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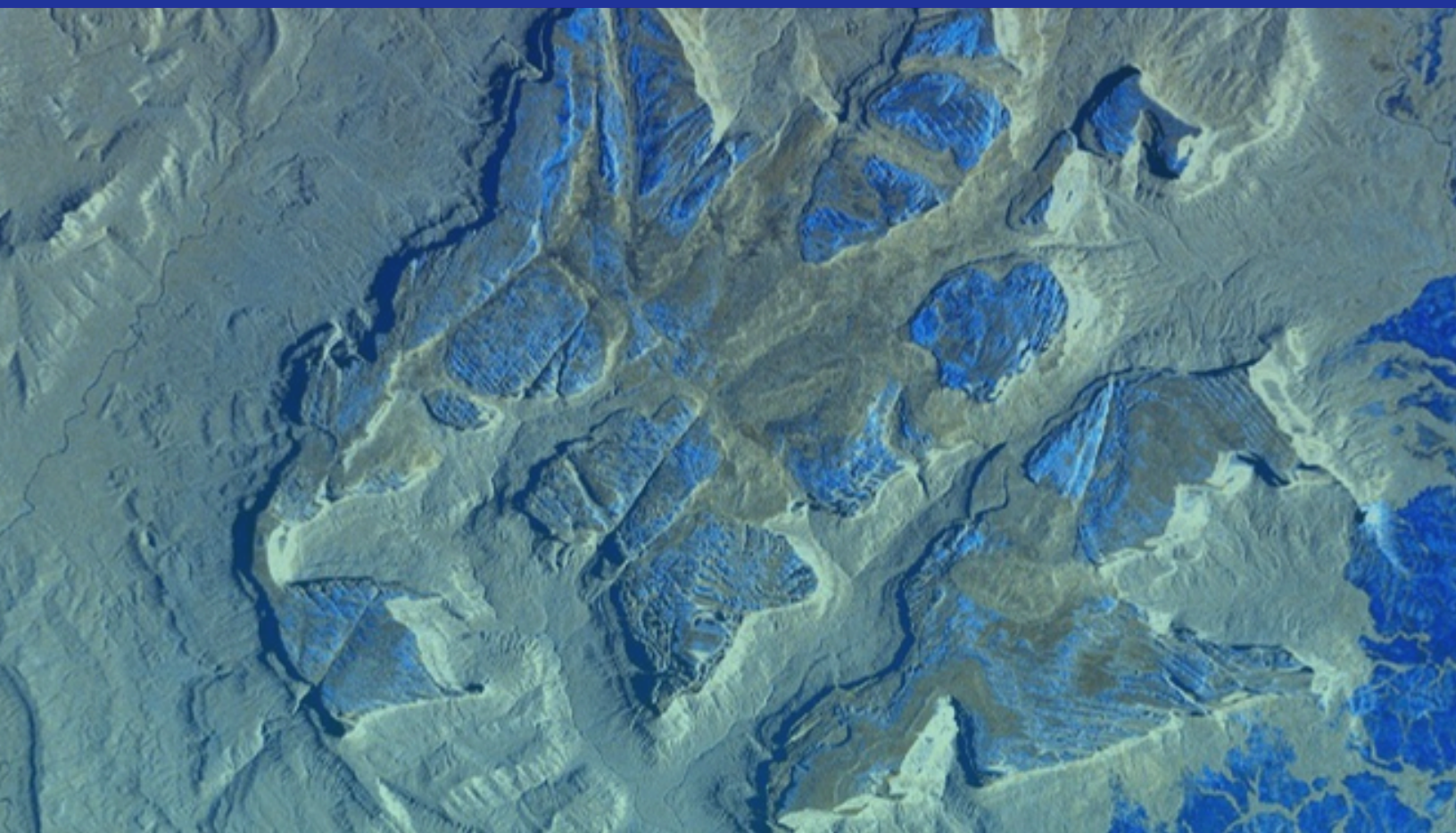
PACIFIC ISLANDS GIS & RS NEWSLETTER



Pacific GIS and Remote Sensing Council

PACIFIC ISLANDS GIS&RS NEWSLETTER

Dear Reader,

The Pacific Islands GIS & RS Newsletter publishes articles related to Geographic Information System (GIS) and Remote Sensing (RS) applications in Pacific Island Countries. The newsletter also provides updates on applicable data and technology for the Pacific. While this issue is long overdue, we are pleased to bring you these highlights of the latest GIS and remote sensing research and technologies relevant to the Pacific.

This newsletter has been published for more than 30 years as one of the few publications that focuses on spatial data applications in Pacific Island Countries. With its own ISSN number, the newsletter provides a platform for regional GIS & RS users to publish and document ideas and developments in terms of data, software, and methods for Pacific applications. The newsletter and all previous issues are available for download from the PGRSC website: https://pgrsc.org/newsletter/.

We certainly wish you an enjoyable read through these stories and invite you to submit your own articles and notable contributions relevant to GIS and Remote Sensing in the Pacific. The Newsletter Team can assist with editing articles and is dedicated to supporting Pacific Island users in sharing their work.

Your Newsletter Team
For contributions and inquiries: Wolf Forstreuter – wolf.forstreuter@gmail.com

Cover Image: Polarimetric Sentinel-1 image of the Guyana Plateau produced through the QVX GeoAI – RADARWATCH monitoring system

CONTENT

2025 PGRSC Conference Summary

by Bradley Eichelberger

For more than 20 years, the Pacific Islands GIS and Remote Sensing User Conference has provided a platform for:

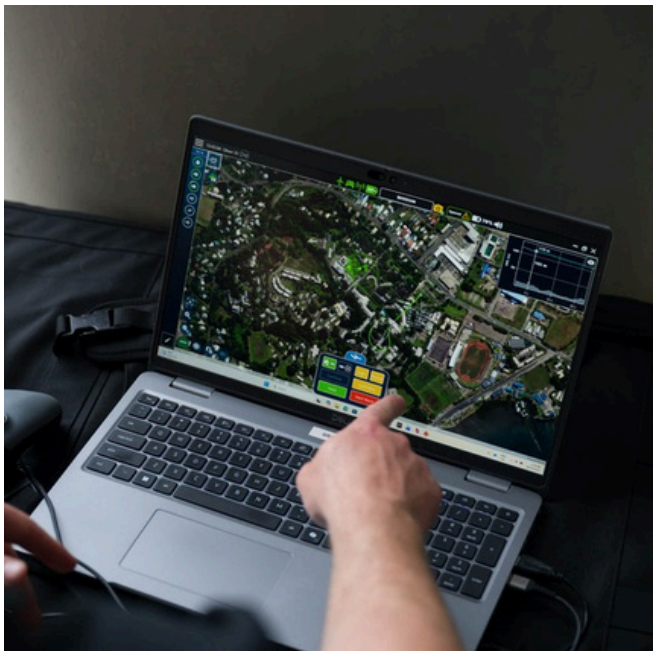
(i) GIS and Remote Sensing (RS) users from nearly all Pacific Island Countries,
(ii) satellite data, software, hardware, and consulting enterprises,
(iii) scientists from universities and research institutions.

