Pacific Community
Communauté du Pacifique

Annex 2: Feasibility Study for Green Climate Fund

Climate change adaptation solutions for local authorities in the Federated States of Micronesia

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Abbreviations

COFA	Compact of Free Association
ENSO	El Niño-Southern Oscillation
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FSM	Federated States of Micronesia
GCF	Green Climate Fund
ITCZ	Intertropical Convergence Zone
LA	Local Authority
NGO	Non-governmental organization
OBM	Office of Budget and Management (Yap)
PACAM	Pacific-American Climate Fund
PIC	Pacific Island Countries
SIDS	Small Island Developing State
SPC	Pacific Community
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

1. Introduction

Objective of Study

This feasibility study is developed to support the Green Climate Fund (GCF) programme "Climate change adaptation solutions for Local Authorities in the Federated States of Micronesia". The objective of the study is to assess the factors supporting the Enhanced Direct Access (EDA) programme's feasibility for GCF investment, identify programme activities, assess the capacity of States and municipalities in the Federated States of Micronesia (FSM) to implement programme activities and develop a grant mechanism for the programme. The proposed programme consists of the following two components:

- **Component 1 –** Local authorities (LAs)[1] empowered to deliver climate change adaptation services to their populations
- **Component 2 –** Priority project implementation of EDA Facility for strengthening local community resilience

This study additionally integrates elements from the programme's Environmental and Social Management Plan (ESMP) (Annex 6 of the full proposal) and Gender Action Plan (Annex 8 of the full proposal) to ensure that the programme will deliver value effectively to all members of the FSM communities in an environmentally and socially responsible manner.

Methodology

Research for this feasibility study was conducted during the period June–August 2020. The research primarily involved a literature review of recent climate change and sustainable development related documents, FSM policies, plans and regulations and project case studies, which had occurred recently in FSM as well as more broadly across the region. The research has been supported by in-person semi-structured interviews and discussions with key government personnel, State and municipal officials and other relevant stakeholders.

A rapid capacity assessment questionnaire was designed and utilized to assess the capacity of municipalities in FSM in regard to their ability to design, implement and manage climate change adaptation projects, as proposed by this programme (see Annex 4). While it was not possible to undertake questionnaires for the over 70 municipalities across FSM, a representative sample were completed and results from the assessment analysed and detailed in section 5 below.

As with many Small Island Developing States (SIDS) there is often a lack of data and information as it relates to climate change. For example, rainfall data is missing for some geographic areas and often there is insufficient economic and financial information to inform a quantitative analysis. In areas where quantitative information is missing, qualitative information has been utilized as well as data from the Pacific region as a proxy for FSM.

The COVID-19 pandemic has also affected the development of the feasibility study. The pandemic has limited the number and type of consultations that could be undertaken for the preparation of the feasibility study. Specifically, the pandemic hindered the ability to reach municipalities to undertake a rapid assessment as well as the ability to travel. Not all local government agencies have strong internet access, especially those on the outer atolls and it was not always easy to find or connect via telephone. Larger stakeholder validation meetings were also not possible.

2. FSM Background and Context

Geography

FSM consists of 607 small islands separated into four States (Yap, Chuuk, Pohnpei and Kosrae) located in the Northern Pacific Ocean, in the region of Micronesia. The islands are spread over a vast region in the Pacific, between

[1] Local authorities broadly are an official organization responsible for governing an area of the country. For the purposes of this programme, local authorities encompass both municipal- and State-level government agencies across FSM.

1°S and 14°N latitude, and between 135°E and 166°E longitude. FSM consists of 708.36 km^2 of land area with a vast exclusive economic zone (EEZ) covering over 2.9 million km^2.

The distance between the eastern-most State (Kosrae) and the western-most State (Yap) is 2,700 km. Much of FSM lies just above the equator, approximately 4,000 km southwest of Hawaii and approximately 3,000 km north of eastern Australia (Figure 1).

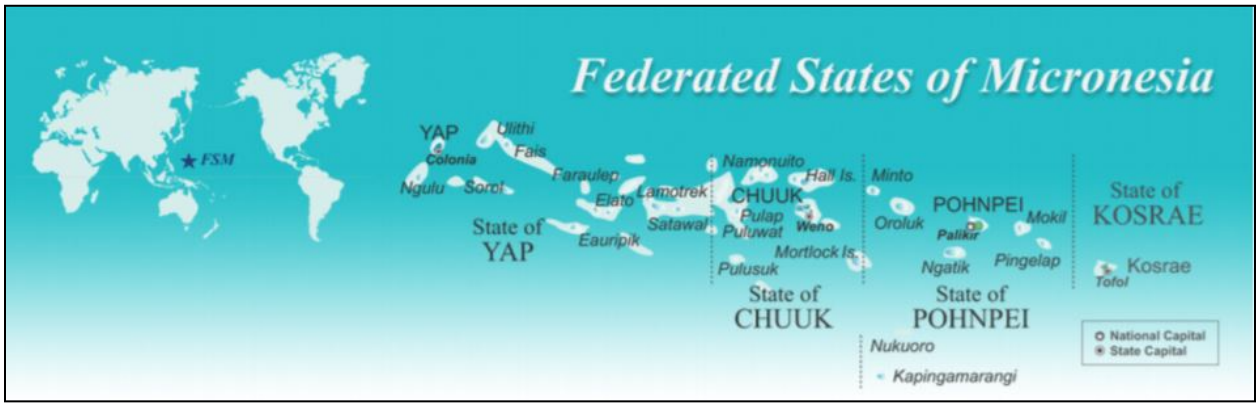


Figure 1: Map of FSM[2]

The four States have varying amounts of land area. Yap State is approximately 119 km^2 in land area, Chuuk is approximately 126 km^2, Pohnpei is 342 km^2 and Kosrae 109 km^2. Each of the four States is centred on one or more main high, volcanic islands and all the States except Kosrae have inhabited outer-island atolls. Yap State is made up of 4 volcanic islands, 7 small islands and 130 atolls (of which 22 are inhabited). Pohnpei State is made up of one large volcanic island and 6 inhabited atolls. Chuuk is made up of 7 volcanic island groups within the Chuuk Lagoon and 24 outer-island inhabited atolls.[3] Many of the islands in FSM are extinct shield volcanoes, with steep and rugged centres that are densely vegetated and eroded. Mangroves grow around the coastal fringes. Land elevations range from near sea level to up to approximately 760 m. Other islands are relatively flat, small and swampy, with low-lying, forested atoll islets typically 1–5 m above mean sea level (Table 1).

Table 1: Geographic Characteristics of Islands in FSM[4]

High, Volcanic Islands	Atoll Islands
Remnants of extinct shield volcanoes	Coral rubble and sand deposited on shallow reefs
Large land area relative to length of coastline	Small land area, absolutely and relative to coastline
High and steep slopes, subject to erosion	Low elevation
Mix of shallow and deep, fertile soils	No or minimal (impoverished coral sand) soils
Fringing mangroves, lagoons and barrier reefs	Fringing reef, limited or no mangroves
Perennial and/or ephemeral streams	No or minimal surface water
Large groundwater resource	Shallow freshwater lens
Orographic rainfall, with flash flooding	Convectional rainfall
Relatively abundant natural resources	Narrow natural/economic resource base
Extensive stands of primary and secondary forest	Vegetation predominately herbaceous strand, or strand forest
High biodiversity	Relatively low biodiversity
Relatively high population numbers, concentrated in coastal areas	Relatively low population numbers, but high concentrations

[2] GCF – Federated State of Micronesia Country Programme.
[3] GCF – Federated State of Micronesia Country Programme.
[4] Adapted from Campbell, J. R. 2006. Traditional disaster reduction in Pacific Island communities, GNS Science Report 2006/38.

Transport and other infrastructure and services relatively well developed	Poorly developed transport and other infrastructure and services

Population

The last census performed in 2010 in FSM noted that the population was 102,843, with an average annual growth rate of -0.4% since 2000, when the population was 107,008.[5] Reasons for the decrease in population include declining fertility and migration to the United States. Recent estimates in 2018 note the population is approximately 105,503[6].

As in many SIDS, a considerable proportion of the population resides within the coastal zone. Close to 60% of households in the FSM live 180 m from the shoreline: 70% in Yap, 68% in Chuuk, 38% in Pohnpei, and 80% in Kosrae. A considerable portion of the population inhabit the outer islands in FSM. In Yap, around 40% (4,006) of the population live on the outer islands; Chuuk, 30% (12,502); Pohnpei, under 1% (1,407). Kosrae does not have outer islands. For the period 2000 to 2010 there has been increasing urbanization from 21.8% in 2000 to 22.3% in 2010. The percentage of urban population varies from 7.4% in Yap to 32.6% in Kosrae, with Pohnpei at 16.8% and Chuuk at 28.5%.

Table 2, Table 3, and Table 4 below provide a breakdown of population in FSM by State disaggregated by gender and municipality. There are 75 municipalities across all four States, 11 in Pohnpei, 4 in Kosrae, 40 in Chuuk, and 20 in Yap.

Table 2: Population of FSM by State and Gender (2010)

State	Population		
	Male	Female	Total
Yap	5,635	5,742	11,377
Chuuk	24,835	23,819	48,654
Pohnpei	18,371	17,825	36,206
Kosrae	3,352	3,264	6,616
Total	**52,193**	**50,650**	**102,853**

Table 3: Population of Pohnpei, Kosrae, and Yap States by Municipality

Pohnpei		Kosrae		Yap			
Municipality	Population	Municipality	Population	Municipality	Population	Municipality	Population
Madolenihmw	5,767	Utwe	983	Rumung	58	Ngulu	6
Kitti	6,470	Malem	1,300	Maap	621	Ulithi	847
Sokehs	6,647	Lelu	2,160	Gagil	863	Eauripik	114
U	3,192	Tafunsak	2,173	Fanif	509	Woleai	1,039
Nett	6,639			Tamil	1,231	Faraulep	193
Kolonia Town	6,074			Weloy	1,031	Ifalik	578
Kapingamarangi	350			Dalipebenau	397	Lamotrek	329
Nukuoro	210			Rull	2,095	Satawal	501
Pingilap	258			Kanifay	314	Elato	105
Mwokil	133			Gilmaan	252	Fais	294
Oroluk	10						
Total	**36,206**	**Total**	**6,616**	**Total**		**11,377**	

[5] FSM Statistics – Population Statistics.
[6] SPC FSM Statistics

Table 4: Population of Chuuk by Municipality

Chuuk							
Municipality	**Population**	**Municipality**	**Population**	**Municipality**	**Population**	**Municipality**	**Population**
Weno	13,856	Romanum	865	Ettal	672	Tamatam	493
Piis-Penau	388	Fanapanges	672	Lekinioch	848	Makur	159
Fono	376	Wonei	638	Oneop	400	Onou	172
Tonowas	3,517	Paata	1,107	Satowan	692	Onoun	633
Fefen	3,471	Tol	4,579	Kuttu	323	Unanu	193
Siis	349	Polle	1,498	Moch	932	Piherarh	227
Uman	2,554	Nema	676	Ta	273	Nowmin	763
Parem	342	Losap	248	Houk	1,116	Fananu	580
Eot	266	Piis-Emwar	258	Polowat	745	Ruo	241
Udot	1,680	Namoluk	355	Pollap	1,168	Murillo	329
Total	**48,654**						

Socioeconomic Context

Under the 1979 constitution, FSM has three levels of government: national, State, and municipal. The national government exercises only certain powers expressly delegated to it by the constitution. The four State governments of Chuuk, Kosrae Pohnpei, and Yap are relatively autonomous. Each State has its own governor, judiciary and legislative bodies, along with relevant government departments. States are further divided into 75 municipalities as above.

As of 2018, FSM had a total GDP of USD 401.9 million (current prices).[7] The breakdown of GDP by industry sector include the following: agriculture, hunting and forestry (16%), real estate, renting and business activities (13%), education (11%), public administration (11%), wholesale and retail trade (11%), fisheries (9%), transport, storage and communications (6%), health and social work (5%), finance (4%), construction (2%), utilities (2%), hotels and restaurants (2%) and other miscellaneous activities (1%).

GDP per capita in constant prices differs per State, with Yap having the highest (USD 3,468) followed by Pohnpei (USD 3,393), Kosrae (USD 2,344) and Chuuk (USD 1,436). GDP per capita across all FSM was USD 2,408 in 2018. The unemployment rate as of the last national census (2010) was 9%, although the jobless rate is much higher. The private sector employs the most individuals (7,282) followed by State governments (4,740), public enterprise (854) and federal government agencies (795).[8] In total, municipalities employee 360 individuals.

The minimum wage in FSM is USD 2.65 per for individuals employed within the national government. For State government works, the minimum wage differs per State: USD 2.00 in Pohnpei, USD 1.25 in Chuuk, USD 1.42 in Kosrae and USD 1.60 in Yap. Additionally, Pohnpei State has a separate minimum wage of USD 1.75 for private sector workers. Although incomes have risen by approximately 18.85% between 2004 and 2018, inflation has reduced real wages. Average annual income has decreased from USD 6,627 to USD 4,961.[9]

In addition to tax revenue, revenue from the sale of tuna fishing licenses for FSM waters and captive insurance, FSM receives economic assistance and other monetary and non-monetary benefits from the United States through the Compact of Free Association (COFA).[10] The first COFA was negotiated in the early 1980s and signed into US law in 1986. In 2003, the Compact was renegotiated, and the amendments were approved by the FSM Congress in 2004. The renegotiated Compact will be in effect until 2023 and will ultimately provide USD 1.3 billion in economic assistance to FSM.

[7] FSM Statistics – GDP, GNI & GNDI: FY2007 to FY2018.
[8] FSM Statistics – Labor Market and Participation.
[9] FSM. First Voluntary National Review on the 2030 Agenda for Sustainable Development.
[10] FSM. First Voluntary National Review on the 2030 Agenda for Sustainable Development.

The ongoing global pandemic is projected to have consequences for the FSM economy over the coming years.[11] Construction, transportation and communications and the tourism sectors are estimated to shrink for at least the next fiscal year. Overall GDP is expected to decline by approximately 5% over fiscal year 2020 and 2% over fiscal year 2021. The private sector is expected to be the hardest hit, with an estimated private sector GDP reduction of 18.7% between 2019 and 2021. The national government announced a USD 15 million pandemic stimulus package to mitigate the negative economic impacts of the pandemic. Additionally, projections are likely to change in the coming months as FSM and other nations around the world enact and retract policies related to travel and economic activity in response to the shifting realities of the pandemic (increased infection rates, development of a vaccine, etc.).

