

PALAU



Country Brief

Project Site Description

1.0 INTRODUCTION and CLIMATE IMPACTS IN PALAU

1.1 Introduction to Republic of Palau

The Republic of Palau (ROP) became an independent nation in 1994 with the arrangement of Compact of Free Association with the United States. Republic of Palau is situated North of Equator 7°20'23" N latitude, 134°28'23" E longitude. Palau is made up of 16 states and has a total land mass of 187 square meter miles counting in the Rock Islands. These 16 states have their own constitutions that govern governmental matters. About 80% of the populations live in Koror State.

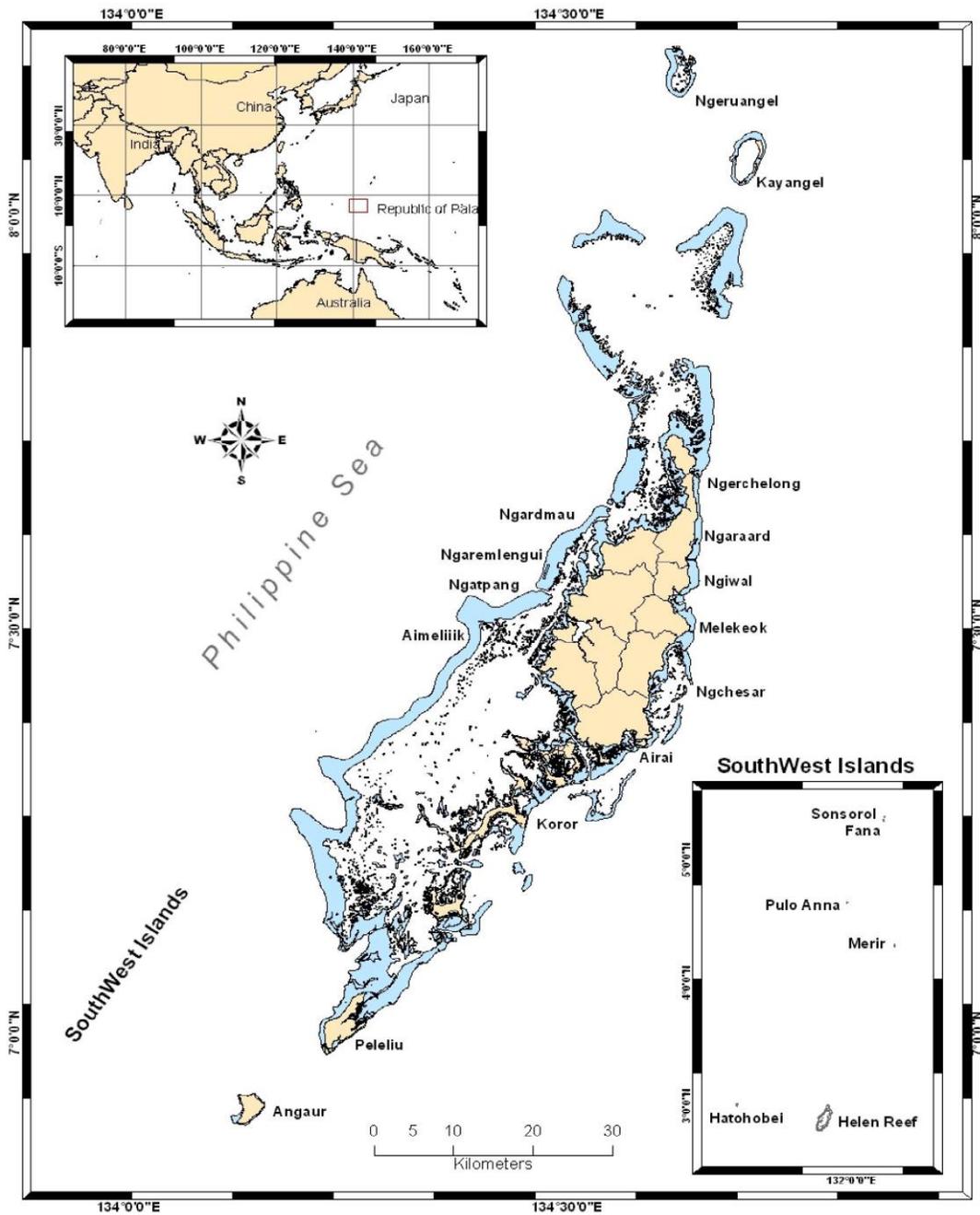


Figure 1. Map of Palau. Source: PALARIS.

