

# A Climate Services Dialog to Build Sector-Based Climate Early Warning Systems in the Republic of Palau

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## KEYWORDS:

Pacific Ocean;  
Climate change;  
Adaptation;  
Agriculture;  
Climate services;  
Health

## Climate Services Dialog

**What:** Approximately 100 participants representing different sectors from Palau's national and local government, communities, nonprofits and NGOs, and academia engaged in a 2-day workshop on the need to translate existing climate data into relevant, tailored products for Palau's critical sectors.

**When:** 28–29 February 2024

**Where:** Koror, Republic of Palau

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## 1. Introduction

Communities throughout the Pacific Islands region are highly vulnerable to the effects of climate variability and change and have therefore become leaders in climate research, advocacy, and adaptation (Parks and Roberts 2006; Farbotko and McGregor 2010; Majuro Declaration 2014; Pacific Islands Development Forum 2015; Frazier et al. 2023). Through the ongoing Pacific Islands Regional Climate Assessment (PIRCA) process (Keener et al. 2022), researchers and practitioners have collaboratively identified a range of climate change impacts on communities and ecosystems in the U.S.-Affiliated Pacific Islands (USAPI) region, which includes the Territories of Guam and American Sāmoa, the Commonwealth of the Northern Mariana Islands, and the Freely Associated States: the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands (Keener et al. 2012; Grecni et al. 2020; Miles et al. 2020; Grecni et al. 2021; Keener et al. 2021; Grecni et al. 2023). The assessments have also identified gaps in sector-specific climate information relevant for each location, as well as decision-making or planning horizons. To properly plan for and build resilience against future climate impacts, decision-makers need integrated climate services and information that are easy to access and that seamlessly cover both short-term (subseasonal) and longer-term (seasonal to interannual) projections (Scott et al. 2011).

The Republic of Palau, a sovereign nation in free association with the United States and part of the USAPI, lies in the northwest tropical Pacific with a total land area of 535 km<sup>2</sup> spread over 500 islands, 9 of which are inhabited by approximately 17 600 people (Palau Population Census 2020). Observed and projected climate impacts include higher precipitation, heat stress and drought, wildfire, landslides, coral bleaching, ocean acidification, coastal erosion, and other threats to ecosystems and livelihoods (Miles et al. 2020). Impacts on nearshore environments, in particular, pose risks to coastal communities in Palau due to sea level rise, landward flooding, storm surge, and destruction from extreme weather events (Republic of Palau 2015; Miles et al. 2020).

As a result, multiple plans and policies have been developed to inform sector-based adaptation to climate change in Palau (Table 1). Palau's 2015 Climate Change Policy (PCCP) established a "no regrets" approach to adapting to expected changes in climate through cross-cutting measures within every major sector (Republic of Palau 2015). The Palau Climate Change Office is currently updating the PCCP to reflect the latest climate assessments, with a focus on linking it with state-level vulnerability and risks. The Palau Development Plan (PDP) encompasses 16 development sectors across five strategic pillars, including climate (Republic of Palau 2023). The plan builds on and updates prior national and sector-specific plans, including the first Voluntary National Review (VNR) of the United Nations Sustainable Development Goals (SDGs) in 2019 (Republic of Palau 2019). There are also sector-based plans, such as the Palau Blue Prosperity Plan (PBPP) [Ministry of Agriculture, Fisheries, and the Environment (MAFE) 2022], and national and regional reports like Palau's State of the Environment (SoE) Report

**TABLE 1. Shading indicates sectors that are represented across plans and reports related to climate and the environment in Palau, including the PCCP (Republic of Palau 2015), PDP (Republic of Palau 2023), VNR (Republic of Palau 2019), PBPP (MAFE 2022), SoE (NEPC 2019), Palau PIRCA (Miles et al. 2020), and PCCM (Marra et al. 2022).**