The 2025 Pacific Islands GIS and Remote Sensing Conference was held in Suva, Fiji, from November 24-28, 2025, under the theme “Building and Enhancing Geospatial Networks in the Pacific Islands”.

Daniel Worger (Quantum-Systems) engages with speakers during conference presentations

Panel Discussion “Women in GIS & Remote Sensing”

The conference was well-received, having hosted 170 participants from 22 different countries (16 Pacific Island Countries and Territories and 6 International) and consisting of 40 presentations, 6 discussion sessions, 4 workshops, and a Women in GIS Session. The event was also held as a back-to-back event coordinated with the FOSS4G 2025 conference in Auckland, New Zealand, and the 2025 Oceania Geospatial Symposium in Suva, Fiji.



Conference workshops offer hands-on learning opportunities

The Pacific Islands GIS and Remote Sensing Conference's Opening Speakers included the Honorable Sakiasi Ditoka, Minister for Rural, Maritime Development and Disaster Management of Fiji; Dr. Stephen Galvin. Senior Lecturer in Biogeography and Deputy Head of School for the School of Agriculture, Geography, Environment, Ocean and Natural Sciences (SAGEONS), University of the South Pacific;

Hon. Sakiasi Ditoka provided the conference opening session

Andiswa Mlisa, Digital Earth Pacific Programme Manager at the Pacific Community (SPC); and Bradley Eichelberger, PGRSC Chair. Featured Guest, Dr. Lena Halounová, President of the International Society of Photogrammetry and Remote Sensing (ISPRS), also attended and presented on the works of ISPRS and connections to PGRSC, which is the Regional Member for the organization.

Exhibitor booths offer insight to new technology and products from conference sponsrs relevant to GIS & RS

Sponsors for the event included Pacific Community (SPC) and the Digital Earth Project, DataTerra, the Pacific Fund, Spatial Intel, OSGeo Oceania, Vodafone, University of the South Pacific, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), LandPro, and Aqua Pacific. Additionally, travel grants were provided by Data Terra and the Pacific Fund for PGRSC focal point Damien Buisson (New Caledonia) and a delegation from French

The 2025 Pacific GIS & Remote Sensing Conference attendess and honorable guests at the University of the South Pacific in Suva, Fiji (November, 2025)

Polynesia. GIZ supported travel for PGRSC focal points Joy Papao (Solomon Islands) and Johnie Tarry Nimau (Vanuatu).

PGRSC also held its Annual General Meeting during the event, which outlined the organization's accomplishments and achievements throughout 2025. Workshops held during the final day of the conference included. Conference presentations and materials can be found on the PGRSC webpage at: https://pgrsc.org/2025-conference-resources/

Confrerence participants getting real-world experience

The 2026 Pacific Islands GIS and Remote Sensing User Conference will be held at the University of the South Pacific from November 30 to December 4, 2026.

More information on this year's event can be found on the PGRSC website at:
https://pgrsc.org/pacific-gis-rs-users-conference/
https://pgrsc.org/pgrsc-sponsorship-packages/


Image Credit © UOG Drone Corps

The University of Guam (UOG) Drone Corps

by John Borja
Email: dronecorps@triton.uog.edu

In the U.S.-affiliated Pacific Islands (USAPI), small uncrewed aircraft systems (sUAS), or drones, are making their way into academic research and natural resource management. With an array of sensors and flight capabilities that can reach areas inaccessible by land, drones are collecting crucial data that modernize monitoring and surveying efforts, especially for remote islands like the U.S. territory of Guam, situated in the Western Pacific.

Because it is a fairly new industry to the USAPI, there are little to no local laws that regulate the use of sUAS. Instead, these islands abide by regulations set by the Federal Aviation Administration (FAA). This presents a challenge in the awareness of such regulations. Federal drone policies can be complex to the untrained eye, and attention to detail is important in ensuring that remote pilots do not find themselves facing penalties, fines, or imprisonment. Navigating through these regulations can be a challenge: how heavy can your drone be until you must register it? How high can you fly in your neighborhood? What credentials do you need to use drones to work?

In Guam, about a third of the island is under controlled or restricted airspace. The areas in which these spaces are regulated include the A.B. Won Pat International Airport, three U.S. Department of Defense (DOD) military bases, and additional DOD facilities that are restricted areas to fly without proper compliance and approval from the agency. Furthermore, a recently enacted federal law surrounding drone use in FAA airspace is specific to drone manufacturers and brands, so there is an added layer of information that drone flyers — recreational, commercial, or governmental — must be aware of.


Thomas Torres II operates a drone equipped with a LiDAR sensor during a mapping mission in Aimeliik State, Palau

Image Credit © OpenStreetMap & ESRI

Controlled or restricted airspace in Guam

The University of Guam (UOG) Drone Corps was established in 2021 to educate the community on these matters and to create a generation of responsible, certified remote pilots. With proper training and flight experience, these new remote pilots can contribute to the growing need of sUAS data collection for research and natural resource management. The applications span across various environmental topics, such as wildfires, coral bleaching, typhoons, and invasive species. Datasets intended for these issues are vital tools for local natural resource managers.

The UOG Drone Corps Program Model

Once accepted into the UOG Drone Corps program, members enter an immersive training pipeline designed to shape them into confident and skilled FAA Part 107b-licensed remote pilots. The workflow is structured around three milestones: the completion of a knowledge course, earning a remote pilot certification, and participating in flight mission opportunities.

The knowledge course, which has been taught by partners from local drone service providers, introduces participants to the fundamental lessons they need to pass the FAA Part 107 exam, including those on airspace regulations, meteorology, crew resource management, and drone safety procedures. During the course, students also receive hands-on training through practical flight modules that teach them about basic drone maneuvers and operations — gradually progressing from handling virtual simulators to operating specialized drones used in real-world applications.