1.2 Climate Change projections and impacts for Palau

Information on Climate Change projections came from the 2019 State of the Environment Report, Republic of Palau (2019 SOE) which compiled information from a wide variety of sources including Coral Reef Research Foundation (CRRF), PACCSAP (Pacific-Australia Climate Change Science and Adaptation Planning Program), the University of Hawaii Sea Level Center, Palau International Coral Reef Center, and published studies. Information on Climate Change's expected impacts came from the PIRCA Climate Science Summary Update (2020) and published studies.

Air Temperature:

Palau climate is mostly dry from January to May and June to December with most rains. Palau's future climate projections indicate an increase of 0.7-1.7°F (0.4°C-1.0°C) of air temperature with increasing variability. Palau's weather station and one of the weather gauges are located in Airai, giving the State the most accurate weather data in the country.

Human impacts:

- Older persons, those with chronic diseases, and persons with disabilities may be more vulnerable to extreme heat days.
- People who work outdoors (tour guides, farmers, construction workers, etc.) may be exposed to high heat days, both at a risk to their health and with potential loss of productivity.
- Children in schools without air conditioning may suffer heat-related loss of learning.
- Economic losses from crop losses may occur.
- Economic costs and carbon emissions associated with cooling and air conditioning may increase.
- Warming may increase the activity of disease vectors, such as dengue-carrying mosquitos.
- Hotter days will increase water demand.

Environmental impacts:

- Increasing temperature is associated with increased incidence of plant diseases and increased likelihood of pests, including in staple crops such as bananas.
- Higher temperatures will increase evapotranspiration affecting the amount of water that crops require and the amount of water available in soil. This may enable crop expansion in some areas, but may also require more irrigation.
- Seasonal planting and harvesting patterns may change as a result of changing temperatures, thus needing adjustment.
- Higher temperatures combined with drier dry seasons increases the likelihood of fire.
- Higher temperatures may be associated with increased spread of invasive species.

Sea surface temperature and Ocean acidification:

Temperatures at multiple reef depths (shallow to deep) indicate an upward trend in water temperatures of about 0.03° per year (or 0.3°C per decade). Trends for deeper depths have greater variability. Projections for annual sea surface temperature are for a continued increase. By 2030, under a very high emissions scenario, this increase is projected to be 0.6-1.0°C (2019



SOE). Coral reef bleaching can occur when temperatures exceed 30 degrees for days to weeks. In mid-2019 there was no bleaching trend expected for Palau, but that is highly variable. By 2040 predictions suggest Palau will have widespread bleaching occurring annually.

Declining coral reef health is associated with lower reef fishery productivity and may negatively impact Palau's tourism industry. Combined with ocean acidification, declines of more than 50% are predicted under a business-as-usual scenario by 2100 for most of the islands in the central and western Pacific.

Ocean water acidity (declining pH) has been steadily increasing in Palau's waters and is expected to continue to increase in the 21st century. Many areas in the Rock Islands are naturally more acidic, and coral reefs there are more acidification-resistant due to chronic exposure.

Human impacts:

- Both nearshore and offshore fisheries have declined and are expected to decline more due to climate change, in all habitats. Reduced supply of fish and invertebrates will hurt income and food supplies.
- Costs and carbon emissions associated with accessing fishing and gleaning areas will likely increase.
- Combined with acidification, coral health is expected to decline, and Palau's reefs and unique marine habitats (such as Jellyfish Lake) will not be able to support high numbers of tourists, with loss of income and negative impacts on Palau's branding and value.

Environmental impacts:

- Coral reef health is expected to decline.
 - Eastern reefs (Airai's reefs are on the East) were heavily damaged by typhoons in 2012 and 2013 and were still in poor condition in 2016.
- The importance of coral refugia, such as resilient reefs in Ngermid, will increase.
- Nearshore and reef fishery availability and catches are expected to decline. Combined with the impact of ocean acidification and typhoons, reef fish abundance is predicted to decline by 23% by 2040, even under a best case scenario. Other scenarios predict a decline in reef fishery productivity by as much as 76%.
 - Reef fisheries declined by approximately 18% in Ngerumekaol Channel (in Koror) between 1991 and 2014, despite its status as a protected area, likely due to the long-term effects of bleaching in 1998.
- Offshore fishery productivity – especially tuna – is expected to decline in Palau's EEZ by 25% in the next few decades. Projected declines range by species, with declines 12-28%. Biomass north of Palau is expected to decrease by as much as 43% (south of Palau it may increase by 15%).
- Increased sea surface temperature may increase the potential for aquatic animal diseases and harmful algal blooms.
 - This may negatively impact tourist sites.
 - This is expected to decrease the productivity of aquaculture. Increased sea surface temperature may decrease the availability of wild seed.