A Household Income and Expenditure Survey (HIES) was conducted by the government in FSM between 2013 and 2014. The HIES found that to meet basic caloric needs in FSM, one requires an average of USD 1.84 per adult per day and meeting all basic needs requires an average of USD 4.34 per adult per day.[12] Throughout FSM, approximately 10% of the population falls below the food poverty line and approximately 41% of the population falls below the total basic needs poverty line. The State of Chuuk has the highest proportion of its population that falls under the food poverty line (16.6%) and the total poverty line (45.5%) compared to the other States, whereas Kosrae does not have any individuals that fall under the food poverty line and approximately 21% of its population falls under the total poverty line. For most of FSM, the poorest individuals and households allocate more than half of their total expenditures on the purchase of food. The HIES study highlighted several additional key findings on the socioeconomic context in FSM:

- The Gini Coefficient at the national level is approximately 38.6%. Each State had a similar coefficient to the national level (Yap – 38.8%; Chuuk – 38.8%; Pohnpei – 37.7%; Kosrae – 37.1%)
- Poverty rates are higher in households with more children
- There is a strong inverse relationship between the level of education and poverty which is observed
- Female-headed households are poorer than male-headed households in all States
- The poverty rate among workers in the public sector is lower than among workers elsewhere

3. Current Climate and Climate Change in FSM

Current Climate in FSM[13]

In general, FSM has a tropical climate, but due to the large distance between States and their respective islands and atolls, the States are characterized by slightly different climates (see Figure 2 for mean monthly rainfall by State). Climatically, Yap lies in an area that generally experiences a monsoon climatic pattern, with more frequent periods of drought. The climate of Chuuk is hot and humid with an average temperature of 27°C, and little variation throughout the year. Average annual precipitation is 3,100 mm with the months of January to March being drier. Pohnpei is generally hot and humid, also with a mean temperature of 27°C. Temperatures vary little from month to month. The mean annual rainfall is 4,826 mm with January and February being slightly drier than the average of all months. Kosrae's climate is characterized by high temperatures, heavy rainfall and high humidity. The average annual rainfall measured at the weather station in coastal Lelu is 5,000 mm. In the mountainous interior rainfall is estimated to be as high as 7,500 mm annually with average temperature 27°C at sea level. Average monthly temperatures vary from the annual average by no more than 1°C and the difference between the average minimum and maximum temperatures is less than 8°C.

[11] Assessing the Impact of COVID-19 on the Federated States of Micronesia Economy.
[12] FSM Statistics – Poverty Profile of the Federated States of Micronesia.
[13] FSM. Second National Communication on Climate Change.

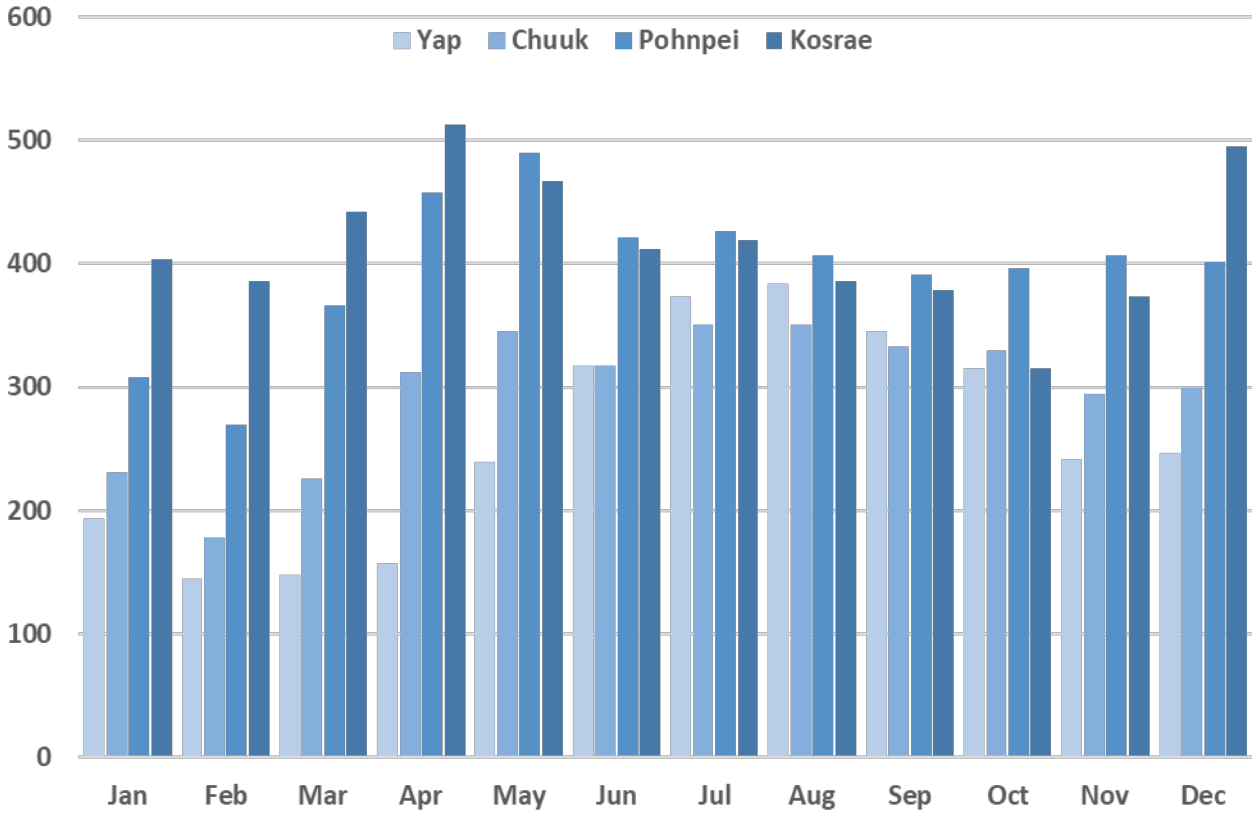


Figure 2. Mean Monthly Rainfall for Yap, Chuuk, Pohnpei and Kosrae (mm).

The country has two seasons – a dry season from November to April and a wet season from May to October. Rainfall in throughout the country and region is affected by the movement of the Intertropical Convergence Zone. The West Pacific Monsoon also impacts rainfall, bringing additional rain during the wet season. The West Pacific Monsoon affects the western States of Chuuk and especially Yap more than the eastern States of Pohnpei and Kosrae. The climate of FSM varies considerably from year to year due to the El Niño-Southern Oscillation (ENSO). In Pohnpei, El Niño tends to result in drier conditions during the dry season, but higher than average rainfall during the wet season. La Niña tends to bring above average rainfall in the dry season. The West Pacific Monsoon tends to be farther east during El Niño, bringing higher rainfall, and in a more western position during La Niña, resulting in less rainfall. The Intertropical Convergence Zone results in less rainfall during El Niño events and more during La Niña.

All of the FSM States are susceptible to acute climate risks such as extreme rainfall events, drought, high sea levels, strong winds and extreme high air temperatures. FSM overall is susceptible to typhoons and tropical storms, though storms and typhoons are generally more severe in the western islands.

Observed and Projected Climate Change

Temperature

Evidence suggests that annual maximum and minimum temperatures in FSM have increased since records began in 1952. Extreme temperatures such as warm days and warm nights have been increasing in Pohnpei consistent with global warming trends. Below are summary tables and graphs for Pohnpei (East FSM) and Yap (West FSM) from the PACSAP Country Report.[14]

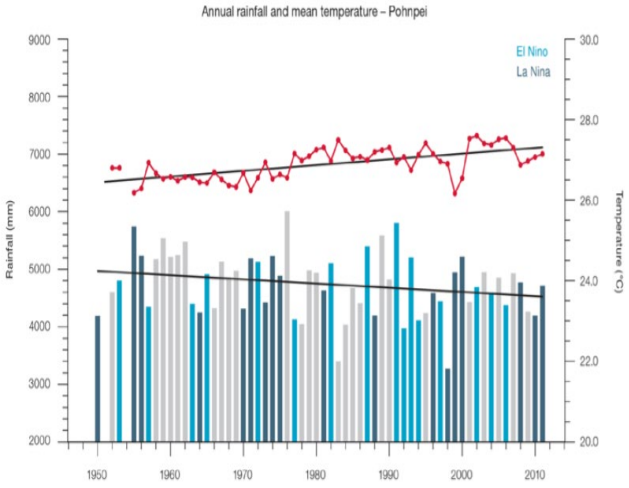
[14] Pacific-Australia Climate Change Science and Adaptation Planning Program

Pohnpei	Tmax °F/10yrs [°C/10yrs]	Tmin °F/10yrs [°C/10yrs] 1951–2011	Tmean °F/10yrs [°C/10yrs]	Total Rain inches/10yrs [mm/10yrs] 1950–2011
Annual	**+0.32** (+0.19, +0.46) **[+0.18** (+0.10, +0.26)]	+0.16 (-0.02, +0.35) [+0.09 (-0.01, +0.20)]	**+0.27** (+0.12, +0.38) **[+0.15** (+0.07, +0.21)]	-2.26 (-5.32, +0.61) [-57.3 (-135.1, +15.5)]
Nov–Apr	**+0.31** (+0.17, +0.48) **[+0.17** (+0.09,+0.27)]	**+0.25** (+0.03, +0.42) **[+0.14** (+0.02, +0.23)]	**+0.29** (+0.11, +0.44) **[+0.16** (+0.06, +0.25)]	-1.80 (-4.60, +1.64) [-45.8 (-116.7, +41.8)]
May–Oct	**+0.32** (+0.16, +0.46) **[+0.18** (+0.09, +0.26)]	**+0.19** (+0.03, +0.37) **[+0.11** (+0.02, +0.21)]	**+0.27** (+0.13, +0.39) **[+0.15** (+0.07, +0.22)]	**-2.23** (-4.52, -0.12) **[-56.6** (-114.9, -3.1)]

Yap	Tmax °F/10yrs (°C/10yrs)	Tmin °F/10yrs (°C/10yrs) 1951–2011	Tmean °F/10yrs (°C/10yrs)	Total Rain inches/10yrs (mm/10yrs) 1952–2011
Annual	**+0.41** (+0.36, +0.48) **[+0.23** (+0.20, +0.26)]	**-0.36** (-0.43, -0.27) **[-0.20** (-0.24, -0.15)]	+0.03 (-0.02, +0.07) [+0.01 (-0.01, +0.04)]	0.00 (-2.85, +3.22) [-0.1 (-72.5, +81.8)]
Nov–Apr	**+0.39** (+0.34, +0.44) **[+0.22** (+0.19, +0.25)	**-0.27** (-0.37, -0.18) **[-0.15** (-0.21, -0.10)]	+0.04 (-0.02, +0.11) [+0.02 (-0.01, +0.06)]	+0.86 (-2.87, +1.44) [-21.9 (-72.8, +36.6)]
May–Oct	**+0.44** (+0.37, +0.51) **[+0.24** (+0.20, +0.28)]	**-0.40** (-0.48, -0.33) **[-0.22** (-0.27, +0.18)]	+0.01 (-0.04, +0.05) [0.00 (-0.02, +0.03)]	+0.93 (-1.27, +3.10) [+23.6 (-32.1,+78.8)]

		Pohnpei	Yap
TEMPERATURE		**1952–2011**	**1952–2011**
Warm Days (days/decade)		**7.86** (+3.65, 11.70)	**12.23** (+4.60, +19.80)
Warm Nights (days/decade)		**5.12** (+1.22, +9.05)	**-16.68** (-21.57, -10.24)
Cool Days (days/decade)		**-3.98** (-5.53, -2.52)	**-8.50** (-13.66, -2.67)
Cool Nights (days/decade)		-2.73 (-8.21, +3.68)	**+8.70** (+3.71, +14.90)
RAINFALL			
Rain Days ≥ 1 mm	(days/decade)	-0.21 (-2.79, +2.48)	-1.01 (-4.20, +1.82)
Very Wet Day rainfall	(inches/decade)	**-2.63** (-5.15, -0.12)	+0.22 (-1.39, +1.97)
	(mm/decade)	**-66.88** (-130.81, -3.05)	+5.55 (-35.30, +49.95)
Consecutive Dry Days (days/decade)		0.00 (-0.43, +0.20)	**-0.37** (-0.77, 0.00)
Max 1-day rainfall	(inches/decade)	-0.015 (-0.29, 0.27)	-0.04 (-0.30, +0.21)
	(mm/decade)	-0.38 (-7.29, +6.84)	-0.88 (-7.62, +5.41)

Warm Days: Number of days with maximum temperature greater than the 90th percentile for the base period 1971–2000
Warm Nights: Number of days with minimum temperature greater than the 90th percentile for the base period 1971–2000
Cool Days: Number of days with maximum temperature less than the 10th percentile for the base period 1971–2000
Cool Nights: Number of days with minimum temperature less than the 10th percentile for the base period 1971–2000
Rain Days ≥ 1mm: Annual count of days where rainfall is greater or equal to 1mm (0.039 inches)
Very Wet Day rainfall: Amount of rain in a year where daily rainfall is greater than the 95th percentile for the reference period 1971–2000
Consecutive Dry Days: Maximum number of consecutive days in a year with rainfall less than 1mm (0.039 inches)
Max 1-day rainfall: Annual maximum 1-day rainfall


Annual rainfall and mean temperature – Pohnpei
El Nino
La Nina
Rainfall (mm)
Temperature (°C)
9000
8000
7000
6000
5000
4000
3000
2000
30.0
28.0
26.0
24.0
22.0
20.0
1950
1960
1970
1980
1990
2000
2010


Annual rainfall and mean temperature – Yap
El Nino
La Nina
Rainfall (mm)
Temperature (°C)
6000
5000
4000
3000
2000
1000
30.0
28.0
26.0
24.0
22.0
20.0
1950
1960
1970
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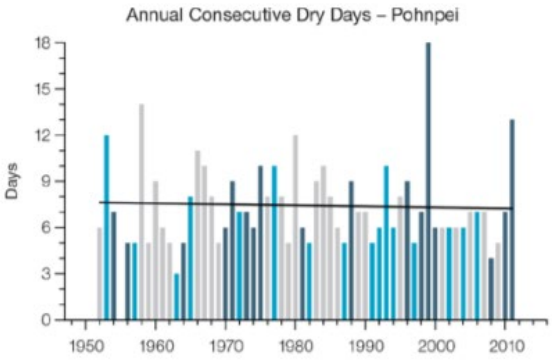
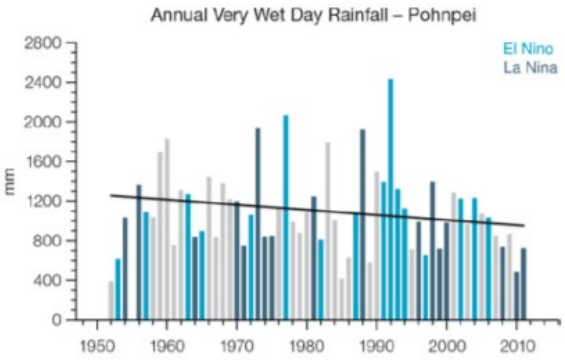
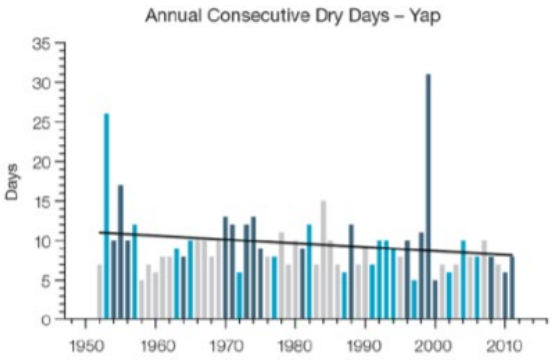
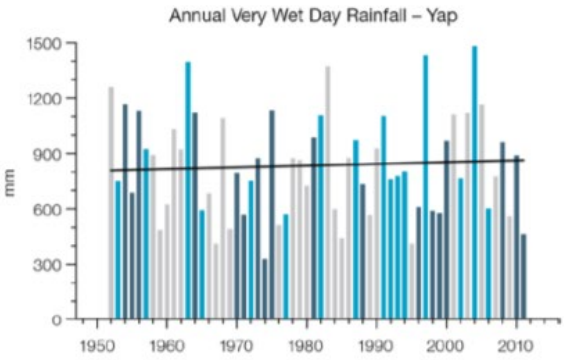
2010