UOG Drone Corps member Andrea Velasquez

After successfully passing the exam and earning their Part 107 certification, UOG Drone Corps members are given opportunities to enhance their professional development through internship opportunities and participate in real-world missions that directly support Guam's environmental research priorities.

Given the lack of local, high-quality environmental datasets available for researchers, many of these missions fill a critical gap by producing high-resolution orthomosaic maps of coral reefs, mangroves, reforestation sites, agricultural plots, and other key ecosystems. These maps offer a clear, high-resolution view of important sites, giving researchers and partners insights into factors such as plant health, topography, and reforestation progress.

To ensure that the work the students produce directly supports place-based needs, the UOG Drone Corps regularly partners with local environmental agencies for surveying efforts that can inform their management and policymaking. Beyond routine mapping opportunities, UOG Drone Corps members have also been called into action during critical, time-sensitive events, including missions focused on coral bleaching surveys, post-wildfire assessments, and post-typhoon damage mapping efforts.

Since its inception, UOG Drone Corps prioritizes college-level students to avail of the program's benefits. In 2025, the program expanded its audience to include UOG faculty and employees from local natural resource agencies. This update provided a more direct impact to technical capacity in university research and government operations. So far, the program has certified 55 local students, educators, and natural resource personnel as FAA Part 107b remote pilots.

Member Stories

Throughout each stage of the program, UOG Drone Corps members are empowered to think critically about how drone technologies can support local environmental initiatives of their own research or environmental interests. For many members, the program has become a stepping stone to help propel them into careers, with many taking the initiative to apply their drone expertise to their individual academic and professional projects.

One such member is Andrea Velasquez, a member from the program's second cohort and a former research associate with the Micronesian Area Geospatial Information Center (MAGIC) Laboratory at UOG. For her, drones have become essential tools for her work in supporting Guam's agricultural community.

"The Drone Corps program has provided me

UOG Drone Corps member Andrea Velasquez operates a drone at a farm in southern Guam during a mapping mission to detect greenhouse gases in May 2025

with opportunities to learn about Guam's environmental struggles and use my skills to help safeguard our land's resources," Velasquez said. "Through my current project with the Southern Guam Soil and Water Conservation District, I am able to directly assist local farmers by providing high-quality aerial maps of their lands so that they can identify areas to improve land and soil health."

Members and instructors of the fifth UOG Drone Corps cohort

In addition to RGB imagery, Velasquez employed multiple drone sensors to create comprehensive datasets for land management, including multispectral payloads for vegetation health, lidar sensors for precise elevation models, and an air pollutant mapping system to detect greenhouse gas emissions.

For other members, the UOG Drone Corps program also equipped them with the necessary skills to apply their drone training in real-world research settings. Thomas Torres II, a member of the UOG Drone Corps' third cohort, had the opportunity to participate in a two-week mission in the Republic of Palau through his NASA Guam Space Grant Professional Internship with 2cofly, which was funded by the U.S. Ambassadors Fund for Cultural Preservation. Working alongside the 2cofly team, he helped survey more than 3,000 acres in Aimeliik State using advanced lidar systems to map ancient terraces and produce detailed digital terrain models of unprecedented clarity. Thomas credited the UOG Drone Corps program for equipping him with essential drone operation and fieldwork skills.

"Participating in the Cohort 3 Drone Corps program helped me learn the necessary skills to confidently handle a drone, as it was my first time flying one," Torres said.

Expanding across Micronesia

With momentum built from the successes of the program on Guam, UOG Drone Corps intends to share its model with other islands in Micronesia, encouraging safer remote flights in island airspaces. Through partnerships and collaborative missions with other institutions, such as the College of Micronesia, Palau Community College, and the Northern Marianas College, UOG Drone Corps is sharing resources to help them eventually build their own network of remote pilots.

UOG Drone Corps' long-term goal is to serve as a geospatial data repository for Micronesia. With the rearing of remote pilots along with network expansion across other islands, UOG Drone Corps intends to fortify its digital capacity to catalog and maintain sUAS data that can be easily accessible to researchers and natural resource managers.

UOG Drone Corps is funded and administered through awards from the NASA Guam Established Program to Stimulate Competitive Research (EPSCoR) and NASA Guam Space Grant, both housed under the University of Guam.

Fugamotu – “Flying Over The Island”: A Spatial Data Infrastructure for Wallis and Futuna

Translated from Portail de l’Information Géographique de la Nouvelle-Calédonie

Back in 2023, the Territory of Wallis and Futuna, through its **Department of Public Works**, embarked on a structuring initiative: the implementation of its own **Geographic Information System (GIS)** carried out by the company SKAZY.

The aim of the project is simple yet essential: to improve the sharing of knowledge about the territory, ease exchanges across departments,

FUGĀMOTU
Portail cartographique
du territoire de Wallis-et-Futuna
APPLICATION

sustainably strengthen local capacities in the field of geodata handling, and above all, provide decision-support tools for local authorities.

An initial **diagnostic** phase, performed in 2023, allowed the inventory of existing resources and the identification of the current and future needs. It also highlighted several constraints specific to the island context, notably the diversity of IT environments and the heterogeneity of networks.

At the end of this analysis, an appropriate solution was selected: **GeoNode**, an open-source platform widely used for management, cataloguing, visualization, and geodata dissemination.

GeoNode can be compared to a **content management system (CMS)**, quite like WordPress, but dedicated to geographic data. It relies on proven GIS components (**GeoServer** for service delivery and **PostgreSQL/PostGIS** for storage), brought together within an ergonomic web interface that facilitates access to data for users with diverse profiles, whether technicians, managers, or decision-makers.

This choice meets a dual objective:

to have a robust and maintainable tool in a context where technical resources are limited, while relying on **open standards** compatible with GIS practices already in place within departments, such as the wide use of **QGIS**.

In 2025, the second phase of the project first enabled the installation of both the hardware and the platform, and verification of its accessibility from all departments. It also marked the launch of **training sessions for GIS** focal points, covering 5 of the 14 departments concerned.

Beyond learning how to use the tool, these sessions provided an opportunity to address key concepts: metadata, structuring of datasets, best practices for updates, and the use of dissemination services. Very quickly, the teams showed a strong interest in a more collaborative approach to managing geographic information.

