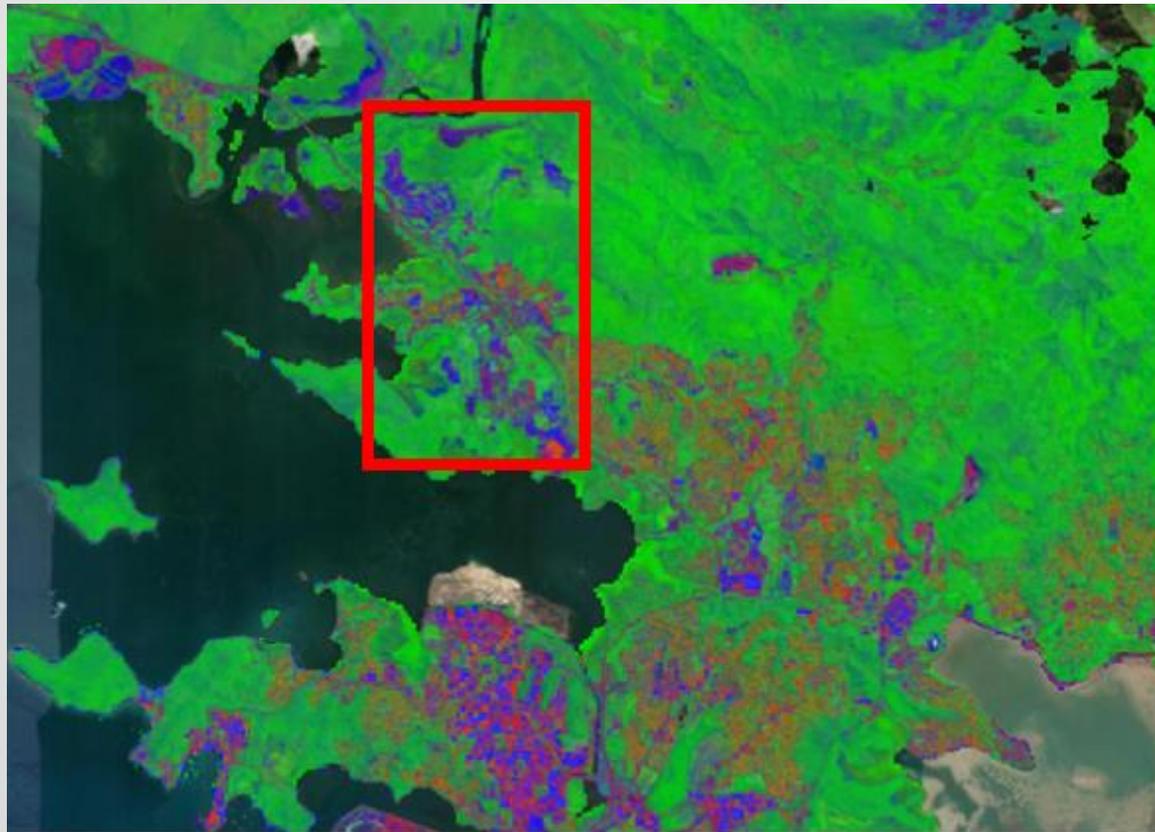
Available for Fiji, PNG, Solomon Islands and Vanuatu

Assessing Coastal Erosion Impact



Estimated **coastline change** from data collected between 1999 and 2023, with rates of change (hotspots) for shoreline retreat or growth, and impact on **population, buildings and mangroves.**

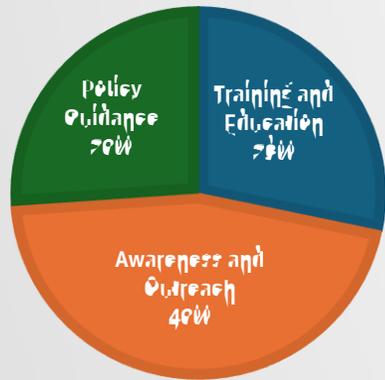
Urban Expansion: Fractional Cover



Urban expansion, **New Caledonia** (Dumbéa, sur Mer and Païta)