Annual Consecutive Dry Days – Pohnpei
Days
18
15
12
9
6
3
0
1950
1960
1970
1980
1990
2000
2010


Annual Very Wet Day Rainfall – Pohnpei
El Nino
La Nina
mm
2800
2400
2000
1600
1200
800
400
0
1950
1960
1970
1980
1990
2000
2010


Annual Consecutive Dry Days – Yap
Days
35
30
25
20
15
10
5
0
1950
1960
1970
1980
1990
2000
2010


Annual Very Wet Day Rainfall – Yap
mm
1500
1200
900
600
300
0
1950
1960
1970
1980
1990
2000
2010

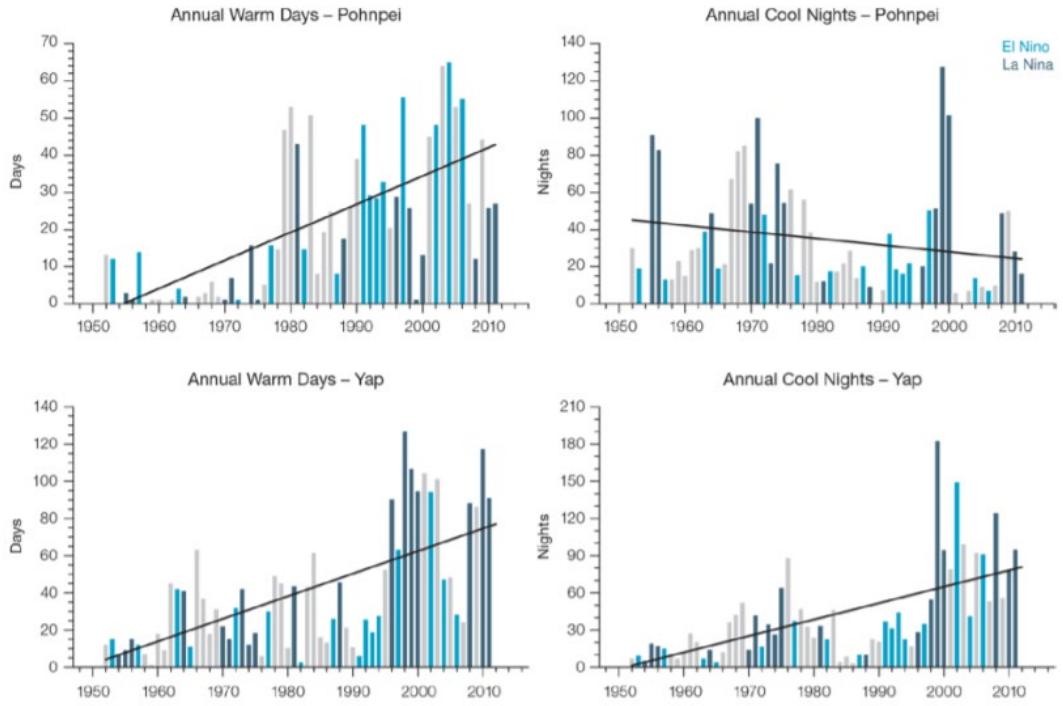


Figure 3: FSM Historic Rainfall and Temperature

Climate projections[15] suggest that the frequency and occurrence of higher maximum daily temperatures will dramatically increase for Pohnpei and FSM more broadly. [16] Projections for all emissions scenarios indicate that the annual average air temperature and sea-surface temperature will increase in the future in FSM (Table 1). By 2030, under a very high emissions scenario, this increase in temperature is projected to be in the range of 0.6–1.1°C.[17]

Table 5: Projected Changes in Annual Average Surface Air Temperature in FSM[18]

Geography	2030	2050	2070	2090
FSM East	Projected °C increase			

[15] Climate projections for FSM were derived from up to 26 GCMs in the CMIP5 database (the exact number is different for each scenario) for four Representative Concentration Pathway emissions scenarios, namely RCP2.6 (very low), RCP4.5 (low), RCP6 (medium) and RCP8.5 (very high) using dynamical downscaling. [Source: Australian Bureau of Meteorology and CSIRO. 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports.] These models were validated through interpolation of model outputs to a regular grid to examine multi-model means. Climate features were assessed over the period 1980–1999 for CMIP3 and 1980–2005 for CMIP5 and compared to the HadISST dataset (for SST), ECMWF Interim Reanalysis (for surface air temperature, mean sea level pressure and winds at 1000 hPa), and the Global Precipitation Climatology Project dataset and the Climate Prediction Centre Merged Analysis of Precipitation (for precipitation). Of the 27 CMIP5 models examined, three were considered unsuitable for making projections for the western Pacific but all 24 other models were identified as being suitable for such purposes. [Source: Grose et al. 2014. Assessment of the CMIP5 global climate model simulations of the western tropical Pacific climate system and comparison to CMIP3. International Journal of Climatology.]

[16] FSM National Communication on Climate Change.

[17] Australian Bureau of Meteorology and CSIRO. 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports

[18] Pacific-Australia Climate Change Science and Adaptation Planning Programme – Current and future climate of the Federated States of Micronesia.

Very low emissions scenario	0.4–0.9	0.6–1.2	0.5–1.2	0.5–1.2
Low emissions scenario	0.5–1.0	0.7–1.4	1.0–1.9	1.0–2.1
Medium emissions scenario	0.4–0.9	0.7–1.4	1.0–2.0	1.3–2.6
Very high emissions scenario	0.6–1.1	1.0–1.9	1.6–3.1	2.1–4.1
FSM West	**Projected °C increase**			
Very low emissions scenario	0.5–0.9	0.6–1.1	0.5–1.2	0.4–1.2
Low emissions scenario	0.5–1.0	0.8–1.4	1.0–1.8	1.0–2.1
Medium emissions scenario	0.4–0.9	0.7–1.4	1.1–1.9	1.4–2.6
Very high emissions scenario	0.6–1.1	1.1–1.9	1.6–3.1	2.1–4.0

Return periods for extreme high temperatures have been estimated for Pohnpei (Table 6).

Table 6: Return Periods (yr) for Extreme High Temperature, Pohnpei

Sea temp (°C)	Observed Data	2025	2050	2100
32	1	1	1	1
33	1	1	1	1
34	4	2	2	1
35	24	11	6	2
36	197	80	39	10
37	2617	1103	507	101

Precipitation

In general, FSM is expected to experience an increase in precipitation over the next century (an increase of up to 8% ± 11% in eastern FSM and up to 12% ± 15% in western FSM's mean annual precipitation by 2090 under a high emissions scenario), with a decrease in the frequency of drought events.[19] Interannual rainfall variability is also projected to increase. However, there is variability in changing precipitation patterns between States. Generally, there has been a decreasing trend as it relates to rainfall in Pohnpei (an eastern State) since 1950 while there has been little change in annual rainfall in Yap (a western State) since 1951 (see Table 7).

Table 7. Observed trends for rainfall in Pohnpei (1950–2009) and Yap (1951–2009) in mm per 10 years[20].

	Pohnpei (east FSM)	Yap (west FSM)
Annual	-68	-3
Wet season	-52	+14
Dry season	-26	-15

There has also been a decreasing trend in Very Wet Day rainfall in Pohnpei. However, Consecutive Dry Days in Yap (a western State) have decreased since 1952. Figure 4 shows the trend in dry and wet days in Pohnpei and Yap.

[19] Pacific-Australia Climate Change Science and Adaptation Planning Programme – Current and future climate of the Federated States of Micronesia.

[20] Pacific-Australia Climate Change Science and Adaptation Planning Programme. 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports 2014. Chapter 4. Federated States of Micronesia.

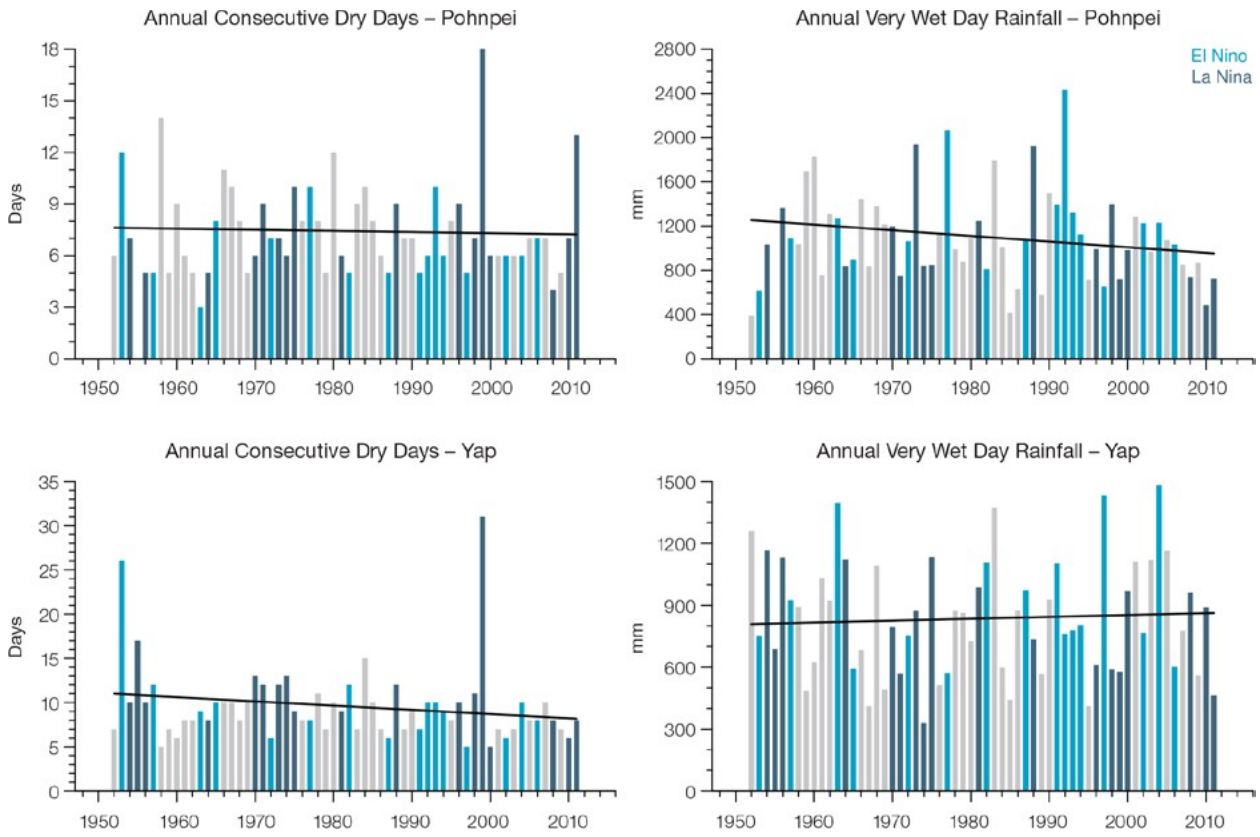


Figure 4: Observed Time Series of ACDD and AVWD in Pohnpei and Yap[21]

The incidence of drought is also expected to decrease over the 21st century (except during ENSO conditions as outlined below), consistent with an overall increase in rainfall for FSM. Recent projections suggest that[22]:

- Mild drought will occur approximately seven to eight times every 20 years by 2090 under the B1 (low) emissions scenario, while by 2030 it will occur six to seven times under the A1B (medium) and eight to nine times every 20 years under the A2 (high) scenarios
- Moderate drought will occur approximately once to twice every 20 years in 2030 and once every 20 years in 2090 for all emissions scenarios
- Severe drought will occur approximately once every 20 years across all time periods and scenarios.

Figure 5 provides the statistical spread for drought projections in FSM. [23] This shows an overall decreasing trend in both the duration and especially the frequency of drought events in future, as a result of the projections of overall increases in precipitation.

[21] Pacific-Australia Climate Change Science and Adaptation Planning Program

[22] Droughts are categorised using the Standardised Precipitation Index (BoM & CSIRO, 2011; Lloyd-Hughes & Saunders, 2002) as follows: i) Mild – 0 to -0.99; Moderate – -1 to -1.49; Severe – -1.5 to -1.99; – Extreme: -2 or lower.

[23] Pacific-Australia Climate Change Science and Adaptation Planning Program

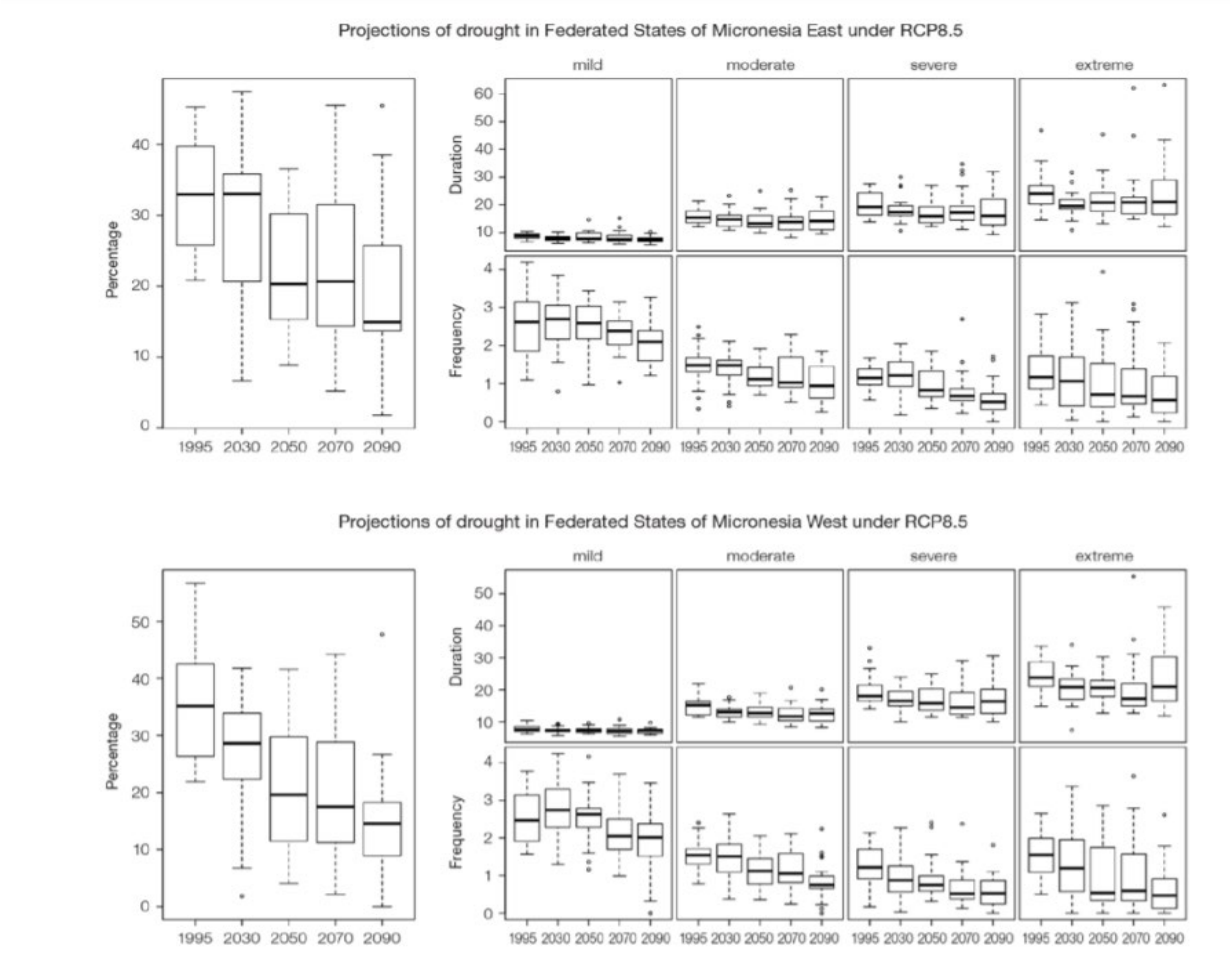


Figure 5: FSM Projections for Drought Occurrence

Although drought conditions are projected to decrease in general in FSM, drier conditions and droughts are linked to ENSO events, with more severe events occurring with El Niño conditions.[24,25] The IPCC Special report on Ocean and the Cryosphere has noted that under some climate scenarios, extreme El Niño and La Niña events are projected to occur about twice as often throughout the 21st century from one such event every 20 years during 1891–1990 to one every 10 years[26], which could imply more severe droughts in FSM when extreme El Niño events occur despite an overall projected decrease in the frequency of drought conditions. Return periods for daily and hourly rainfall values have been estimated for Pohnpei (Table 8, Table 9).