- High water temperatures can negatively impact Palau's unique marine lakes. Airai has several marine lakes, all of which have unique assemblages of flora and fauna, including different species of jellyfish.
- Outside of the Rock Islands, coral skeletal bioerosion is expected to increase as waters become more acidic.
- Lower pH-tolerant coral reefs (refugia) will become more important.

Sea level rise

Sea level projections vary widely, ranging from 1.6 to 7 inches (4 to 18 cm) by 2030. Palau's sea level is rising at the global rate when yearly rates are considered (SOE 2019). However, sea level rise is variable, with some years seeing drops in sea level associated with El Nino. Since 1993, sea level in Palau has increased by approximately 9 mm/year. Using Palau's yearly rate, sea level rise by 2030 is expected to be around 90 mm (9 cm; 3.5 inches).

Human impacts:

- Homes near the coast are vulnerable to damage and loss from sea level rise, coastal erosion, or from flooding during storms.
- Many cultural and historical sites are in low-lying areas and risk being damaged or lost due to sea level rise.

Environmental impacts:

- Salt water intrusion into low lying taro patches, farms, and water sources is a growing problem, with loss of crops. An estimated 6% of taro crops are lost annually due to salt water intrusion.
- Coral reefs are not expected to be highly impacted by sea level rise, as shallow reef flats are able to grow at pace with sea level rise. Drops in sea level can lead to mortality of some corals.
 - The importance of resilient coral refugia will increase.
- Mangroves generally have low vulnerability to sea level rise, as they are able to grow at pace with the rising seas.

Stronger Typhoons and Storms

20 typhoon and storms passed through Palau's EEZ between 1945 and 2013, averaging 1 typhoon every 3 years. Kayangel was the most often the closest point to the typhoon. Predictions are not clear on the expected future frequency of typhoons, although some models predict a decrease in the number of typhoons. However, those that will occur are expected to be of higher intensity, with an increase in wind speed of 2-11% and increase in rainfall intensity of 20%.

Human impacts:

- Storms can cause power outages and require evacuation for safety. Older adults and persons with disabilities, foreigners without support networks, and children are particularly vulnerable to storm impacts.

- Economic impacts from storms also disproportionately impact poor and vulnerable populations through lost income and recovery costs.
- Mental health impacts are associated with strong storms, especially in coastal populations.
- Storms can disrupt communications, transportation networks, food supply, housing, and infrastructure (including water, electricity, and sewer) which carry health and safety risks.
- With a high reliance on imported foods, typhoons can disrupt food security. There was a 3-week delay in resuming imports after typhoons in 2012 and 2013.
- Coastal flooding is expected to negatively impact coastal properties and infrastructure.



Figure 2: Extensive loss of banana trees during Surigae Typhoon, April 16-18, 2021

Environmental impacts:

- Storms can cause significant damage to coral reefs and marine environments. Some shallow coral reefs have lost nearly all live coral cover.
 - Recovery of damaged reefs takes over a decade.
 - Deeper reefs (30-150 meters deep) have also declined due to the effects of storms sending sediment and rubble downslope.
 - Algal blooms on reefs in Palau have been documented after typhoons.
- Seagrass cover declined by 20-30% from 2011 levels after typhoons in 2012 and 2013.
- Shorelines are susceptible to erosion and landward movement due to storms. Shorelines in Palau have generally stabilized due to new vegetation, but in some places, a steady loss

of beach has been seen. Ngardmau shorelines are well protected in most cases by mangroves.

- With much of Ngardmau land at a slope of high or medium, there is a greater risk of slope failure following intense rainfall events.



Figure 3: Remachel, Choll, Ngaraard expansion of beach and sand bar after Typhoon Surigae.