Sectors represented	PCCP	PDP	VNR	PBPP	SoE	PIRCA	PCCM
Agriculture, forestry, and fisheries	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
Health	Shaded	Shaded	Shaded				Shaded
Biodiversity and natural resources	Shaded	Shaded	Shaded			Shaded	
Society and culture	Shaded	Shaded	Shaded		Shaded		
Tourism	Shaded	Shaded	Shaded	Shaded			Shaded
Infrastructure	Shaded	Shaded	Shaded		Shaded		
Utilities	Shaded	Shaded	Shaded		Shaded		Shaded
Finance, economics, and trade	Shaded	Shaded	Shaded			Shaded	
Education	Shaded	Shaded	Shaded				

[National Environmental Protection Council (NEPC) 2019], the Palau PIRCA report (Miles et al. 2020), and the Pacific Islands Climate Change Monitor (PCCM; Marra et al. 2022) that inform priorities and frameworks.

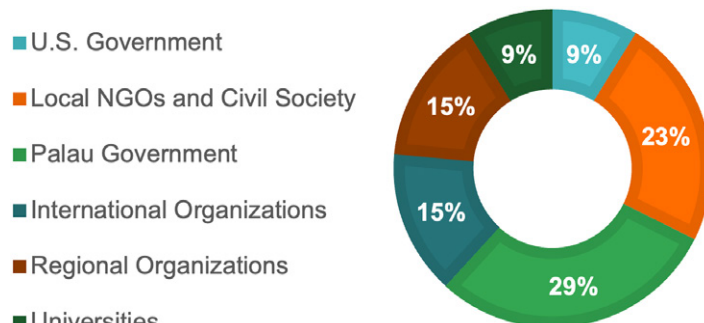
Building on Palau’s interest in sector-specific climate information to support adaptation planning, the Pacific Research on Island Solutions for Adaptation (Pacific RISA) program, the National Oceanic and Atmospheric Administration (NOAA) Climate Adaptation Partnership for the U.S. Pacific Islands region, codeveloped a workshop focused on climate services in Koror, Palau. Supported by a United Nations (UN) Environment Programme multicountry initiative financed by the Green Climate Fund,<sup>1</sup> Pacific RISA worked with NOAA, the University of Hawai‘i International Pacific Research Center, and in-country partners from the Palau Ministry of Finance Bureau of Budget and Planning, Palau Office of Climate Change, and the Palau Weather Service Office to identify and develop actionable, locally relevant climate information such as real-time observations, forecasts, and long-term trends for sector-based decision-making and early warning.

<sup>1</sup> <https://www.greenclimate.fund/project/fp147>.

## 2. The workshop: A Climate Services Dialog

The workshop followed the format outlined in the Pacific Islands Climate Storybook (Marra et al. 2021), which details an extensive Climate Services Dialog process with technical materials, process guides, and activity templates for users. Approximately 100 participants representing various sectors from Palau’s national and local government, communities, nonprofits and NGOs, and academia attended (Fig. 1). This approach has been applied numerous times throughout the Pacific Islands region (Marra et al. 2021), and in addition to being easy for decision-makers to understand and apply, it can serve as a model for governments and other organizations that seek to engage communities in adapting to a changing climate. Some guiding principles for the Dialog process include the following:

- Focusing on the transformation of information by placing content in a form that is easily



**FIG. 1. Institutions represented at the 2024 Palau Climate Services Dialog.**

understood and readily accessible, aggregating and customizing it so it is place based and sector specific, and linking it to local or traditional knowledge and terminology.

- Grounding climate information and services development and delivery in the iterative coproduction of knowledge at multiple levels to ensure that science and services are appropriately applied to relevant problems and questions (Jagannathan et al. 2021).
- Integrating program planning and product development by directing attention to the alignment and coordination of activities needed to minimize gaps and overlaps and to support sustained capacity development in the region.