Table 8: Return Period (yrs) for Daily Rainfall Values in Pohnpei and Kosrae

Rainfall (mm)	Observed	2025	2050	2100
		Pohnpei		
100	1	1	1	1

[24] Fletcher et al. 2010. Climate Change in the Federated States of Micronesia Food and Water Security, Climate Risk Management, and Adaptive Strategies. University of Hawai'i Sea Grant College Programme.
[25] McGree, S., S. Schreider and Y. Kuleshov. 2016. Trends and variability in droughts in the Pacific islands and Northeast Australia. Journal of Climate 29: 8377–8397.
[26] Cai et al. 2014. Increasing frequency of extreme El Niño events due to greenhouse warming. Nature Climate Change 4(2): 111–116.

150	2	1	1	1
200	5	2	1	1
250	10	5	2	1
300	21	9	4	2
350	40	17	8	2
400	71	28	13	3
450	118	45	20	5
500	188	68	30	7
Kosrae				
100	1	1	1	1
150	3	2	1	1
200	6	4	2	2
250	16	9	5	2
300	38	21	12	4
350	83	50	31	9
400	174	119	83	22
450	344	278	237	64
500	652	632	410	230

Table 9: Return Period (yrs) for Hourly Rainfall Values in Pohnpei and Kosrae

Rainfall (mm)	Observed	2025	2050	2100
Pohnpei				
50	2	1	1	1
100	6	3	2	1
150	14	7	4	2
200	23	12	7	4
250	34	18	11	5
300	47	25	15	8
350	61	32	20	10
400	77	40	26	13
Kosrae				
50	2	2	1	1
100	8	6	5	3
150	16	13	10	6
200	28	21	16	11
250	41	31	24	16
300	56	42	33	22
350	73	55	43	29
400	91	68	54	37

Sea Level Rise

Between 1993 and 2010, FSM has experienced disproportionate sea level rise (ranging from 8–12 mm per year) compared to other areas in the Western Pacific (see Figure 6). Tide-gauge records since 1950 have been combined with satellite data since 1993 to reconstruct sea levels from 1950 (see Figure 7). Moreover, since 2000, FSM has been occasionally experiencing a periodic rise of sea level in the low-lying coastal areas of both high and low islands. These "king tides" – most commonly occurring during perigean spring tide events[27] – cause marine inundation that

[27] Perigean spring tide events typically occur 6–8 times per year and result in higher-than-normal high tides, particularly in locations that are significantly influenced by tidal range and when combined with seasonal effects on water levels such as thermal expansion of warming water. Such extreme high tides are locally known as "king tides".

damages groundwater resources, taro beds, soil, and agroforestry resources in coastal settings, especially on low atoll islets. With higher sea surface temperatures and higher sea levels in general, "king tides" can be expected to become more frequent and severe. Furthermore, on high islands, coastal communities that experience both intensifying storm runoff and rising ocean waters are experiencing increased flooding and other drainage problems.[28]

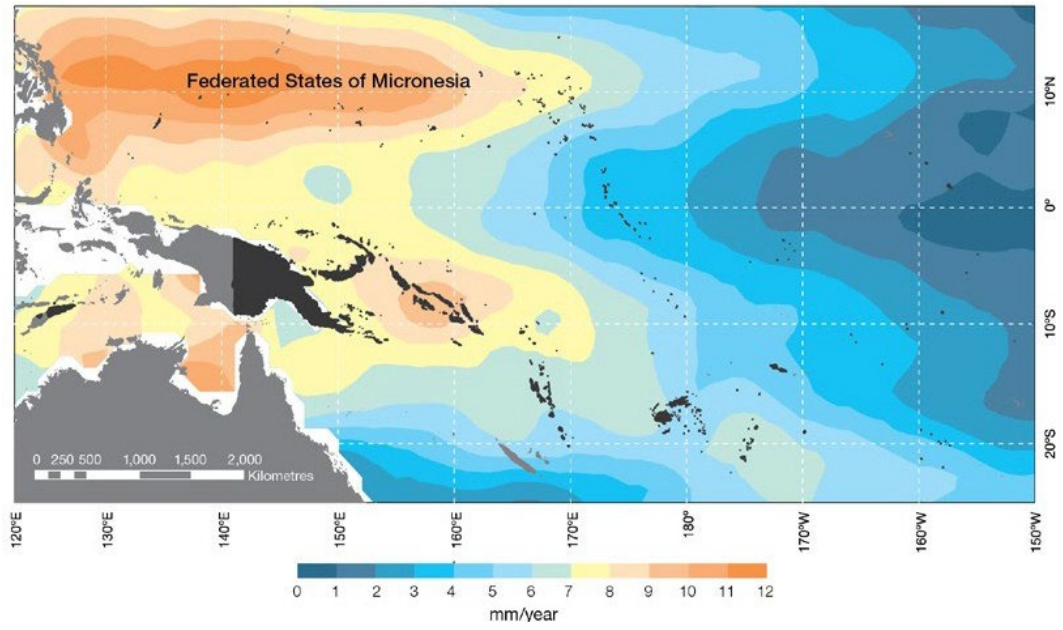


Figure 6: Regional distribution of the rate of sea level rise (1993-2010) in the Western Pacific[29]

Sea level rise is projected to continue to increase under all climate scenarios (see Figure 7, Table 10 below). Monthly mean sea levels in FSM have risen gradually since 1974 and more markedly since the early 2000s (see Figure 8). The sea-level rise combined with natural year-to-year changes will accentuate the impact of storm surges and coastal flooding. Frequency of extreme high sea level (tidal surges) for FSM are projected to increase dramatically as a result of climate change.[30] Observed wave heights in FSM are typically in the range of 1.5–2.1 m, and are higher during the period December to March (see Table 11)[31]. By 2030, under all emissions scenarios, this rise in sea level is projected to be in the range of 7–18 cm. When viewed in combination with the project increase in frequency of tidal surges, it is likely that this will lead to more frequent inundation events, as the tropics are expected to see more than double the frequency of extreme water-level events with associated flooding by 2030 with sea level rise of only 5–10 cm, less than what is projected for FSM for that period[32].

[28] Fletcher et al. 2010. Climate Change in the Federated States of Micronesia Food and Water Security, Climate Risk Management, and Adaptive Strategies. University of Hawai'i Sea Grant College Programme.
[29] FSM. Second National Communication on Climate Change.
[30] FSM. Second National Communication on Climate Change.
[31] Pacific-Australia Climate Change Science and Adaptation Planning Programme. 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports 2014. Chapter 4. Federated States of Micronesia.
[32] Vitousek et al. 2017. Doubling of coastal flooding frequency within decades due to sea-level rise. Scientific Reports 7: 1399.

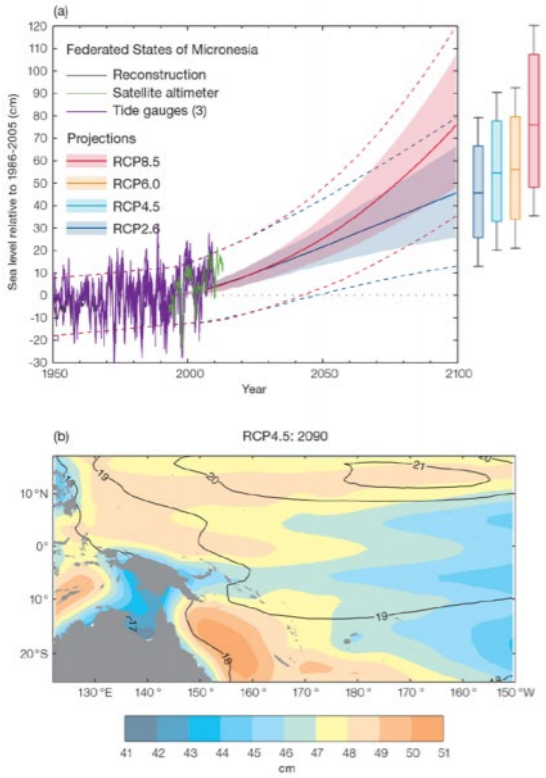


Figure 7: Historical (since 1950) and Projected (up to 2100) Sea Level Rise for FSM[33]

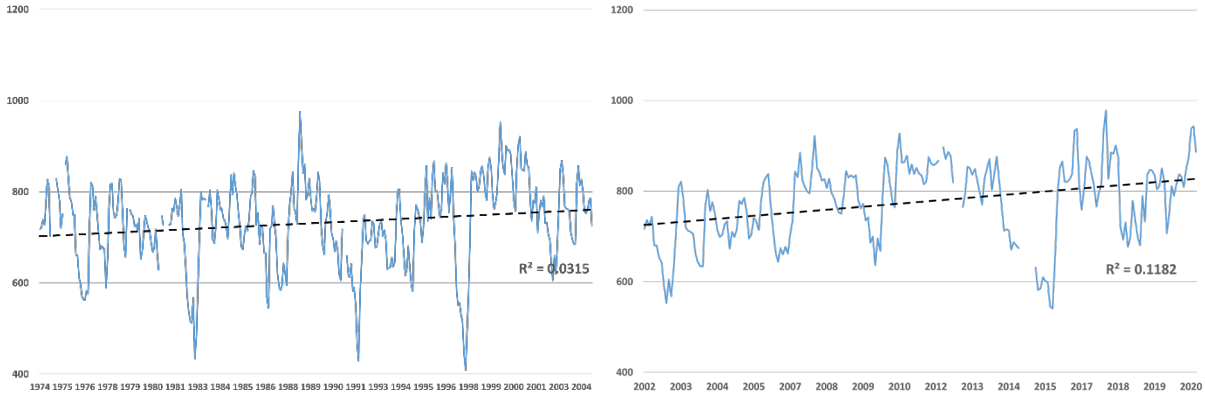


Figure 8. Monthly mean sea level for 1974–2004 at Pohnpei-B and 2002–2020 at Pohnpei-C tide guages[34]

[33] Pacific-Australia Climate Change Science and Adaptation Planning Programme.
[34] Data drawn from the Permanent Service for Mean Sea Level database.

Table 10: Sea Level Rise Under Various Emissions Scenarios[35]

Emissions Scenario	2030	2050	2070	2090
Very low (RCP 2.6)	8–18 cm	14–30 cm	20–45 cm	24–60 cm
Low (RCP 4.5)	8–17 cm	14–31 cm	22–49 cm	30–68 cm
Medium (RCP 6)	7–17 cm	14–30 cm	22–48 cm	31–69 cm
High (RCP 8.5)	8–18 cm	17–35 cm	28–59 cm	41–90 cm

Table 11. Historical wave height and period (means and 5–95th percentile, in metres) for east and west FSM.

	Pohnpei (east FSM)		Yap (west FSM)	
	Hindcast (1979–2009)	**Simulated (1986–2005)**	**Hindcast (1979–2009)**	**Simulated (1986–2005)**
Dec–Mar	2.2 (1.5–2.9)	2.0 (1.7–2.4)	1.5 (1.0–2.2)	1.8 (1.5–2.2)
Jun–Sep	1.1 (0.7–1.6)	1.1 (0.9–1.4)	1.1 (0.6–2.1)	1.0 (0.8–1.3)

Extreme Weather Events

FSM is highly susceptible to extreme weather events such as tropical storms and typhoons. For example, in 2002 Typhoon Mitag caused a storm surge that inundated up to 500 m inland and destroyed nearly all the food crops in low-lying areas in the north, northeast, and southern parts of the main island of Yap (see Annex 2 for a list of past climate damaging events). It is projected that there will be a decrease in the number of typhoons globally (as well as in the region of Micronesia) by the end of the 21st century. Recent studies have highlighted that tropical cyclones across the world have become more intense over the past four decades[36] and that cyclones are becoming stronger.[37] Projections also indicate that typhoon intensity will increase by the end of the century, with an increase in average maximum wind speed of typhoons between 2–11% and an increase in rainfall intensity of 20% within 100 km of a typhoon's centre.[38] Extreme hourly and daily rainfall events, such as Tropical Storm Chataan which resulted in massive landslides and damage across Chuuk State are also projected to increase in frequency, particularly in Pohnpei and Kosrae. [39]

ENSO Events

Another uncertain risk of climate change stems from its impact on ENSO. As highlighted in the sections above and the graphs for rainfall and temperature, El Niño/La Niña events cause significant variability in climate for FSM. El Niño events in FSM tend to cause droughts which have resulted in water and food shortages (including staples such

[35] Sea level rise was modelled using CMIP5, combining global average sea-level projections with regional distributions associated with ocean density and circulation changes, as well as mass redistributions from changes in ice masses. [Source: Pacific-Australia Climate Change Science and Adaptation Planning Programme. 2014. Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports 2014. Chapter 4. Federated States of Micronesia.]

36 Kossin J, Knapp K, Olander T, Velden S. 2020. Global increase in major tropical cyclone exceedance probability over the past four decades Proceedings of the National Academy of Sciences Jun 2020 https://doi/10.1073/pnas.1920849117

[37] Emmanuel, K. 2020. Evidence that hurricanes are getting stronger. Proceedings of the National Academy of Sciences.

[38] Pacific-Australia Climate Change Science and Adaptation Planning Programme – Current and future climate of the Federated States of Micronesia.