The integration of the first core datasets (**administrative boundaries** and the **road network**) represented a decisive step in the project. Carried out by the Department of Public Works and its team, with support from SKAZY's teams, this work brought to light a major cross-cutting issue: data governance.

Initially perceived as a constraint due to the lack of formalised procedures and the heterogeneity of formats, this situation ultimately proved to be a real

The Open Source Geospatial Stack (OSGS)

driver of change. By making everyone's needs visible and confronting existing practices, the project fostered a collective reflection on production responsibilities, update procedures, data quality, and the harmonisation of methods. Data governance, far from being an additional burden, thus appears as an essential lever for enhancing data value, improving reliability, and strengthening collective efficiency.

Beyond the mere installation of GeoNode, this project marks a turning point for Wallis and Futuna. It initiates a dynamic based on sharing, transparency, and the progressive structuring of geographic information. By laying the foundations for a collaborative and sustainable GIS, the Territory equips itself with a key tool for steering public action, gaining a detailed understanding of its island space, and developing a truly shared culture of geographic data.

Collaborative Mapping For A Sustainable Future:

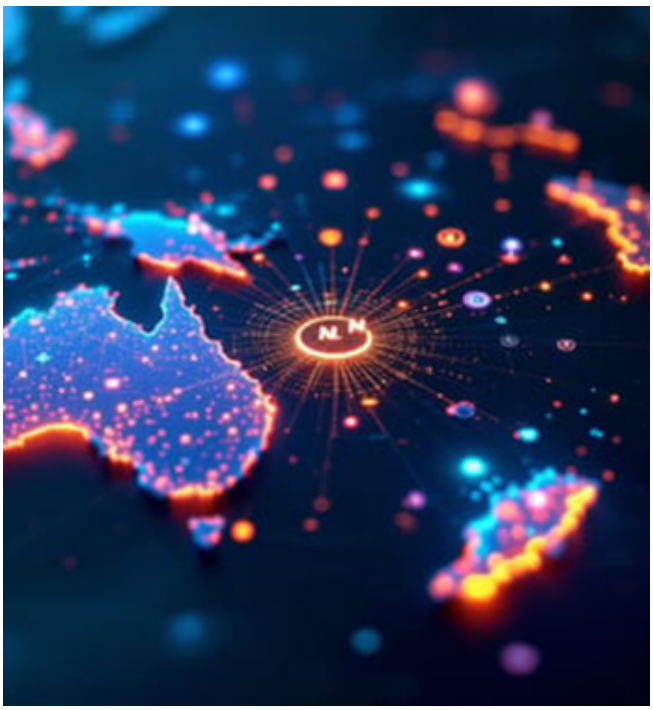
The New Caledonia GIS Club

by Damien Buisson

GOUVERNEMENT DE LA NOUVELLE-CALÉDONIE

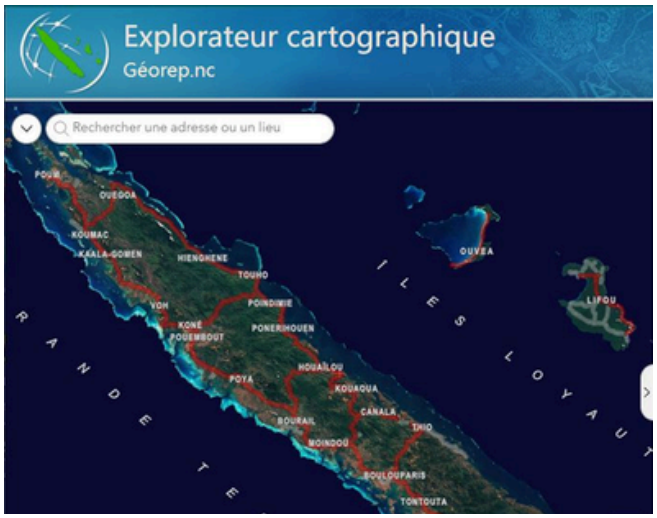
New Caledonia, an archipelago renowned for its exceptional biodiversity and complex economy—ranging from coral reefs to extensive mining developments—faces unique environmental and management challenges. To navigate these complexities, the territory relies on a "digital nervous system" known as geomatics: the science of collecting, analyzing, and visualizing location-based data to drive decision-making. At the center of this technological dynamic stands the "***New Caledonia GIS Club***".

A community of collective Intelligence, ***New Caledonia GIS Club*** is not only a technical group; it is a living community designed to structure, federate, and animate the geospatial ecosystem of the territory. Since its inception as an informal network in 2016, the club has grown to include 38 active member organizations. These members are distributed across eight distinct "colleges," representing a diverse mix of public administrations, private companies, research institutes, and NGOs. This diversity ensures that all perspectives, from ground-level operations to high-level research, are represented.



From ideas to action, the club's activity is driven by a practical rhythm designed to turn ideas into tangible tools. This includes:

- **Quarterly meetings:** To keep members informed of current events and regional developments.
- **Working Groups:** These groups collaborate on specific, member-proposed themes such as the use of drones, the exchange of geo-maritime data, and tracking UN Sustainable Development Goals (SDGs).