### 3. Findings and outcomes

**a. Share climate knowledge: Climate stories and historical timelines.** At the start of the Dialog, participants shared climate “stories” in which they described their first-hand experiences of climate events in Palau and what type of information or early warning they had access to. One storyteller shared her memories of taking her children to school during Typhoon Surigae in 2021 when local disaster warnings and communication systems failed. Another described working in Palau’s disaster response but feeling underprepared to deal with the needs of many residents following a flood-induced landslide, and a third shared her stories of how drought is impacting Palau’s taro farming industry and culture. Some key messages and best practices that were identified during the subsequent discussion were as follows:

- Need to engage locally—warnings might be issued by a central office, but they have to reach the local people more effectively.
- Learn from past events—look backward to when an event occurred before (e.g., the 2015–16 El Niño) for lessons on how to prepare or respond in the future.
- Collaborate across levels of governance—departments, states, and village chiefs should deliver the same message at the right times.
- Pay attention to local observers and practitioners—they are the ones who might be the first to be aware of evidence of a brewing problem or have ideas on how best to adapt.
- “Who you know” is the status quo—people get information from trustworthy sources, so it is important to improve existing information pathways and fill gaps.

**b. Historical events and impacts.** After the storytelling activity, participants shared their collective knowledge of past climate-related events and the impacts that were experienced by developing a historical timeline (Fig. 2) and identifying the locations of those events and impacts on national and state-level maps (Fig. 3). Key guiding questions for this exercise were as follows:

- What historic climate-related events have impacted specific sectors or resources of interest?
- What areas were impacted by these events?
- How long did the events last and how often did they occur?
- What are the patterns and frequency of these events? Have these climate-related events occurred at the same time?
- What were the impacts of the climate-related events (e.g., ecological, socioeconomic, infrastructural, or cultural)?
- What priority issues have you had to deal with as a result of these impacts?

After capturing this information, the day concluded with a discussion of lessons learned—both best practices and opportunities for improvement—related to measures that could be taken to increase community resilience in light of a changing climate. In particular,