Advocacy and Capacity Building

DELIVERY FRAMEWORK



Custom-designed workshops with abstraction libraries and tools to enable co-creation, development and validation of ML-driven Land Cover Change Detection and Analysis, Invasives Species Detection, Mangroves Blue Carbon Stock Assessment, Agro-census et.al

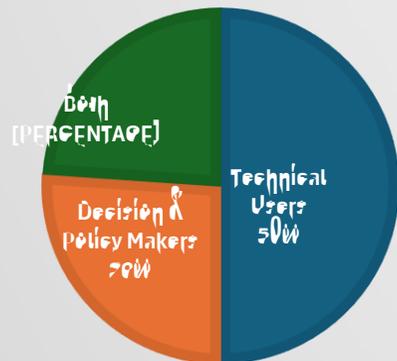
+200 individuals reached

36% females reached

12 workshops held

16 countries reached

STAKEHOLDER GROUP REACHED



Summary and Get Involved

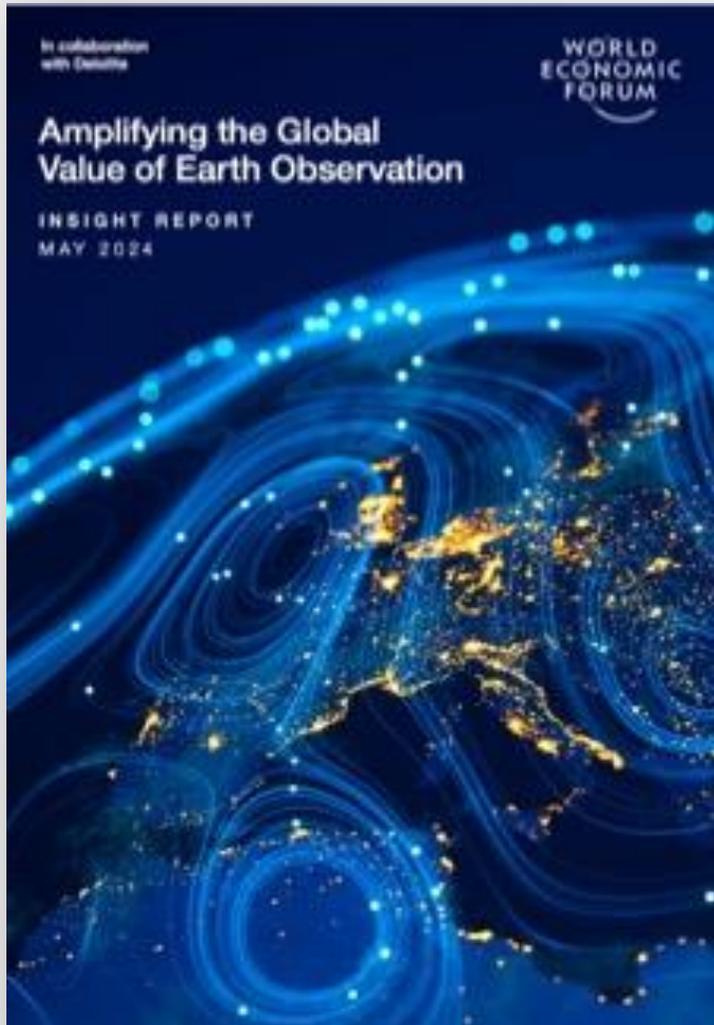
Turning open satellite data into evidence that reflects Pacific contexts and priorities.

Empowering Pacific countries to generate, interpret, and apply Earth intelligence.

Providing the consistent, transparent data needed to assess and report economic and non-economic loss and damages.



Is the Pacific ready for Reaping the Value of EO?



- EO could add \$703 billion, yearly, to the global economy while eliminating 2 gigatonnes of GHG emissions by 2030.
- The **Asia Pacific region is poised to capture the largest share of EO's value** in this period, reaching a potential value of \$315 billion.
- Top sectors benefiting being agriculture, electricity, government services, insurance, mining, and supply chain

Thank You

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