[39] FSM National Communication on Climate Change.

as taro, coconut, breadfruit, banana, yam, sweet potato, and citrus), impacts on terrestrial habitats, wildfires, and invasive species.[40]

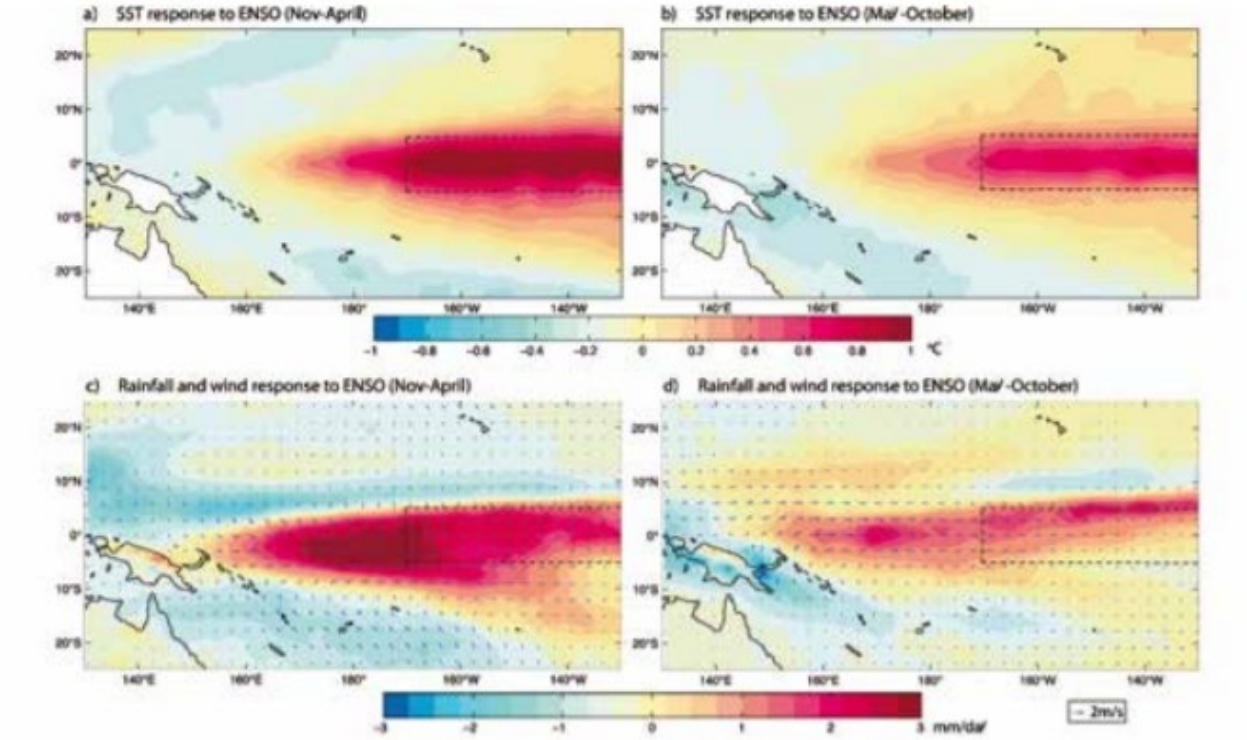


Figure 9: Spatial Variation in SST and Rainfall in the Pacific Region[41]

ENSO variations also significantly impact the mean sea level across FSM which impacts tidal surges, rainfall, and extreme events like typhoons. The ENSO cycle has a profound effect on the distribution of tropical cyclones in the FSM. During La Niña events, above average numbers of tropical storms occur in the FSM region. The formation region of cyclones is also impacted. During El Niño, typhoon formation extends eastward resulting in an increased risk of a typhoon for Pohnpei during El Niño years, and a decreased risk during the year following El Niño and during La Niña years. On Pohnpei, the risk of having typhoon force winds of 65 kt (33.4 $m.s^{-1}$) or greater is one year in 10 for El Niño years, and approximately one year in 50 for non-El Niño years. Overall, the effect that climate change will have on ENSO incidence and severity remains a critical uncertainty, but it has the potential to dramatically shape climate and impact in FSM.

[40] FSM. Second National Communication on Climate Change.
[41] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)

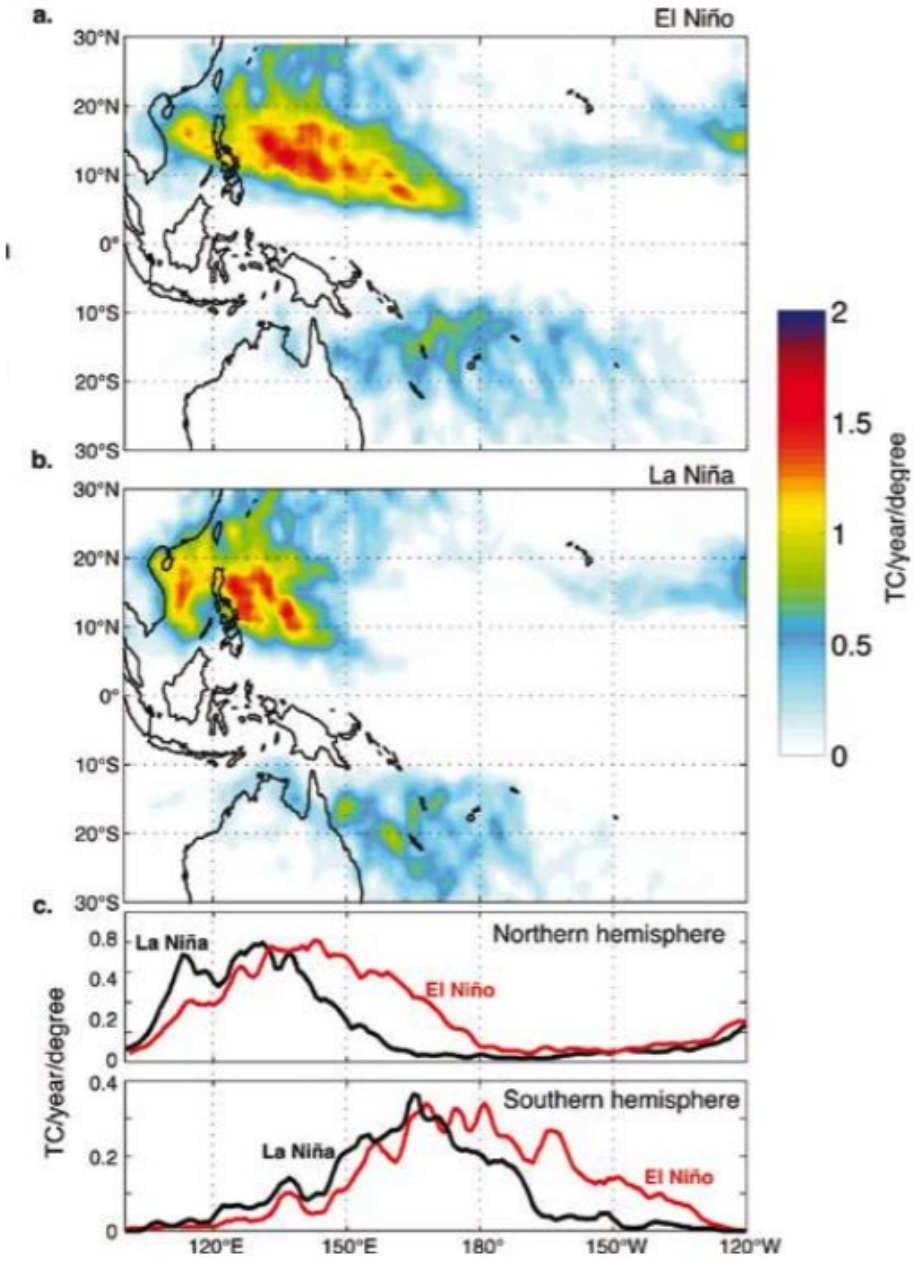


Figure 10: Tropical Cyclones and ENSO Conditions in the Pacific[42]

Ocean Acidification and Sea Surface Warming

Ocean acidification, as measured by the decrease in aragonite saturation, has risen in the region of Micronesia since measurements began in the late 18th century.[43] Previous studies have indicated that an aragonite saturation level above 4 is optimal for coral growth in the Pacific. Projections indicate that aragonite saturation levels will fall below 3.5 by approximately 2030, indicating an increase in ocean acidification which would severely negatively affect coral reefs in FSM. Under all emissions scenarios for FSM, sea surface temperatures are expected to increase in the coming

[42] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)
[43]FSM. Second National Communication on Climate Change.

decades. The current policies outlined in NDCs under the Paris Agreement will lead to an increase in global temperatures of 2.8–3.2°C by 2100.[44] This will negatively impact coral reefs throughout Micronesia. The IPCC has noted in the Special Report on the Cryosphere[45] that almost all coral reefs will degrade from their current state, even if global warming remains below 2°C, and the remaining shallow coral reef communities will differ in species composition and diversity from present reefs.

4. Sectoral Vulnerabilities and Potential Impacts

As discussed above, FSM is already facing challenges from climate change and these effects (sea level rise, changing precipitation patterns, increase in intensity of extreme weather events and ocean acidification and sea surface warming) are expected to become even more exacerbated in the future. These effects will significantly impact all sectors in FSM but are expected to have a significant impact on disaster risk reduction and coastal protection, food security and water security. The baseline for these sectors and how they are expected to be impacted from climate change can be found below.

Disaster Risk Reduction and Coastal Protection

Existing Community and Infrastructure Susceptibility to Disasters

Approximately 60% of households in FSM live within 180 m of the shoreline, with Kosrae having the greatest proportion of coastal-dwelling households (80%) and Chuuk having the least (38%).[46] Additionally, the majority of structures located in FSM are located near or along the coast (see Figure 11 below). Almost all outer island islets lie within the 2-metre zone of potential sea level rise, and all lie within a 5-metre zone of storm surge.

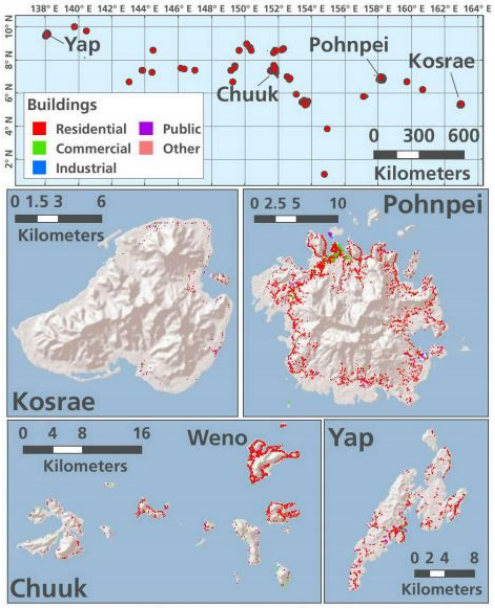


Figure 11: Building locations for main islands/atolls for FSM States

[44] Climate Action Tracker – 2100 Warming Projections
[45] IPCC. 2019: Technical Summary. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [Pörtner et al. (eds.)].
[46] GCF – Federated State of Micronesia Country Programme.

The World Bank has estimated that the replacement value of all exposed assets in FSM is approximately USD 2 billion (see Table 12 below for a breakdown of assets in FSM).[47] Extreme weather events have already caused considerable damage to communities and infrastructure in FSM in the past (see Annex 2 for a list of past climate damaging events).

Table 12: Exposed Assets and Cost of Replacement in FSM

Asset Counts:	
Residential Buildings:	28,226
Public Buildings:	1,257
Commercial, Industrial, and Other Buildings:	2,505
All Buildings:	31,988
Hectares of Major Crops:	7,729
Cost of Replacing Assets (million USD):	
Buildings:	1,729
Infrastructure:	313
Crops:	6
Total:	2,048

Impacts

Sea level rise and extreme weather events such as typhoons and storms are important risks for communities and infrastructure throughout FSM. These storms can cause devastating effects on both communities and infrastructure. Past tropical typhoons and depressions have caused significant damage in FSM, including Typhoon Maysak in 2015 for which the repair and construction of damaged homes and public buildings, totalled more than USD 40 million.[48] Annex 2 provides a more detailed list of climate damaging events, broken down by State.

Lower-lying atolls are especially vulnerable to inundation events and even losing arable land from projected sea level rise and extreme tide events. With projections of increased sea level rise under all climate scenarios and an increase in extreme high tide events due to climate change, these resources will become more vulnerable in the future.

On average, in any one year, FSM is expected to incur USD 8 million in losses due to tropical cyclones and earthquakes. The relative contribution from earthquakes is small as most islands of FSM are situated in a relatively quiet seismic area. In the coming 50 years FSM has a 50% chance of experiencing natural disaster losses exceeding USD 105 million. Additionally, there is at least a 10% chance that FSM will experience a loss greater than USD 450 million and fatalities of more than 600 individuals.[49]

Sea level rise analysis was conducted for the main islands of Yap, Chuuk, Pohnpei and Kosrae. This analysis utilized projections of sea level rise of 0.3 m by 2055 and 0.62 m by 2090. The projected sea level rise for Yap indicates that there will be inundation of large parts of existing coastline and low-lying areas of the main island.[50] The main island of Pohnpei will experience coastal changes due to sea level rise by 2055 as well as saltwater inundation of low-lying areas, including the Pohnpei airport.[51] The main island of Chuuk and the other islands located in the main atoll are also projected to experience coastal changes due to sea level rise by 2055 along with saltwater inundation.[52] The main island of Kosrae is projected to experience sea level inundation of low-lying areas up through 2090 (Figure 12).[53]

[47] World Bank – FSM Country Risk Profile.
[48] USAID's Office of U.S. Foreign Disaster Assistance (USAID/OFDA), March 2019
[49] Pacific Catastrophe and Risk Financing Initiative, 2011.
[50] DECEM FSM. Yap State Vegetation Overlay Analyses Vulnerability Map (2055 – 2090 Scenarios).
[51] DECEM FSM. Pohnpei Vegetation Overlay Analysis Vulnerability Map (2055 Scenario).
[52] DECEM FSM. Chuuk State Vegetation Overlay Analyses Vulnerability Map (2055 – 2090 Scenarios)
[53] DECEM FSM. Kosrae State Vegetation Overlay Analyses Vulnerability Map 2030, 2055 and 2090 Scenarios.