# Climate Events

TY = Typhoon; EN = El Niño; LN = La Niña

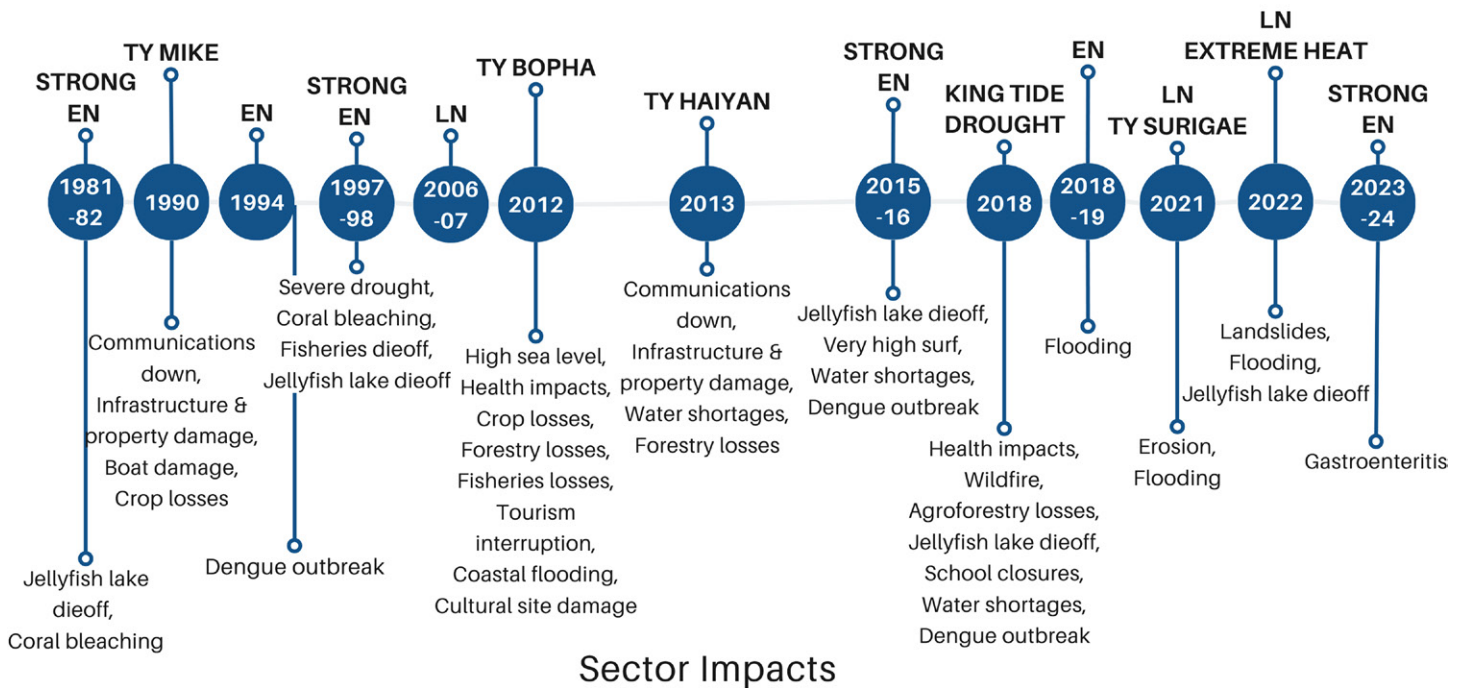


FIG. 2. Timeline of historical climate events and sector impacts in Palau since 1980, as developed by participants during the Climate Services Dialog. Note: Timeline is not to scale.

participants identified where specific actions can be taken to enhance situational awareness and early warning in Palau.

**c. Diagnosing early warning systems.** The second day of the Dialog was focused on diagnosing the strengths, weaknesses, and opportunities for existing climate services to support climate early warning in two priority sectors: agriculture and health. In small groups, participants followed the “Ready–Set–Go” framework (Marra et al. 2021) to identify existing products and services that support situation awareness—in the framework, “Ready” refers to ongoing planning and forecast monitoring activities, updating contingency plans, and enabling early warning systems. “Set” is a progression during which the responsible agencies continue monitoring and adjusting plans as needed, issue warnings to communities, and conduct local preparation activities. “Go” is the time to activate response mechanisms and instruct communities to evacuate, if needed. Throughout this session, participants described the information flow of actions related to different climate events and impacts and identified both gaps in the current systems as well as key actions needed for climate early warning.

**1) KEY THEMES FOR THE AGRICULTURAL SECTOR.** Participants agreed that the climate events most relevant to the agricultural sector are precipitation extremes (drought and heavy rainfall), sea level rise and saltwater intrusion due to high tide events or storm surges, and strong winds related to tropical cyclones. Taken together, these impacts translate into crop losses, especially with respect to taro production that often occupies vulnerable coastal areas and is sensitive to changes in precipitation that affect planting, harvesting, and weeding schedules. While existing tools like the Clime app,<sup>2</sup> official weather forecasts, and traditional knowledge are being used to make decisions, there are limitations to their use—such as inaccurate forecasts that cause uncertainty in decision-making, and a need for better drought warning

<sup>2</sup> <https://climeradar.com/>.