Increasing rainfall, Rainfall variability, and Extreme weather

Total annual rainfall appears to have increased by 7.6 cm (~3 inches) between 1948 and 2011. It is difficult to project exactly how rainfall will change, except that rainfall variability is expected to increase. Rainfall in the wet season is projected to increase by 2% by 2030 and up to 8% by 2090. Projections show extreme rainfall days are likely to occur more often and be more intense, with rainfall lasting longer days (wetter wet seasons and drier dry seasons). However, the number of months with high rainfall shows a decreasing trend, suggesting increasing frequency of possible drought.

Human impacts:

- Droughts are associated with water shortages and water rationing. This disrupts the local economy as well as food security.
- Intense rainfall after a drought is associated with higher sediment and pollution loads in water supplies, increasing the likelihood of water-borne disease and ill health. This also stresses the public utility.
- Warming may increase the activity of disease vectors, such as dengue-carrying mosquitos

Environmental impacts:

- Increased rainfall and increased intensity of storms and typhoons is associated with higher rates of erosion and sedimentation.
- Accelerated erosion from forests may result in loss of topsoil, organic matter, and nutrients.
- Some trees in Palau's forests are not well adapted to dry seasons, and may be stressed by more frequent droughts.
- The risk of fire significantly increases during the dry season.
- Prolonged rainfall (wetter wet seasons) are associated with loss flowers and less fruiting in forest trees.

3.0 PROJECT SITE DESCRIPTION

The initial project site for this project was Airai State. Toward the end of March 2021, it became evident that the current situation with the leadership of Airai State created a new challenge to continue the project with Airai State. There was a consultation with the Office of Climate Change and the Palau GCCA+SUPA Coordinator to resolve the issue. After additional consultations with the management team of USP, Palau decided to identify a new site for the project. Ngardmau State has been designated as the new site for USP under the GCCA + SUPA Project. Initial consultation with Ngardmau Office of the Governor took place on March 23, 2021. A follow up consultations with the entire leadership of Ngardmau State took place on April 8, 2021.





Figure 4: Office of the Governor, Ngardmau State. L to R: Kamesak Demk (Project Manager), Governor Johnson Aderkeroi, Carol O. Emaurois, USP Consultant, Harry Ngraiwet, Director Public Works.

Ngardmau State is located on the north west side of Babeldaob. It is bordered at the North by Ngaraard State and South by Ngaremlengui State. Ngardmau has an area of 30 km square with 185 populations.

Progress

Activities	Status	
Desktop Review	✓	Completed
Stakeholder Consultation – PNA Report	•	Initiated
Outreach and Awareness Raising	✓	On-going
Identification of Change Agents	X	Yet to be done
Consultation with Ministries	✓	On-going
Identification of Training Needs	✓	Completed
Training as per the identified need	X	Yet to start



Identification of national CC Plan (Discussions with CC Unit)	•	Initiated
implementation of CC Plan revisions	X	Yet to start

4.0 Government Ministry Consultations

Palau GCCA + SUPA project is coordinated by the Office of Climate Change under the Bureau of Budget & Planning in the Ministry of Finance. Local consultation for the implementation of GCCA + SUPA is directly with the local government. For USP project site, Ngardmau State has been designated as the new site for the implementation of GCCA + SUPA. Initial consultations with Ngardmau Office of the Governor and the Leadership of Ngardmau State were held in March and early April 2020.

5.0 Desktop Review

A desktop review was conducted for Airai State. However, Airai State is no longer a site for the USP GCCA + SUPA implementation in Palau. A new site for USP GCCA + SUPA was designated late March 2021. A decision based on the current situation and a need to move forward in order to complete other important milestones for the project, desktop review for Ngardmau State was tabled for now.

6.0 Local Development Plans/Island Strategic Development Plans

6.1 “GEF6 Palau’s National Project with implementation started 2018-2014 is managed under Environmental Planning & Coordination Unit (EPCU) under the auspices of Ministry of Natural Resources, Environment and Tourism. Main focus of this project is mainstreaming biodiversity conservation into land and seascape governance, planning and management. The implementation of GEF6 project will strengthen the states capacity to protect biodiversity and development of key sectors 1) Landscape and Seascape Planning 2) Reduction of threats to biodiversity 3) Implementation of State Plans in an equitable with social inclusive 4) Partnerships and Communication.