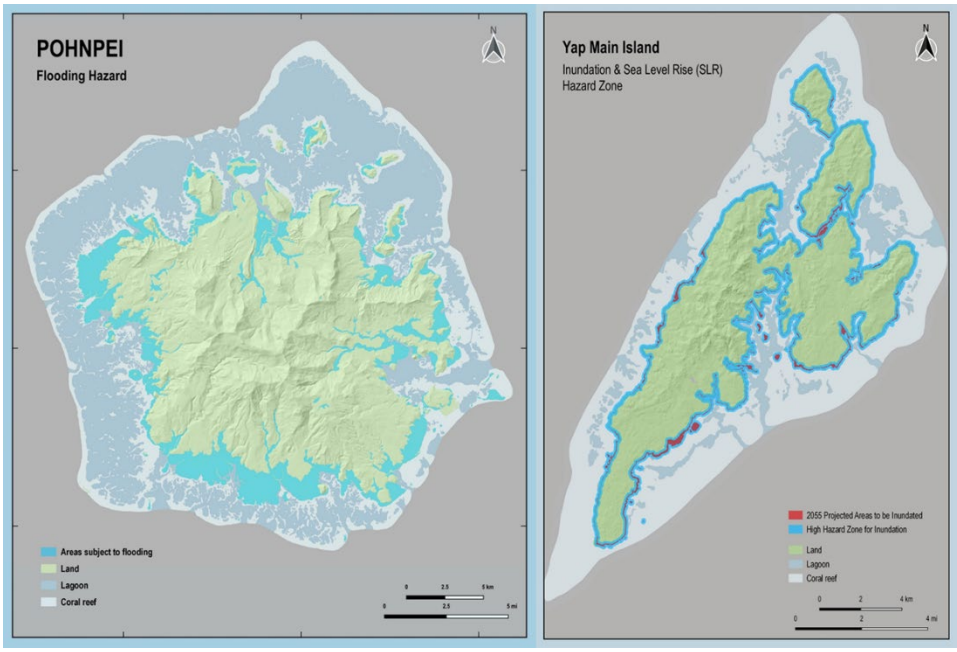


Figure 12: Sea Level Rise and Flood Hazard Maps for Pohnpei and Yap

The return periods for such extreme high sea level events have been estimated for Pohnpei (Table 13, no such data available for other islands in FSM). The monthly mean sea level for 1974–2004 in Pohnpei[54] is provided in Figure 13 (only values above the overall mean sea level for that period are displayed) showing a gradual increasing trend over that period.

Table 13: Return Periods (yr) for Extreme High Sea Level, Pohnpei

Sea Level (cm)	Observed Data	2025	2050	2100
80	1	1	1	1
90	1	1	1	1
100	4	2	1	1
110	14	5	2	1
120	61	21	5	1
130	262	93	20	1
140	1149	403	86	2

[54] Data drawn from the Permanent Service for Mean Sea Level database.

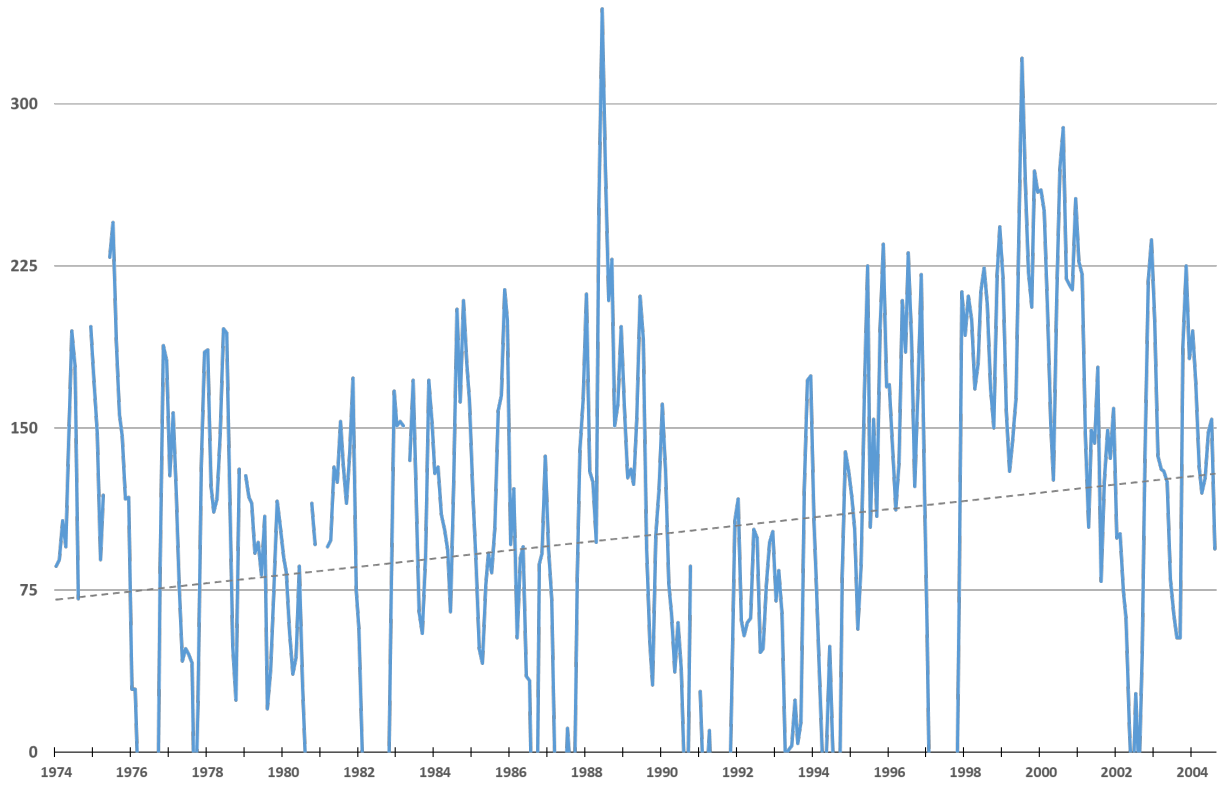


Figure 13. Monthly mean sea levels (mm) in Pohnpei for 1974–2004 above mean sea level for the period.

Parts of FSM are also currently subject to inundation from extreme rainfall events. As noted above, extreme precipitation events and the intensity of typhons and tropical storms are expected to increase in the future due to climate change. An increase in the intensity of these events will result in more severe inundation of low-lying communities. For example, Figure 14 below is a case study for the village of Sapwohn in FSM.[55] The study estimated depths of flooding in the area associated with an hourly rainfall event with a return period of 25 years for current conditions and for year 2050 with climate change projections. Under the current conditions scenario, the simulated event results in flooding up to a depth of between 0.4– 0.6 m for most of the study area (coded orange in figure). Under the 2050 scenario, maximum flood depths are projected to be over 1 m (coded red in figure), and all areas will be flooded by at least 0.2 m. This increased flooding will cause severe damage to community structures and infrastructure.

[55]FSM. Second National Communication on Climate Change.

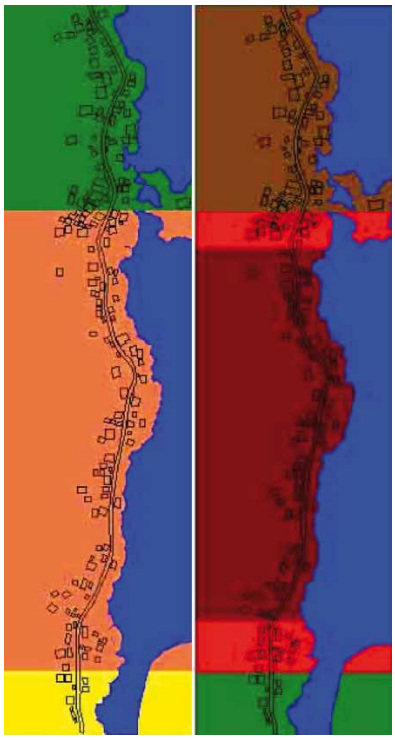


Figure 14: Flooded areas for a simulated rainstorm event (current conditions left 2050 conditions right).

Further, protracted La Niña-like conditions during the first decade of the 21st century caused marine inundation that required provision of emergency food and water supplies to some FSM communities. For example, in 2007 and again in 2008, many FSM communities were flooded by a combination of large swell and spring high tides that eroded beaches, undercut and damaged roads, intruded aquifers and wetlands, and inundated communities. Food and drinking water were in short supply. Seawater flowed into coastal wetlands and surged up through the water table, killing taro, breadfruit, and other foods. Fresh water ponds and wetlands turned brackish and have not yet recovered fully. On approximately 60% of inhabited atoll islets cropping sites in use for generations were physically and chemically damaged or destroyed.[56,57] Typhoons have caused significant damage in FSM.

Landslides have also been an issue for FSM during extreme precipitation events. In 2002, for example, tropical storm Chataan struck islands in Chuuk State and resulted in approximately 500 mm of rainfall within a 24-hour period.[58] This subsequently resulted in numerous severe landslides, which led to 43 deaths, hundreds of injuries and extensive damage to infrastructure on six islands.

Each State in FSM has been subject to several other climate damaging events throughout the 20th and 21st century. In Kosrae, since 1961, there have been six large swell events, two major high tide inundation events, three typhoons, one major drought, two flood events and one major landslide event[59]. In Chuuk, since 1971, there have been one major landslide event, 11 typhoons, two major high tide inundation events and four major droughts, the most recent of which was in 2016[60]. In Pohnpei, since 1957, there have been one major high tide inundation event, five typhoons, one major landslide event and three major droughts recorded, the most recent of which was also in 2016[61]. In Yap,

[56] Johnston, M, 2012: Federated States of Micronesia: Development of National Water and Sanitation Policy. Assessment Report, Course WATR7500, University of Queensland. Prepared in partnership with FSM DRD and SPC-SOPAC, 83pp
[57] Shigetani, M. 2009. Preliminary Damage Assessment, Federated States of Micronesia: High Tide Event, December 7-12, 2008.
[58] FSM. Second National Communication on Climate Change.
[59] FSM. 2016. Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change.
[60] FSM. 2017. Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change.
[61] FSM. 2016. Pohnpei Joint State Action Plan for Disaster Risk Management and Climate Change.

since 1997, there have been six typhoons and two major droughts[62]. These events have caused damage on both the high, volcanic islands and the outer atolls to infrastructure (public, commercial and residential), livelihoods, food and water security, marine and terrestrial ecosystems and, in some instances, fatalities. Additional information on these events can be found in Annex 2.

Food Security

Food security in FSM is composed of both terrestrial food production (e.g. agroforestry and livestock) and utilizing near- and off-shore marine resources (e.g. fishing in coastal reefs).

Terrestrial Agriculture and Livestock – Baseline

Across FSM, 40% of land area is used for agricultural purposes.[63] The highest percentage of land area used for agriculture is in Chuuk (70%), with the lowest percentage of land used in Kosrae (10%). A large portion of agricultural land is shared across households, with 54% of households with agricultural land identifying that they had an average of 1.6 parcels of land shared with other households. Most of the agricultural land is either owned, free-hold land (61%) or held through customary titles (32%).

A large percentage of FSM households (90%) have access to land that can be used for agricultural purposes. Over 90% of households with agricultural land grow the staple crops of the region across all FSM States: coconut, breadfruit and banana. Additionally, households grow a variety of root crops including yams, which are grown by 36% of all agricultural households. Vegetable crops are not very common, with the most common vegetable crop being peppers grown by 17% of households. Additional indigenous crops to FSM include kava (referred to as "sakau") and betelnut.

When it comes time to harvest, the staple crops of coconut, breadfruit and banana are harvested by most agricultural households within a 12-month period (90%). However, because of the nature of agroforestry practices, some crops are not harvested. Additionally, agricultural households experience some percentage of crop losses from weather events, diseases, pests and crop theft. In 2016 for example, weather events were the largest source of crop losses, resulting in losses on more than 10% of household agricultural land parcels across FSM.

Most of the crops grown by households in FSM are for subsistence purposes. However, some households sell a portion of their crop in commercial markets. The dominant commercial crop is kava and is sold by 57% of households that grow it. However, 98% of households growing kava for commercial purposes are located in Pohnpei. Other common commercial crops include cucumber, betelnut, swamp taro, coconut and breadfruit. The dominant method for selling commercial crops is directly to consumers (38%) across all of FSM. However, in Yap the dominant market for selling crops are local shops (>40%) and in Pohnpei the dominant medium is public markets.[64]

Cultural practices, tradition and subsistence use make livestock production an important component of terrestrial agriculture in FSM. Across the country, 61% of households with agricultural land have livestock, with Yap having the highest percentage of households with livestock (76%) and Kosrae having the lowest percentage (57%). The most common livestock type kept by agricultural households in FSM include pigs (adult and piglets), chickens (various breeds), ducks and dogs. Adult pigs are the most common animal kept by all FSM agricultural households, with over 40% of all households keeping adult pigs across all four States. Livestock kept by agricultural households is predominantly used for home consumption (48%). However, livestock is also commonly gifted (34%) and sometimes sold to individuals or in markets (19%). In 2016, the total value of livestock production across FSM was estimated at USD 4.8 million.

Terrestrial Agriculture and Livestock – Impacts

Both the volcanic and atoll agricultural areas in FSM are already susceptible to coastal erosion and saltwater inundation from storm surges and sea level rise. Saltwater inundation results in an increase in soil salinity, which can be deadly for most crops. Taro patches, which are generally located in low-lying areas, are especially susceptible to

[62] FSM. 2015. Yap Joint State Action Plan for Disaster Risk Management and Climate Change.
[63] FSM. Integrated Agriculture Census 2016.
[64] There are also key markets in Pohnpei that are privately owned, such as Saimon's and Ellen's.

saltwater inundation. The coastline of many volcanic and atoll islands in FSM harbour mangrove forests, which act as a buffer from storms and reduce saltwater inundation. However, sea level rise is already affecting the ability of mangroves to shield agroforests and other agricultural areas from seawater intrusion.

The majority of agricultural production within FSM occurs in the low-lying areas of the high, volcanic islands. These areas are increasingly subject to lowland flooding as well as seawater inundation from sea level rise, more extreme high tide events and storm surges from more intense tropical storms and typhoons. [65] Figure 15 below includes vegetation overlays of the four States' main islands with projected sea level rise. As can be seen in the figure, much of the coastal areas where agroforestry and other terrestrial activities take place is subject to future inundation. This inundation could result in a greater proportion of crops being destroyed and decrease overall food security for communities throughout FSM.