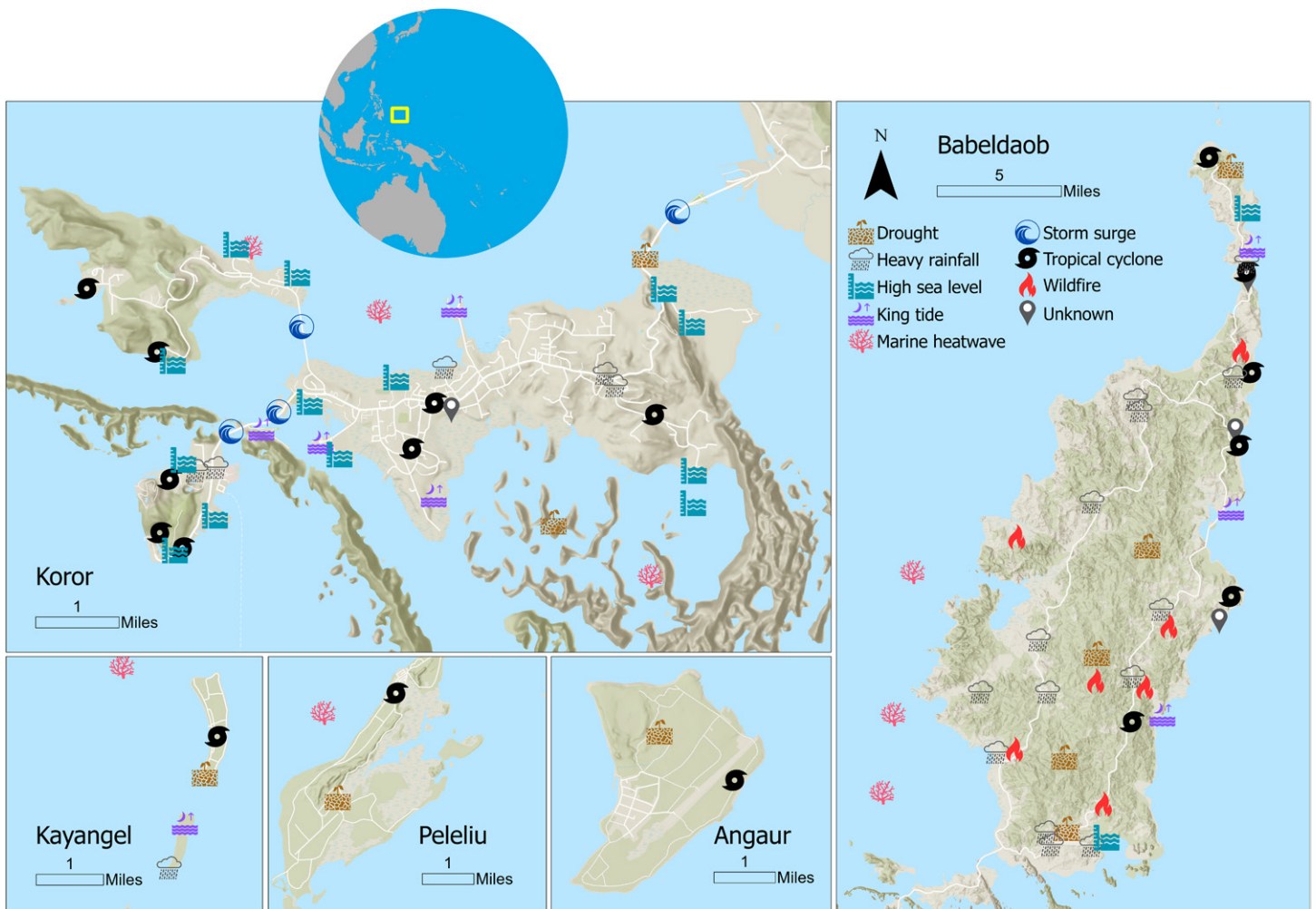


FIG. 3. Locations and types of historical climate impacts in Palau's states of Koror, Kayangel, Peleliu, and Angaur and the island of Babeldaob. The yellow box in the top inset shows the location of Palau in the western Pacific Ocean.

plans and communication strategies to ensure timely response. Farmers, especially women, were highlighted as key stakeholders who need to be informed about climate events and their impacts; on the other hand, women are increasingly leaving the agricultural workforce for other employment and have less time to cultivate food. Improving local understandings of the thresholds and tolerances of different taro crop species could also enable farmers to take action. For example, planting and harvesting could be done before a period of hot days.