The GEF6 project includes Ngardmau State. For 2021, under GEF6 project, Ngardmau Planning team is working on their Master Plan with possible revision to include additional data and Eco-huts action plan as part of supporting tourism development diversification. The Joint Coordination Body on Babeldaob (JCB) is made up of members representing the 10 states in Babeldaob; sectors 1) Landscape and Seascape Planning 2) Reduction of threats to biodiversity 3) Implementation of State Plans in an equitable with social inclusive 4) Partnerships and Communication.

The GEF6 project includes Ngardmau State. For 2021, under GEF6 project, Ngardmau Planning team is working on their Eco-huts action plan as part of supporting tourism development diversification. The Joint Coordination Body (JCB) Babeldaob is made of members representing the 10 states in Babeldaob.

Consultant for USP, Palau GCCA + SUPA is a member of Babeldaob Joint Coordination Body that is responsible for finalizing and approving housing criteria and economic maps that will support the development of land use and master plans for 10 states in Babeldaob.

6.2 Palau Ministry of State conducted a Gender Consultation workshop on April 20, 2021. The GCCA + SUPA project has a goal to mainstream gender and social inclusive for building climate resilience and disaster risk management.

6.3 National Development Plans

1) National Climate Change Policy for Climate and Disaster Resilient Low Emissions Development (2015)

The National Climate Change Policy provides a national framework for addressing Adaptation and Disaster Risk Management, plus low emission development, with a sector-by-sector approach.

Assessment: The National Climate Change Policy is highly relevant and its approach to Climate Adaptation, Disaster Risk management, and Low emissions development should guide local area development plans. The framework of the National Climate Change Policy should guide local area development plans.

2) Koror-Babeldaob Island Urban Development: Strategy and Action Plan (KBUDSAP)

The KBUDSAP is currently under development through a partnership with ADB. The Vision and Goals of the KBUDSAP specifically include mention of the word “resilience.” A key element of the Terms of Reference for the development of the KBUDSAP is “Environment/Sustainability, Climate Change and Disaster Resilience.” Particular emphasis was given to the impacts of climate change on tourism and housing. Strategies and actions proposed in the KBUDSAP with relevance to Airai include:

- Relocation of hospital services to Airai or Aimeliik, particularly as the existing hospital is close to sea level and to improve access especially during disasters and emergencies.
- Promoting tourism in Airai, with tourism product development of several cultural sites.
- Extending public transportation (bus services) to Airai, with provision of terminals and bus stops.
- Utilizing the Airport as a site for business development.
- Better managing the Public Water System, based in Airai.
- Improving sewerage collection in Airai.
- Increasing density and providing new housing.

Assessment: The KBUDSAP is currently a National Government plan. Suitability criteria for identifying resilient development land is updated and uses more relevant data.

3) Other National Plans

- The National Development Master Plan 2020 is outdated and did not include climate change.
- The Resource Management and Development Suitability Study (RMDSS, aka MWM) did not include Climate Change. It’s suitability identifications were based on slope, proximity to ports and docks, and distance to infrastructure. While underlying data and maps can be used to guide an update to local area development plans, the suitability criteria may no longer be relevant.

6.4 Challenges and Solutions

The COVID-19 has created a new working environment for all of us. Working environment may never be the same again. Meeting people and sharing challenges makes it so humane. But for now, we work in an isolated bubble. It



creates tendencies for confusion and timeline issues. Patience is required to navigate through this virtual new world.

6.5 Lesson Learnt

I am still trying to adjust to this virtual world. COVID-19 has closed many doors and opened many new doors for us. We must make necessary adjustment to move forward. Working from home has many disadvantages and advantages and need new balancing act.

Financial Summary

Item/Activity	Total Budget Allocation (EUR)	Year 1 & 2 Actual (EUR)	Balance (EUR)
(2.1) Mobilisation and outreach on climate and disaster resilience with local area stakeholders in intervention areas	21,000	17,096	3,904
(2.2) Provision of training in resilient development to local area stakeholders	16,500	-	16,500
(2.3) Mainstream and integrate climate change and disaster risk management in sub-national sustainable development plans e.g. island plans	15,500	-	15,500
(2.4) Enhance the capacity to implement, monitor and evaluate sub-national sustainable development plans e.g. island plans	10,656	-	10,656
Total	63,656	17,096	46,560