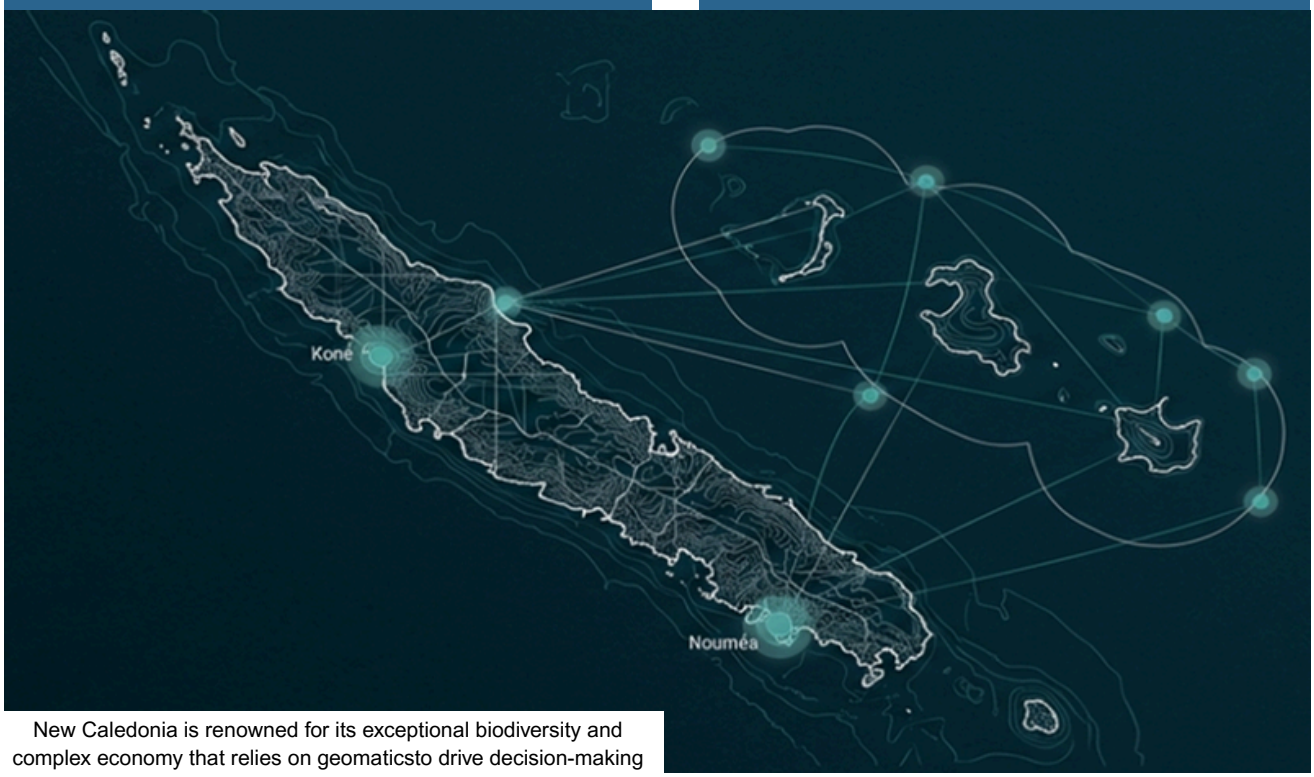


The map explorer allows you to view data from the government of New Caledonia and some data from its partners

- **Recommendation Sheets:** A key output of the working groups, these documents guide best practices and standardize approaches to facilitate the exchange of geographic data between different structures.

Celebrating and expanding the community, it gathers annually for GIS Day, a flagship event that showcases geomatic actions. Participation has steadily increased, growing from 152 attendees in 2019 to over 160 in 2023, featuring events like artistic mapping contests.

Looking beyond its own shores, the club has ambitious goals for the future. It is actively building regional bridges to create a **#PacificIslandsGISPower**. The network already includes members from Wallis & Futuna and French Polynesia and works closely with the Pacific Community (SPC). As the club facilitators note, in a region defined by vast oceans and shared climate challenges, sharing geospatial information is likely the key to unlocking a resilient future for the entire Pacific.



New Caledonia is renowned for its exceptional biodiversity and complex economy that relies on geomaticsto drive decision-making

In-Situ Sensors: The Missing Link for Pacific Resilience

by Michael Healy
edited by Angela Manchester

Why is the Pacific GIS community pivoting to sensors today? Recent events, from the 2025 Kamchatka Tsunami to the "cloud-blindness" experienced during the last cyclone season, have proven that our "Eye in the Sky" needs a "Pulse on the Ground." As maritime security threats evolve and infrastructure reaches its breaking point, real-time data is no longer a luxury; it is the baseline for survival.

Across the Pacific, Remote Sensing (RS) and Geographic Information Systems (GIS) have revolutionized how we map our islands and monitor the vast ocean between them. From Digital Earth Pacific's satellite archives to global flooding analysis tools, we have never had a better "eye in the sky."

However, as environmental challenges and security needs evolve, a critical challenge remains: The Ground-Truth Gap. While satellites provide an expansive macro-view, they often struggle with cloud cover, orbital revisit times, and the hyper-local nuances of island topography. To build true resilience, the next frontier for Pacific GIS is the integration of high-frequency, in-situ sensor networks.

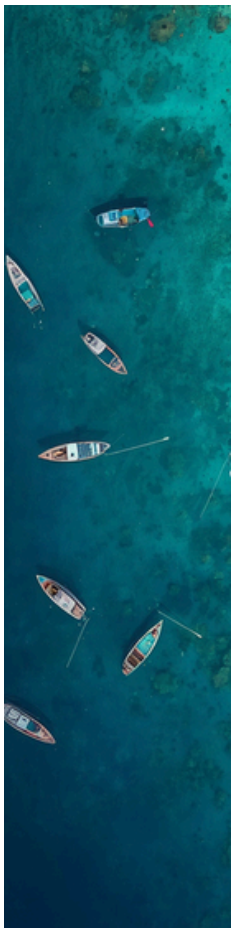
High-frequency, in-situ sensor networks are needed to ground truth local nuances of island topography across the Pacific

1**. Real-Time Calibration for Flood and Tsunami Surges**
In July 2025, a massive magnitude 8.8 earthquake off the Kamchatka Peninsula sent a tsunami across the Pacific Basin. While NASA's experimental GUARDIAN system (using GPS/satellite signals) flagged the wave, the event reinforced a critical point - for remote island communities, waiting for a tide gauge at a major port 500km away to confirm a wave is too dangerous. Distributed in-situ sensors provide local verification 30–40 minutes faster than regional networks, turning "estimated risk" into "confirmed reality."

Satellite altimetry is world-class at mapping flood extents post-event. But for a community in a low-lying atoll, "post-event" is too late. Integrating ground-based sensors—like the Attentis multi-sensor units—allows for live monitoring of river heights and coastal surge levels. When these sensors are networked, they provide the "ground-truth" needed to calibrate satellite models in real-time, triggering automated alerts long before the next satellite pass.

2. Maritime Security: Tracking Illegal Fishing
Protecting Exclusive Economic Zones (EEZs) is a significant challenge for Pacific nations. While AIS (Automatic Identification System) tracks compliant vessels, "dark targets" involved in illegal, unreported, and unregulated (IUU) fishing often go undetected.

- Visual & Acoustic Intelligence: Strategically placed sensors on coastal infrastructure use 360-degree high-definition and thermal imaging to detect vessel movement in protected areas.
- Integrated Data: By layering this local visual data over satellite SAR (Synthetic Aperture Radar), GIS officers can identify and verify suspicious vessels even when they have disabled their transponders.



3. Monitoring Climate Change at the Micro-Level
Global climate models often lack the granularity to show how climate change affects a specific valley, reef, or village.