**2) KEY THEMES FOR THE HEALTH SECTOR.** For Palau's health sector, extremes in precipitation were once again identified as relevant climate events, as well as periods of high humidity and low wind. These affect outbreaks of vector-borne disease, incidence of heat-related illnesses, and economic losses due to workforce impacts—all of which may be felt by communities, states and regions, and even nationally. Warning signs for vector-borne disease outbreaks in particular must be monitored to ensure early detection and response. Once a threshold is met, for example, Palau's Ministry of Health Emergency Operations Center initiates alerts, house cleanups, and monitoring through different channels including social media and radio. Village leaders transmit information locally, and education campaigns promote community-based prevention and response efforts. Efforts are currently underway to develop climate outlooks specifically tailored for vector-borne diseases, aiming to establish correlations between weather events and disease outbreaks. Nevertheless, there

is no sector-wide coordination mechanism for health with international partners in Palau, and ongoing challenges include staffing limitations and gaps in preventive measures.

**3) PUTTING IT ALL TOGETHER.** In the final Dialog session, participants once again formed small groups to collaborate on designing an ideal climate early warning system [Climate Risk and Early Warning Systems (CLEWS)] tool tailored to their sector. Common themes and elements emerged across these groups, including the following components, features, and functionalities:



FIG. 4. Graphic interpretation of the Climate Services Dialog in Palau by artist Janine Tewid. Photo credit: Pacific RISA.

- Incorporation of multiple sector-based hazards and monitoring capabilities.
- Information that is easily read and understood (e.g., a three-tiered, color-coded alert system; translating text into the Palauan language).
- Inclusion of a monthly forecast and identification of hotspots or points of interest.
- Establishment of a web portal accessible to all relevant agencies, combined with a public-facing mobile-optimized application and web page linked to existing bulletins, for access to real-time information and alerts.
- Inclusion of adaptation actions, traditional and local knowledge, links to additional resources and information, and contacts.

Throughout the Dialog, a local Palauan artist produced a live illustration that captured key messages, climate stories, CLEWS components, and feedback to visually tell the story of the event (Fig. 4). The artwork was presented as a gift to the Palau Office of Climate Change at the close of the Dialog.

#### 4. Next steps

**a. Develop sector-based CLEWS tools.** After sharing a full Dialog summary with partners and participants, Pacific RISA will convene virtual follow-up sessions with each sector to ensure that information was captured correctly and identify any gaps. This will also be an opportunity to invite and hear from sector practitioners who were unable to attend the Dialog. Using the information from the Dialog and follow-up sessions, the team will conduct a review of CLEWS approaches and methodologies. The data and web development team will collect available climate indicator data to create a draft CLEWS tool for each sector. This draft will form the basis for the next in-country workshop to receive feedback and iterate.

**b. Coordination mechanism and approach.** A final key theme that was highlighted throughout the Dialog was the need for improved coordination and collaboration across technical partners to minimize the duplication of effort, reduce the burden on stakeholders, and increase the equity, effectiveness, and sustainability of climate initiatives. In addition to increasing coordination capacity within the Green Climate Fund specifically and across appropriate projects, strengthening interagency opportunities for alignment across regional

programming could increase coordination and, in turn, support projects on the ground. Better approaches to coordination across the donor community working in the Pacific Islands region could also contribute significantly to increasing the access and effectiveness of climate projects in Palau and across the region, as they navigate both multilateral and bilateral climate initiatives, grants, and loans. Specifically, encouraging donors to prioritize harmonization across initiatives and procedures, and converge and integrate them into national and local systems, could help reduce the burden on stakeholders, leverage funds and expertise, and accelerate project outputs and goals that enhance the effectiveness of adaptation efforts. Participants voiced the need for regional-scale, sector-based coordinating fora for climate and climate-adjacent organizations to share knowledge, create new and innovative partnerships, develop joint response plans and protocols, and collaborate to build regional networks.

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