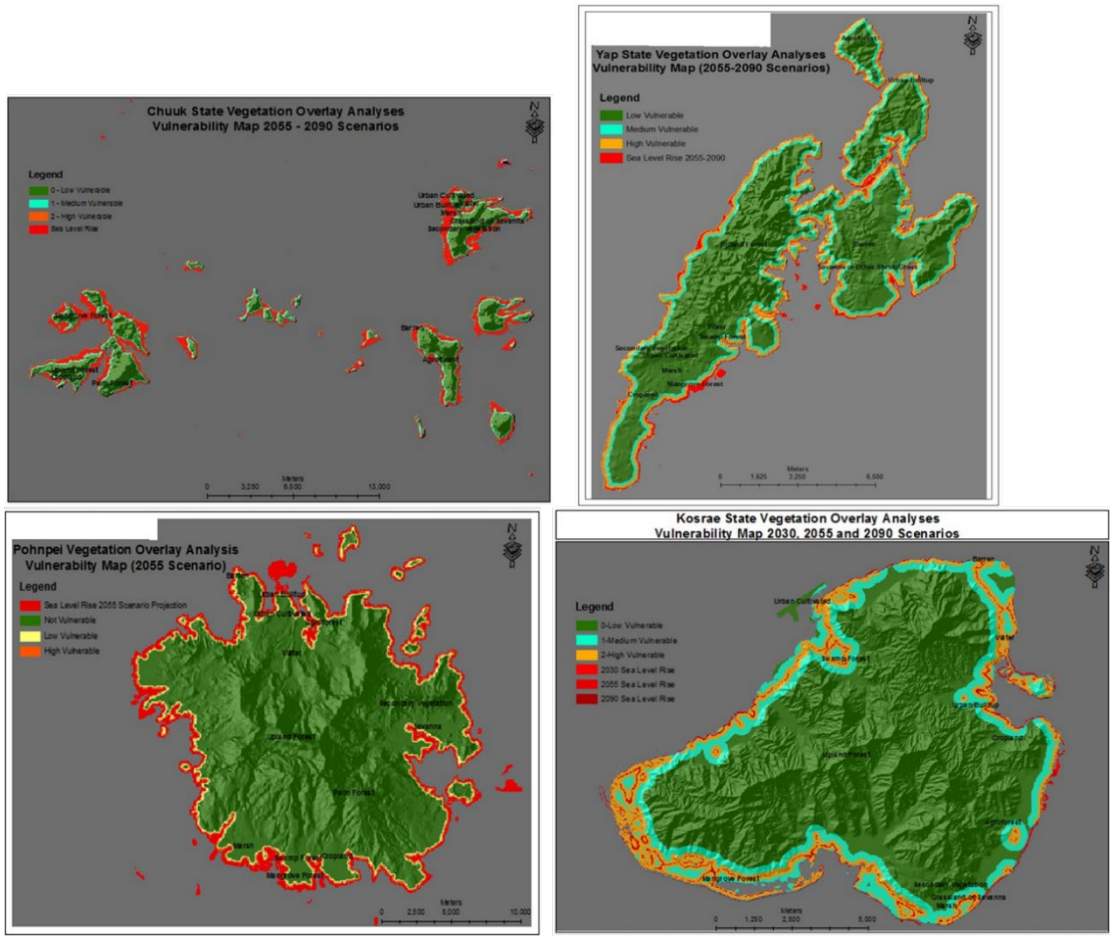


Figure 15: Vegetation overlays with projected sea level rise for FSM States

Terrestrial agriculture in FSM is also subject to impacts from changing precipitation patterns. Overall, precipitation is expected to increase throughout FSM, with some differences between States. However, precipitation patterns and extreme events may become harder to predict with the uncertainties surrounding the effects of climate change on ENSO patterns. Additionally, more intense extreme storm events and typhoons under climate change will have impacts on livestock and local markets (e.g. damage to market structures and livestock pens from strong winds and flooding).

[65] GCF Country Program – Federated States of Micronesia

As above, extreme tides, known as "king tides", are worsening under climate change and cause significant flooding, salinization, and erosion that ultimately damage groundwater resources, taro beds, soil, and livestock/agroforestry resources in coastal settings, especially in the low islands. [66] In March 2007 an acute-onset, high sea-level event occurred in two coral atoll islands of Lukunoch and Onep in Chuuk State, resulting in coastal erosion, shoreline inundation, and saltwater intrusion. In Onep, 50% of people suffered partial loss of livestock, while 36% of people completely lost all of their livestock. In Lukunoch, 25% of people suffered damage to their livestock. Saltwater intrusion during tidal surges in 2007 also affected Yap, which led to the mortality of 90% of the taro crop on the islet of Falalop, Ulithi atoll, and 75% of the taro crop on the islet of Falalop, Woleai atoll.[67] Assessment of damage following the 2008 tidal surges indicated substantial damage to four staple crops (taro, breadfruit, banana, and coconut) in the Chuuk State Islands – particularly the subsistence crops of taro and breadfruit which had severe damage or were fully destroyed.[68] Roughly half of all households surveyed reported at least a partial loss of their primary dietary staple and source of calories (taro and breadfruit). These findings are consistent with events that have been predicted to occur as a result of climate change.[69] Salinity levels will be highest during the dry season, with less precipitation to wash away salinity build-up. This will be particularly detrimental for agricultural production as the planting of most root staples in FSM occurs during the dry season (see Figure 16).

One of the most comprehensive reviews of climate change and agriculture in the Pacific[70] highlighted that for most staple food crops, extreme weather events including storm surges and king tides (and the resulting salinization) are most likely to have the greatest impact in the short- to medium-term timescale (2030–2050), compared with changes in mean temperature where significant impacts are not expected before 2050. Most cash crops and high value horticultural products are also highly vulnerable to extreme weather events, accounting for many of the losses that occur in the Pacific. The projected increase in the frequency and intensity of extreme weather events due to climate change poses the greatest risk to cash crop production over the next few decades.

This conclusion is supported by a number of other publications. The World Food Programme's Pacific Interim multi-country strategic plan (2019–2022)[71] highlights that "The increasing number and intensity of natural hazards is the main driver of food insecurity in the region" and that the effects of extreme weather patterns, including cyclones, salination due to sea level rise and the increase in seawater temperature exacerbate the already fragile natural environments of the PICTs, making it increasingly difficult to produce enough food to meet their populations' needs." And further that, while hunger and malnutrition in the Pacific are driven by other sociocultural drivers, the most severe challenges to maintaining development gains and making further progress towards the achievement of the SDGs are posed by the increase in frequency and impact of extreme weather events such as tropical cyclones and El Niño-related droughts, which reduce the amount of arable land suitable for farming. The PICTs are particularly vulnerable because fertile coastal plains are threatened by super storms and saltwater intrudes into previously fertile land as sea levels rise". The Asian Development Bank's Food Security and Climate Change in the Pacific[72] similarly highlighted the loss of land due to inundation as the primary adaption need for agricultural production and food security in FSM. IPCC's Fifth Report focuses on extreme weather, sea level rise, cyclones, etc. as "key risks" for adaptation in small islands.[73] Finally FAO's vulnerability assessment report[74] for FSM's agriculture sector highlighted that "FSM is highly vulnerable to impacts of natural variability and climate change as evidenced though actual extreme weather events such as typhoons, storms, drought, flooding that have affected peoples food security and livelihoods by destroying staple crops and terrestrial and marine ecosystems."

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[66] Climate Change in the Federated States of Micronesia Food and Water Security, Climate Risk Management, and Adaptive Strategies (2010)

[67] Perkins and Krause, Adapting to climate change impacts in Yap State, Federated States of Micronesia: the importance of environmental conditions and intangible cultural heritage, Island Studies Journal (2018)

[68] Post Disaster Assessments of FSM Outer Islands Via FSMNC2 pg. 81

[69] Assessment of a Centennial Event for Climate Change in Chuuk via FSMNC2 pg. 91

[70] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)

[71] WFP - Pacific interim multi-country strategic plan (2019-2022)

[72] ADB - Food Security and Climate Change in the Pacific (2011)

[73] IPCC 5th Report

[74] FAO Climate risks, vulnerabilities and impacts of climate change on the agricultural sector in FSM: Assisting Small Island States to Integrate the Agricultural Sectors into Climate Change Priorities and Nationally Determined Contributions (2020).

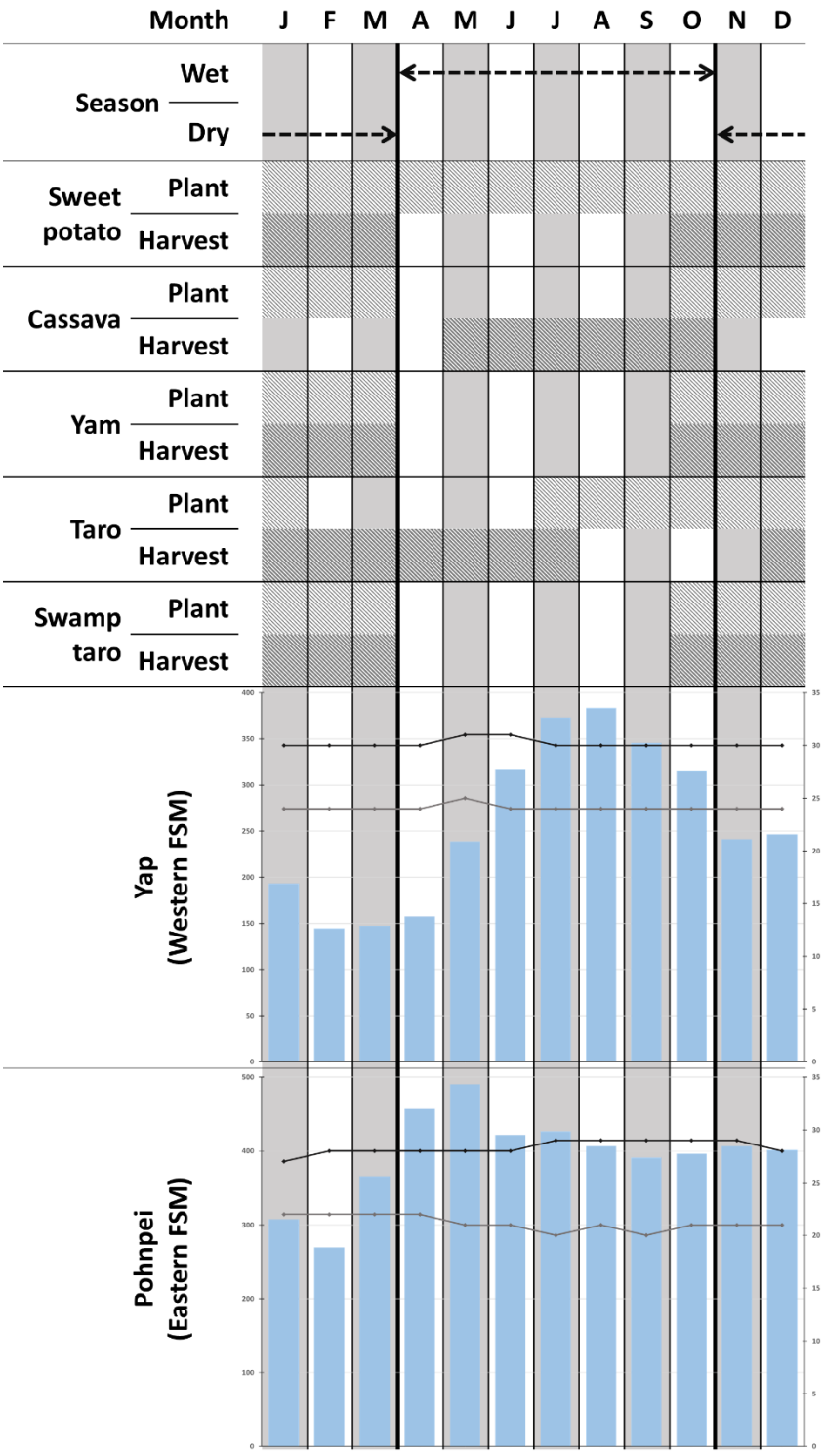


Figure 16. Cropping calendar for key root crops affected by salinity[75,76] with average monthly rainfall, minimum and maximum temperatures provided for eastern (Pohnpei) and western (Yap) FSM.

[75] FAO. 2020. Crop production manual: A guide to fruit and vegetable production in the Federated States of Micronesia
[76] Fiji Ministry of Agriculture. 2016. The Crop Farmer's Guide.

Almost all outer island islets lie within the 2-metre zone of potential sea level rise, and all lie within a 5-metre zone of storm surge. Many of these islands already have had to abandon taro patches because of inundation in the past.[77] In urban areas on the high islands, most of the agricultural areas are located around coastal areas and are vulnerable to rising ocean waters and are already enduring increased flooding and drainage problems.[78] Further, the high islands of the FSM will need to begin now to prepare for rapid population increase in the form of climate change refugees from low-lying islands, while at the same time, enhancing and adapting their own food production systems.

As highlighted above, the risk of sea level rise, extreme weather events, and salinization are likely to be much larger drivers of climate impacts on agriculture in FSM at least until 2050 and beyond when temperature and precipitation variables are likely to have a more pronounced impact, especially if global emissions continue to track the high emission scenarios (RCP 6.0 and RCP 8.5).[79] Negative production impacts have been assessed as high for rice, swamp taro, domesticated yams, and moderate to high for sweet potato and taro. By contrast, the production impacts on cassava, aibika (bele), breadfruit and banana has been assessed as low to moderate and low for cocoyam, giant taro, and wild yams. However, despite these threats the overall impact on Pacific food crop production is expected to be generally low over the next few decades and far less than the impact on imported grain crops from other regions. A summary of temperature, precipitation, and pest impacts from the Pacific vulnerability report can be seen generally, and for specific crops below.

It should be noted that while insights for FSM crop yields can be seen, the report focuses on the entirety of PICTs. While the resilience of these crops cannot be separated from their cropping systems and from the farmers and communities who manage those systems, individualized country level assessments have been more limited, particularly for FSM. However as highlighted by the 5th IPCC report[80], "Uncertainty in the projections is not a sufficiently valid reason to postpone adaptation planning in small islands. In several small islands, adaptation is being progressed without a full understanding of past or potential impacts and vulnerability. Although assessment of future impacts is hampered because of uncertainty in climate projections at the local island level, alternative scenarios based on a general understanding of broad trends could be used in vulnerability and sensitivity studies to guide adaptation strategies" [81].

- **Temperature** – Pacific root and tuber crops will be less affected by projected climate conditions than cereal crops. Generally, the projected temperature increases (0.5–1°C regardless of emission scenario) up to 2030 will not affect production, based on what is currently known for optimum crop production conditions. Between 2030 and 2050, temperatures will be influenced by the emission scenario with projections of 0.5–1°C (very low scenario) to 1–2°C (very high scenario) increases by 2050, and beyond 2050, the temperatures again vary significantly depending on the emission scenario. Specific impacts are difficult to predict based on current knowledge, but obviously temperatures approaching 2°C and beyond will create significant physiological stress for many of the staple crops.[82]

- **Precipitation** – An increase in average annual rainfall over large parts of the tropical Pacific is predicted for a warmer climate, with impact prior to 2030 being minimal. After 2030, more distinctive patterns emerge, which will become progressively stronger with time and for higher emission scenarios (RCP 6 and RCP 8.5). Projected rainfall increases for countries such as Papua New Guinea (PNG), parts of the Solomon Islands, Palau and FSM will need to be considered in the context of rainfall that is currently high. An increase of 25% in mean annual rainfall would have a significant damaging effect on crop production in locations where rainfall is already high to very high.[83]

- **Pests** – Of importance also is the impact of extreme events on pest and disease outbreaks. There is very limited information regarding how climate change will influence pest and disease incidence and

[77] FSSLP via FSMNC2
[78] Statewide Assessments and Resource Strategies via FSMNC2 pg. 64
[79] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)
[80] IPCC 5th Report
[81] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)
[82] Ibid
[83] Ibid

distribution, so projections are difficult. However, projections for changing climate in the Pacific generally improves conditions for pest growth and spread.[84] An assessment of food security in FSM specifically also identified the possibility of climate change triggering expanded opportunities for pests and disease in staple crops specifically, fruit flies, mealybugs, scale insects, and whiteflies.[85] A further assessment highlighted uncertain impacts of climate change on pests, but noted that there was significant potential for expanded optimal conditions for pest spread, particularly for fruiting trees.[86]

Table 14: Potential Impacts on Pacific Crop Production from Climate Change

Crop	General Summary	Temperature	Precipitation	Pests
Sweet Potato	**2030–2050:** Impact on tuberisation and yield will be greatest in those countries where rainfall is already high, and where temperature is currently around 32°C. Impact on pests and diseases is unclear — possibly increased pressure from sweet potato scab. **Overall production assessment impact: moderate** **Beyond 2050:** Increasingly serious impact for those countries where there is currently high rainfall and temperatures, especially with high emissions scenario. The impact on pests and diseases is unclear. **Overall production assessment impact: moderate to high**	An increase of 1–2°C (very high emission scenario) by 2050 would affect production in countries where temperatures are currently around 32°C (e.g. FSM), within one or two generations, which would have major food security implications. Beyond 2050, the food security implications under all emission scenarios except RCP2.6 could be serious. Extreme heat events would also be expected to have impacts in countries with temperatures around 32°C. The impact would depend on the timing and duration of the event, as well as soil moisture levels.	An increase in mean annual rainfall might cause some reductions in tuber yield, particularly on heavy clay soils. Excessively high soil moisture, however, particularly during initiation (6–10 weeks after planting) reduces tuber yield. Where rainfall is already very high, most growers will find it difficult to counter a significant rainfall increase — an increase in rainfall, particularly between October and March, would result in yield reductions in many locations.	A wetter climate could increase problems with sweet potato scab.
Cassava and Yams	**2030–2050:** Cassava impact is expected to be minimal, but extreme rainfall events could cause problems with waterlogging. Cyclone intensity could cause lodging problems which would affect growth. Possible yield benefits from eCO_2. For yam production, impact from increased intensity of cyclones would be expected and increased rainfall likely to increase incidence and spread of anthracnose. **Overall**	While the optimum temperature for cassava tuber growth is 25–29°C, it will tolerate a wide temperature range of 12–40°C. Thus, increases in average temperature, even up to 2°C and beyond, are not expected to have a significant impact on cassava production. Extreme heat days would also be expected to have little impact, but as with all crops the ability to	Overall, it could be expected that a wetter environment would favour cassava and yam production compared with other root crops. However, Cassava is particularly susceptible to waterlogging. Based on simulations in Fiji using three different future climate change scenarios (warmer through to warmer/drier conditions), tuber yields	Higher rainfall will increase the incidence and intensity of yam anthracnose disease, possibly resulting in epidemic developments with serious implications for yam production.