- Micro-Climate Trends: Attentis sensors capture high-frequency data on temperature, humidity, and air quality at a hyper-local level.

Long-term Adaptation: This allows GIS professionals to move beyond regional averages and map exactly how micro-climates are shifting. This data is essential for "climate-proofing" local agriculture and predicting shifting habitats for endemic species.

4. Foreign Object Detection (FOD) for Critical Infrastructure

For island nations, the airport runway or shipping port is a lifeline.

- Automated Surveillance: Utilizing AI-integrated visual sensors, they can detect Foreign Object Debris (FOD) or unauthorized incursions on runways and restricted zones.

In-situ sensors can provide local verification 30–40 minutes faster than regional networks for real-time calibration for floods and tsunami surge

Safety & Continuity: In the wake of a storm, these sensors provide immediate visual confirmation of runway integrity, allowing for the rapid resumption of humanitarian and commercial flights without waiting for manual inspections.

5. Seismic and Multi-Hazard Resilience

By incorporating seismic sensing directly into environmental sensor nodes, we move from "estimated risk" to "measured impact." This data allows GIS officers to overlay real-time ground acceleration onto building footprints, instantly identifying which remote structures—such as communication towers or clinics—are most likely to have sustained structural damage during an event.

The Path Forward: A Hybrid Data Ecosystem

The goal for the Pacific GIS community isn't to choose between the "Eye in the Sky" and the "Sensor on the Ground." The goal is a Hybrid Ecosystem.

By layering live, in-situ data from on the ground sensors over traditional GIS layers, we create a "Digital Twin" of our environment. This doesn't just look like a map; it behaves like a living nervous system, providing the 24/7 situational awareness required to protect our islands from the frontline of climate change and maritime threats.

MEET THE AUTHOR

Michael Healy, Director of New Zealand Operations at Attentis Technology

Attentis®

Attentis provides integrated high-speed sensor networks designed for extreme environments. Our mission is to provide every community with the real-time information they need to stay safe, informed, and resilient. In his role, Michael is leading the company's growth across Aotearoa, helping deliver real-time monitoring networks that support environmental resilience, fire prevention, and critical infrastructure protection.

Image Credit © GeoAwesome

From Access to Impact:

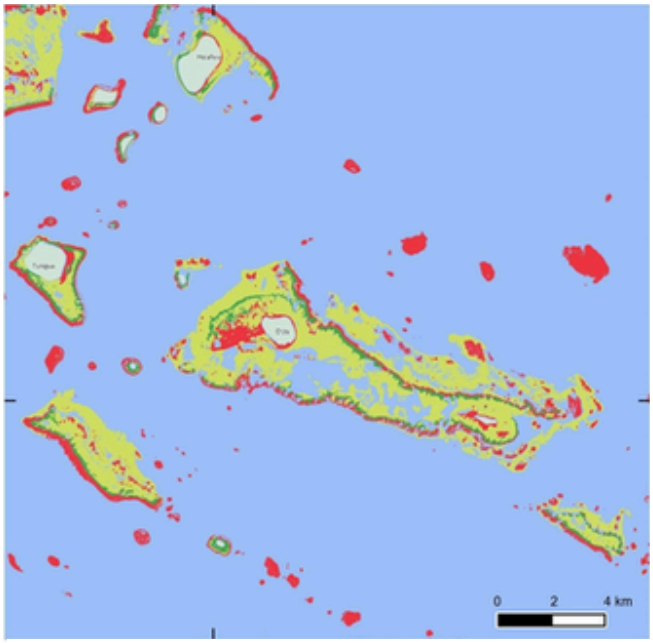
Advancing Coastal Monitoring with QGIS in the Pacific

by Naomi Jackson

Across the Pacific region, access to geospatial tools has long influenced how effectively countries can monitor their environments, plan infrastructure, and respond to climate risks. While advanced mapping technologies exist, sustaining their use beyond project timelines remains a challenge for many national institutions.

Over the past decade, open-source Geographic Information Systems (GIS), particularly QGIS, have emerged as a practical and sustainable solution. What began as an alternative for resource-constrained environments is now becoming a central tool in advancing geospatial capacity across the Pacific.

QGIS Training in Tuvalu



Examples of the QGIS outputs of one area selected in the Ha'apai Region of Tonga Archipelago (Peirano et al., 2023)[1].

Bridging the Gap in Sustainable GIS Use

A recurring challenge across Pacific Island countries is maintaining access to commercial GIS software after project funding concludes. Once licenses expire, institutions often face disruptions in their ability to continue spatial analysis, mapping, and data management.

[1] Peirano, Andrea, et al., 2023. Baseline Assessment of Ecological Quality Index (EQI) of the Marine Coastal Habitats of Tonga Archipelago: Application for Management of Remote Regions in the Pacific. *Remote Sensing*. *15*. *909*. 10.3390/rs15040909.

In this context, QGIS has proven to be more than a temporary workaround. It provides:

- **Cost-free access** to geospatial tools
- **Flexibility** for diverse applications
- **Independence** from licensing constraints

As a result, more countries are recognising QGIS as a long-term solution that supports continuity in national geospatial workflows.

Building Capacity Across the Region

Capacity building has been central to the adoption of QGIS in the Pacific. Training initiatives across countries such as Tuvalu, Tonga, Vanuatu, Solomon Islands, Fiji, the Republic of the Marshall Islands, and Samoa have introduced QGIS to a wide range of stakeholders.

Participants have included representatives from:

- Lands and Survey Departments
- Climate Change Divisions
- Fisheries and Environment Agencies
- Meteorological Services
- Disaster Management Offices

Initial engagement with QGIS is often met with curiosity and, at times, surprise at its capabilities. However, with guided training and continued support, users quickly develop confidence in applying QGIS for their specific national needs.

From Training to Practical Application

Beyond training environments, QGIS is increasingly being applied to real-world challenges across the region. In coastal monitoring, it plays a critical role in analysing shoreline changes and supporting climate adaptation initiatives.

For example, within coastal monitoring projects in the Pacific:

- Historical imagery and maps are **georeferenced and analysed**
- Shorelines are **digitised to track changes over time**
- Spatial outputs support **evidence-based planning and decision-making**

QGIS has also been used for:

- Drone data processing and mapping outputs
- Infrastructure and asset mapping
- Geospatial database management

Digitised Shorelines of Niutao in Tuvalu, output using QGIS

This versatility allows countries to use a single platform across multiple sectors, strengthening national geospatial systems.

