

Kingdom of Tonga/Pacific Region

The Kingdom of Tonga is a Polynesian archipelago in the South Pacific Ocean with 170 islands, of which only 36 are inhabited. With a total surface area of approximately 750 km² scattered over 700,000 km² of the Pacific Ocean, Tonga consists of more water than dry land. Its location makes it highly vulnerable to natural disasters and the impacts of climate change, such as sea-level rise, and it faces more frequent and severe weather events, such as tropical cyclones and drought. To strengthen the management of Geospatial Information in Tonga, the National Integrated Geospatial Action Plan 2023 – 2027 was developed and launched through the guidance of the Integrated Geospatial Information Framework (IGIF).

Remote Sensing plays a crucial role in various areas, with its significance particularly pronounced in Disaster Management, Environmental monitoring, and Agricultural monitoring.

1. Environmental Monitoring

Having updated aerial imagery is crucial for decision-making in Tonga. Aerial images are used for various reasons, particularly in urban planning, disaster management, environmental monitoring, and infrastructure development. Over the years, Tonga has been collecting aerial images from LIDAR Surveys. In 2012, the main island of Tongatapu and the main island of the Ha'apai Group (Lifuka) were surveyed. In 2018, another survey was

conducted covering Eua Island and the remaining islands of the Ha'apai Group. In 2021, another survey was conducted for the Island Group of Vava'u and Niua. Orthoimages, Digital Elevation Models, Contours, and Building Polygons were generated from these surveys. The Ministry of Lands and Natural Resources conducted small-scale drone surveys to obtain more recent images. Between 2023 - 2024, 32 villages were droned to collect images that can be used to identify changes before and after a cyclone event. The products generated from these surveys further support Quarry Analysis, Flood Analysis, Tsunami Modelling, Identifying coastal changes, and so much more.

2. Disaster Management

In 2022, Tonga was greatly affected by the Hunga Tonga – Hunga Ha'apai volcanic eruption and tsunami. This became a trigger for improving strategies and monitoring natural hazards and weather events in the Kingdom. Thus, the integration of Remote Sensing become vital in various agencies. At the Tonga Geological Services, satellite images monitor volcanic activities. The NOAA/CIMMSS Volcano Cloud Monitoring Web Portal offers multiple satellite images and monitors Thermal Anomaly and Ash covers. The Sentinel Hub is also now used to look at visuals on the islands, such as monitoring growth or size. Access to satellite imagery is valuable because islands are widely spread and remote in Tonga. Other

Agencies have also begun to create platforms for sharing information and installed new equipment to improve monitoring. Two new activities were launched during the 53rd Pacific Islands Forum Leaders Meeting in Tonga in August 2024. The first activity aimed to enhance disaster preparedness using remote sensing in Tonga and is a joint initiative by the UN-SPIDER and the Committee on Earth Observation Satellites (CEOS) for a CEOS Tonga Preparedness Pilot Project. The National Disaster Risk Management Office leads this initiative in Tonga and will utilise satellite imagery and advanced Earth observation technologies to enhance our disaster preparedness significantly. The second activity was the deployment of Tonga's first Weather Radar at the Tonga Meteorological Services. Weather Radar coverage in the Pacific is sparse; therefore, this addition provides improved air measurements. This is a crucial tool for Tonga, given its exposure to severe weather events such as cyclones, heavy rainfall, and thunderstorms.

3. Agriculture Monitoring

Satellite Images were used to identify land cover changes in Tonga. In collaboration with the Tongan Department of Forestry, the Global Green Growth Institute (GGGI), as an implementing partner of the Regional Pacific NDC Hub, conducted two major activities to support the preparation of Tonga's National Forest Inventory (NFI) during a workshop on July 23, 2024. These included 1) the handover

of the National Forest Inventory Document to the Government of Tonga and Tongan foresters and 2) Capacity building on Satellite Imagery. The National Forest Inventory aims to support the sustainable management of Tonga's forests and tree resources.

The application of Remote Sensing in various fields is still growing in Tonga. However, several limitations and challenges hinder this growth, including financial constraints, technical expertise, limited access to infrastructure and technology, and geographic and environmental challenges. However, continuous support is provided through Development Partners, Foreign Embassies, and Regional Organizations to overcome these challenges.

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