Strengthening Local Ownership of Geospatial Work

One of the most significant benefits of QGIS adoption is the shift towards local ownership. With unrestricted access to tools and data, institutions are able to:

- Maintain and update datasets independently
- Develop standard workflows suited to local contexts
- Continue operations without reliance on external funding

Over time, this contributes to stronger institutional capacity and resilience.

Growing Confidence and Regional Collaboration

Follow-up engagements across countries have shown a clear progression in user confidence. Participants who were initially introduced to QGIS are now:

- Producing maps independently
- Managing spatial datasets
- Supporting internal training within their organisations

At a regional level, the use of a common open-source platform has also improved collaboration. Countries working on similar initiatives can apply consistent methodologies, share knowledge, and produce comparable outputs—strengthening regional geospatial cooperation.

Looking Ahead: Embedding Open-Source GIS in the Pacific

While progress has been significant, there remains an opportunity to further strengthen the role of open-source GIS in the Pacific. One key area is education. Many graduates entering the workforce have experience with commercial software but limited exposure to open-source alternatives. Integrating QGIS into academic curricula would:

- Build foundational skills early
- Reduce the need for retraining
- Support workforce readiness across the region

As the Pacific continues to address challenges such as climate change, disaster risk, and sustainable development, accessible and sustainable geospatial tools will remain essential.

Conclusion

The transition towards open-source GIS in the Pacific reflects more than a shift in software—it represents a move towards sustainable, inclusive, and locally driven geospatial practices. QGIS has demonstrated that high-quality spatial analysis is not dependent on costly systems, but on accessible tools, strong capacity building, and regional collaboration.

As adoption continues to grow, it offers a pathway for Pacific Island countries to strengthen their ability to monitor, understand, and respond to the changing environment—ensuring that geospatial knowledge remains in the hands of those who need it most.

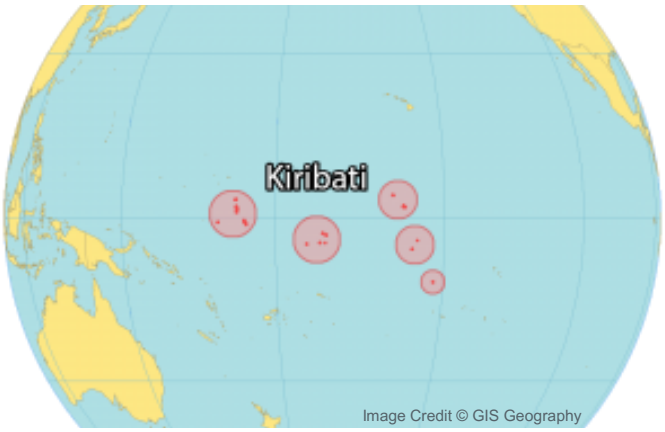
GIS & Remote Sensing in Kiribati: From the Early 1990s to Today

by Wolf Forstreuter, Litia Gaunavou, and Tiaotin Enari

The Republic of Kiribati has witnessed remarkable advancements in its GIS and Remote Sensing (RS) journey over the years. From the early days of manually hand-drawn maps and aerial photograph interpretation and analysis to the current use of geospatial software and platforms, GIS and RS tools have played a significant role in strengthening Kiribati's geospatial capabilities. The following outline traces the history of this journey, largely guided by national government needs and collaboration with regional organisations such as the South Pacific Applied Geoscience Commission (SOPAC) and later the Pacific Community (SPC).

1990s – Early Beginnings

GIS and RS were not formally recognised within Kiribati's government structure. Initial mapping applications were land-based and relied on coordinates collected manually by land surveyors. With maps drawn by hand and with limited accuracy, often based on general knowledge of land features. These datasets were then stored on plastic sheets as reference material. Later, "mapping" came in[1].



In May 1992, SOPAC organised a dedicated aerial photography mission over South Tarawa. The team was led by Richard D. Gillie. The flight covered Betio, Bairiki, Bikenibeu, Temaiku, Bonriki, and the Nippon Causeway areas[2]. The products were delivered on CDs containing rectified low-level colour aerial photography at a scale of 1:3,000. The CDs also included initial interpretation layers such as building outlines, roads, coastlines, vegetation and related features. The projection used was UTM WGS84. The Lands Department

distributed copies rather than storing them locked away in cupboards.

The first article in the Pacific Islands GIS & RS Newsletter related to Kiribati appeared in the 1999 Issue 02 edition: Robert Smith, *"Coral Reef Management in Tarawa and Abaiang"*[3]. Another important driver of GIS development occurred when Wolf Forstreuter, while travelling to support GIS activities in the Marshall Islands, was stranded in Tarawa for several days. During this time, Tebutonga Ereata, Director of Lands, contacted Wolf and requested assistance in preparing a GIS and RS development project proposal.

After the Turn of the Millennium – First Development

In 2003, the European Development Fund (EDF) provided funding to support the introduction of GIS using MapInfo Professional and ERDAS IMAGINE as the RS tool. The project also procured a Global Positioning System (GPS) to improve the accuracy of field data collection.

During the planning stage of the EU project's GIS and RS component, Ms Naomi Atauea prevented SOPAC from sending a fact-finding mission. Instead, she presented the project proposal of Tebutonga Ereata and stated, "We know what to do."

First GIS training in Kiribati in 2003 provided by Litea and Wolf for a wide range of users

Shortly after this statement, the first training sessions and system installations commenced without any fact-finding mission. The training was conducted in a hands-on style, involving all interested government departments. It was also a period marked by the election of a new president under whose administration development initiatives were strongly encouraged.

A very interesting GIS installation happened in Kiribati's Telecommunication utility. Naibunaki Teraoi installed the GIS covering all asset items of the utility without any help from outside. He followed the instructions on SOPAC's website, not knowing that SOPAC GIS assistance was available. He got an award for his presentation at the Pacific Islands GIS&RS User Conference.

The Lands Department supplied all GIS units with software copies and basic datasets and GIS was subsequently implemented in many locations throughout Tarawa. Following the model established in Fiji, a GIS and RS user group was

Training of vegetation mapping, where the different potential strata are written on the blackboard, and the projector displays satellite images and photos taken during the field trips

formed to discuss spatial issues and provide mutual support among users. In one of the resulting newsletters, highlighting some of the first GIS & RS activities in Kiribati[4].

The first very high-resolution image data were captured by the IKONOS satellite. At that time, the company Space Imaging did not have accurate reference data, and the first images showed water but no visible islands. During the time of the first GIS and RS training sessions, Litea Biukoto established a base station equipped with a battery and solar panel at the centre of an island and then walked along the vegetation line. The "vegetation line" refers to the boundary between green vegetation and the bright beach sand, which is clearly visible in satellite imagery. She carried out this process on five different atolls, enabling the company to calibrate the satellite image data accurately.

In 2009, SOPAC supported a land-use mapping initiative in which the Agriculture Department, Lands Department, and Department of Environment worked together. One specialist initially worked at SOPAC, first Taato Murdoch and later, for several years, Kataebati Butaua.

The Food and Agriculture Organization (FAO) Measurement, Reporting and Verification (MRV) programme, under which countries are required to submit annual reports on vegetation conditions to Rome, was able to utilise the land-use mapping products and represented the

Field plots of the coconut resource inventory, Maio Tebania (Agriculture Division of Natural Resources) counts coconuts as fertility indicator

first quantitative approach to vegetation monitoring in Kiribati. As a result, the position at SOPAC was financed by the Agriculture and Forestry Department of the Pacific Community (SPC).

All atolls of Kiribati were mapped at a scale of 1:10,000 and stratified into categories such as shrubland, forest patches, coconut areas, mangroves, and other land-use types.

Kiribati had a major interest to map the coconut resource. Together with SOPAC, a method was developed to count the available palms through a statistically sound method. The coconut palm areas were stratified into three densities, and in image sample plots, the number of palms was counted using a semi-automatic approach. These counts were then extrapolated to estimate totals across each stratum. Again, this was carried out for all atolls in Kiribati. The coconut production was estimated as a factor of available palms per hectare.

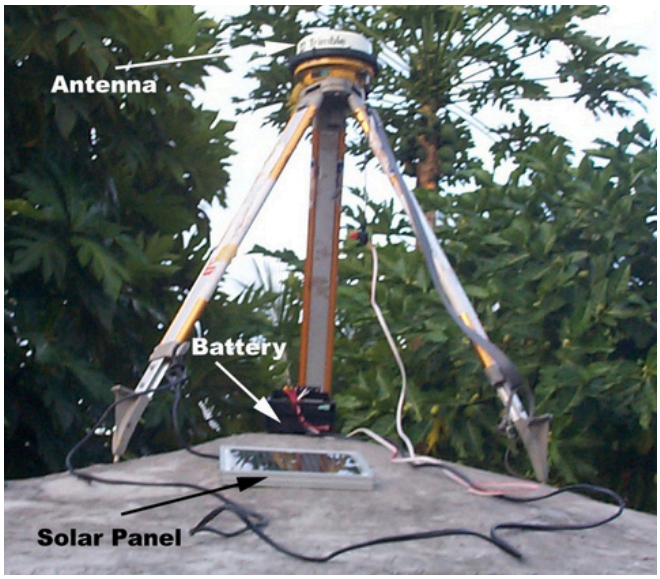
In 2013, coconut palm mapping was supported by field plots where additional parameters were captured, such as age, height, fertility, biotic damage, etc. The plots also allowed to quantify the difference palms visible in the image data

and actually on the ground[5]. The method was developed in Tarawa with the Kiribati Department of Agriculture. The method was then applied in Tonga, FSM, and other countries [6, 7].

SOPAC identified historical vegetation maps from Kiribati and Tuvalu. The vegetation maps were originally developed by the UK Directorate of Overseas Survey in the UK, released in 1973, based on aerial photographs recorded in 1969. These historical maps were subsequently overlaid with very high-resolution (VHR) satellite imagery (QuickBird and GeoEye) for all islands, enabling quantitative change detection analysis. The results indicated that the Kiribati atolls have been increasing in size rather than decreasing[8]. All over 30 related reports are downloadable from the PGRSC website.

Kiribati was one of the first countries to receive drone training through SPC, performed by a German consultant[9]. In 2012, when SOPAC merged with SPC, the GIS unit had established Pacific-wide GIS&RS guidance offering a range of software training. The government ministries in Kiribati started to adopt QGIS. The access to pre-processed satellite data was also available. This era witnessed the emergence of the Kiribati GIS User Group, which was started by Wolf, Litea and Tiontin in 2003.

Self powered GPS base station, test run on a water tank in Tarawa



2020s – Expansion and Integration

To date, the expansion of GIS and RS has become integrated into the land, environment, and planning sectors in Kiribati. The infrastructure has evolved to support high-end GNSS technology as well as free online data platforms such as Google Earth Engine.

Recent support from the Pacific Community (SPC) included conducting training for the Kiribati Women in Mapping (KWIM) initiative and the Kiribati Marine Spatial Planning Coordinating Committee (KI-MSPCC). This was the first training programme specifically customised for a local women's non-profit group, promoting the mainstreaming of geospatial technologies and encouraging women to utilise GIS and RS in their community-based projects.

The Land Management Division established a Ministry GIS Users Group in 2015, together with its Terms of Reference (TOR). The MELAD GIS Users Group consists of representatives from the Land Management Division, Agriculture and Livestock Division, and Environment and Conservation Division, all of which fall under the Ministry of Environment, Lands and Agricultural Development (MELAD). The group now conducts monthly meetings and basic GIS training sessions, including field data collection using Garmin GPS devices, as well as downloading and processing the data in QGIS.

Current Applications in Kiribati

Apart from the broader range of applications currently being utilised, the main GIS and RS applications within the Department of Lands are:

- urban planning and land-use management
- coastal erosion and climate risk monitoring
- infrastructure development and environmental protection
- disaster preparedness and response

Kiribati Marine Spatial Planning Coordinating Committee (KMSPCC)

Conclusion

The journey from manual, paper-based mapping to the advanced GIS and RS environment of today within the Government of Kiribati demonstrates the value of collaboration between national focal points and regional organisations. The sharing of specialist knowledge has helped build both technical systems and a collegial culture of learning and capacity development.

In conclusion, continued investment in technology, capacity building, and policy frameworks will ensure that GIS and Remote Sensing remain central to sustainable development and climate resilience in the country.

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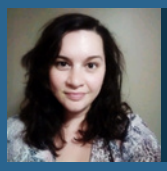

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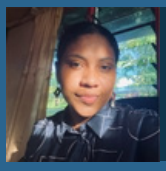

Aliti Beitaki,
Editing Assitant

Pacific GIS and
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