[84] Ibid
[85] Fourteen Atoll Assessment of Food Security via FSMNC2 pg. 61
[86] Building climate-resilient food systems for Pacific Islands

	production assessment impact: cassava (insignificant to low) wild yam (insignificant) domesticated yams (moderate to high) **Beyond 2050:** Extreme rainfall and cyclone events would be likely to increase lodging and waterlogging problems. It is unclear how cassava pests and diseases will be impacted. Possible yield benefits from eCO_2. For yams, projected temperature rise could affect bulking and therefore yield. Damage from cyclones would occur and increasing rainfall levels would intensify anthracnose problems. **Overall production assessment impact: cassava (Low to moderate), wild yams (low) and domesticated yams (high)**	manage heat stress will be influenced by precipitation.	were projected to decline by up to 9% by 2030, and up to 18% by 2050. In addition to declines in yield, the year-to-year variability was shown to increase by up to 19% by 2030 and up to 28% by 2050 (the increase in variability is driven by more frequent lower yielding years).	
Taro and other Aroids	**2030–2050:** Countries where rainfall levels are currently a constraint could be more able to grow taro. Increased intensity of cyclones could cause damage depending on stage of crop growth. For cocoyam and giant taro — impact is expected to be minimal. For swamp taro — increasing losses from saltwater intrusion are likely. Taro — possible yield benefits from eCO_2. **Overall production assessment impact: taro (low to moderate), cocoyam (insignificant), swamp taro (moderate to high), giant taro (insignificant)** **Beyond 2050:** Very high temperature increases (>2°C) could affect production especially in countries where temperatures are currently high. Cyclones will continue to cause damage. A continued	Modelling studies suggest that projected changes in mean climate conditions will have little effect on taro production, with the exception of extremely low rainfall. Extreme heat days are likely to pose a threat in this regard. In the long term, as 30°C is the optimum temperature for taro, temperature increases of 2°C and beyond could impact on production, and similarly with the other aroids, possibly with the exception of swamp taro. It is likely that cocoyam production will remain unaffected by changes in temperature in the short term. However, as a marked reduction in mean temperature is required for tuber bulking, the projected temperature increases in the long term and extreme heat	Overall wetter conditions would generally favour taro production and extend the areas available for successful cultivation. Taro can be highly tolerant of waterlogging, depending on the variety. Taro cannot survive prolonged moisture stress, which seldom poses a problem in traditional food gardens	A rise in minimum night-time temperatures increases the likelihood of TLB spreading to locations currently free of the disease. The vulnerability of susceptible taro varieties to TLB will be increased if higher levels of humidity are associated with higher night temperatures. Increased rainfall would also favour the spread of Pythium (which would affect both taro and cocoyam) and probably taro

	spread and increase of TLB and other taro pests and diseases would also be expected. For cocoyam and giant taro — temperature (>2°C) would be a constraint to productivity. Swamp taro could disappear from atoll environments. Taro — possible yield benefits from eCO_2. **Overall production assessment impact: taro (moderate to high), cocoyam(low), swamp taro (high), giant taro (low)**	events, depending on timing and duration, could be significant.		armyworm or caterpillar.
Bananas	**2030–2050:** Favour cultivation in currently sub-optimal locations and at higher altitudes. Higher temperatures could affect flowering and fruit filling. Higher temperatures could increase pest and disease. Increase in cyclone damage. **Overall production assessment impact: low** **Beyond 2050:** Increased pest and disease pressure (Fusarium wilt, nematode and weevil) is likely though the enhancing impact of rainfall on BLDS could be lessened by higher temperature. The heat stress effect on flowering and fruit filling would increase, as would cyclone damage. **Overall production assessment impact: low to moderate**	Up to 2030 the projected mean temperature rise of 0.5–1°C is not likely to result in any significant reduction in banana yields at low altitudes, and could in fact support banana cultivation at higher altitudes. However, temperatures in excess of 35°C (heatwaves) are likely to affect flowering and bunch filling. By 2050 and beyond, temperature could be a significant constraint on banana production at low altitudes, especially if warming proceeds according to the very high emissions scenario (RCP 8.5), where 1–2°C will be reached by 2050, and 2–4°C by 2090.	The impact of changes in rainfall on bananas is harder to project, but greater irregularity and decreasing rainfall will increase the length of the crop cycle and the seasonality of bunch production. Some banana production areas could have problems with waterlogging. Bananas will grow within a reasonably wide range of rainfall, and therefore in the short to medium term, projected increases in rainfall are unlikely to affect production. In the longer term, beyond 2050, and especially with countries lying between latitudes 5°N and 5°S, the projected rainfall increases could affect production, assuming that 4000 mm rainfall per year is the threshold for the banana varieties cultivated in the Pacific. As with temperature, the projected increase in number of heavy rain days is more a cause for concern in the short to medium term, with the	Optimum temperature for development of black leaf streak disease (BLSD) is 27°C and the disease is reduced by very high temperatures (>36°C). Higher rainfall is also likely to increase pressure from BLSD and from Fusarium wilt.

			potential for waterlogging to affect bunch yield.	
Breadfruit and Aibika	**2030–2050:** Expected to be minimal though cyclone damage likely to increase. **Overall production assessment impact: insignificant to low** **Beyond 2050:** Expected to be minimal though higher temperatures could reduce fruiting and fruit quality. Cyclone damage will worsen with increased intensity of cyclones. Possible increase in pest and disease problems. **Overall production assessment impact: low to moderate**	Increasing temperatures are unlikely to have much impact on breadfruit at least to a 2°C increase, although fruit drop and smaller fruit are likely to be a problem if heat stress is accompanied by low rainfall. Increasing temperatures are unlikely to affect aibika unless accompanied by low rainfall, in which case growth would be affected, as would pest and disease incidence and severity. A study on the cultivation potential of breadfruit (a key staple crop for FSM) under different climate change scenarios in Hawaii and the broader Pacific highlights that using average annual temperature and rainfall projection data to 2070 (CMIP5 model using RCP 4.5 and RCP 8.5) breadfruit suitability increases in area and quality with larger increases under RCP 8.5. The study also highlights that current producing regions (i.e. FSM) largely remain unchanged in both projections, indicating relative stability of production potential in current growing regions.[87]	A study on the cultivation potential of breadfruit (a key staple crop for FSM) under different climate change scenarios in Hawaii and the broader Pacific highlights that using average annual temperature and rainfall projection data to 2070 (CMIP5 model using RCP 4.5 and RCP 8.5) breadfruit suitability increases in area and quality with larger increases under RCP 8.5. The study also highlights that current producing regions (i.e. FSM) largely remain unchanged in both projections, indicating relative stability of production potential in current growing regions.[88]	Drought will reduce growth of aibika and drier weather, will generally increase attack from the Nisotra beetle, jassid and leaf roller. Extremes of rainfall are likely to provide conditions that will encourage increased incidence and severity of pests and diseases of aibika. Increased rainfall will favour collar rot, and stem and tip rot. Increased rainfall is likely to exacerbate damage by *Phytophthora palmivora*, affecting fruit quality.
Papaya	**2030–2050:** Severity of some diseases such as Phytophthora and anthracnose likely to increase because of a wetter climate. Increase of 1°C could affect fruit set. Although cyclone	An increase in mean temperature of 0.5–1°C (projected for 2030, regardless of emission scenario) could increase the occurrence of 'female sterility', in which normally	Extreme rainfall events can cause damage to tree stands and contribute to waterlogging and washout.	Any increase in rainfall will exacerbate the severity of fungal diseases such as Phytophthora

[87] Cultivation potential projections of breadfruit (Artocarpus altilis) under climate change scenarios using an empirically validated suitability model calibrated in Hawaii (2020)
[88] Ibid.

	frequency is expected to decrease, papaya production will be negatively impacted by likely increasing intensity of cyclones. **Overall production and economic impact assessment: low to moderate** **Beyond 2050:** Impacts of increased temperature, increased high rainfall events and intensity of cyclones likely to be significant. It is expected that the competitive position of the Australian papaya industry relative to Fiji and other potential Pacific Island producers will improve. **Overall production and economic impact assessment: moderate to high**	hermaphroditic papaya plants produce male flowers, resulting in poor fruit set and production. However, this increase in temperature during the winter months might also result in better ripening during these normally 'slow' months of the year.		and anthracnose which are already causing production problems.
Mango	**2030–2050:** Fruit set will continue to be adversely affected by unpredictable rains and temperature fluctuations during winter months. Reduction of fruit quality would result from frequent pre-wet season rains. Increasing problems with anthracnose possible. **Overall production and economic impact assessment: low to moderate** **Beyond 2050:** High temperatures could affect flowering. Mango production will be negatively impacted by increasing intensity of cyclones. Unpredictable rains could also have a significant impact. Possible increasing mango fly and anthracnose problems. **Overall production and economic impact assessment: moderate**	Mango, being a perennial fruit crop, will respond differently to increases in temperature than annual crops. A perennial crop such as mango may survive desiccating conditions, which could be highly beneficial for yield in succeeding growth seasons. An increase of 0.5–1°C by 2030 will have little or no impact on mango production in the region. However, an increase in mean annual temperature of at least 1.5°C (projected for 2050 under RCP 8.5) may adversely impact the flowering of mango trees, because floral induction occurs in response to cool temperatures.	Extreme rainfall events can cause damage to tree stands and contribute to waterlogging and washout.	The impact of climate change on the incidence and severity of *Bactrocera frauenfeldi* (mango fly) is unclear. Higher rainfall is expected to cause an increase in the pest, but excessive rainfall could also decrease populations (Jackson pers. comm.)
Citrus	**2030–2050:** Minimal impact on pests and diseases of citrus as a result of a warmer and generally wetter environment. **Overall**	Citrus trees of the various species and cultivars are widely adapted, and will survive and grow (although sometimes with difficulty) in	Extreme rainfall events can cause damage to tree stands and contribute to	A warming temperature and a wetter environment can be expected to

	production and economic impact assessment: insignificant to low **Beyond 2050:** Increasing temperature and wetter environment can be expected to increase the incidence of pests and diseases. The likelihood of more intense cyclone events could accentuate the spread of diseases. **Overall production and economic impact assessment: low**	nearly any climate that does not kill them	waterlogging and washout.	increase the incidence of pests and diseases. More intense cyclone events could accentuate the spread of diseases.
Pineapple	**2030–2050:** Expected to be minimal. **Overall production and economic impact assessment: insignificant** **Beyond 2050:** No apparent adverse impact from increasing temperature. Severe rain events and subsequent waterlogging would impact production. An increase in ENSO-associated drought events could increase pineapple wilt disease. **Overall production and economic assessment impact: low to moderate**	No apparent adverse impact from an increase in mean annual temperature is likely for pineapple production	Any increase in severe rain events could negatively impact pineapple because of its susceptibility to waterlogging.	Diseases like pineapple wilt disease, a serious disease of pineapples vectored by *Dysmicoccus brevipes*, are likely to increase with a reduction in rainfall (Jackson pers. comm.).
Kava and Betel nut	**2030–2050:** More intensive cyclones likely to have significant impact, particularly for plantings not in agroforestry food gardens. Unlikely any significant impact on betel nut in existing production areas. **Overall production impact assessment: insignificant for kava, low for betel nut.** **Beyond 2050:** More intense cyclones expected to have a major impact. Significant increases in rainfall could cause problems with water-logging. How climate projections will affect kava dieback is not known. An increase in rainfall levels in	A 1.5°C increase in mean annual temperature (projected for 2050 under RCP 8.5) is unlikely to have an adverse impact on kava and betel nut production.	Any overall increase in rainfall levels is unlikely to be damaging to either kava or betel nut production; if rainfall increased in currently drier areas, then the impact could be positive.	The impact of the projected climate conditions on kava dieback is not clear, except that an increase in environmental stress could mean the plant is more susceptible to the disease.

	currently dry areas could favour production for betel nut. **Overall production impact assessment: moderate for kava, low for betel nut.**			
Coconuts	**2030–2050:** No major effect is expected until at least 2050. The main impact will be from the expected increased intensity of cyclones on the increasingly senile population of coconut palms. **Overall production and economic impact assessment: low** **Beyond 2050:** The likelihood of increasingly severe cyclones could have a severe impact on coconut production. Rainfall could reduce production especially in areas where rainfall and cloud cover are already relatively high. The impact of major pests and diseases is unclear; effectiveness of biocontrol agents for rhinoceros beetle could be reduced. **Overall production and economic assessment impact: Low to Moderate**	Research indicates that rising temperatures and rainfall changes could reduce coconut yields by reducing pollen quality and/or germination, thereby affecting fruit formation and nut development, leading to a smaller number of nuts or empty nuts. An increase in average annual temperature of 1.5°C would enable a further increase in the altitude at which palms bear. In areas where there is a large increase in rainfall, with a concurrent increase in cloud cover, nut production is likely to decline.	Coconuts are unlikely to be significantly impacted by climate change (changes in mean annual temperature and precipitation) until beyond 2050 when, depending on the emissions scenario, rainfall could be a factor affecting production, particularly in those areas where rainfall and cloud cover are already relatively high. Extremes of temperature and periods of drought could lead to reduced yield.	Rising temperatures and lower rainfall could reduce the effectiveness of the fungus, *Metarhizium anisopliae*, which is still used in the control of rhinoceros beetle. As little is known about Bogia coconut syndrome, it is impossible to predict how this disease will respond to the projected conditions.

For livestock, the same Pacific vulnerability report highlights the following general impacts on livestock production in PICTs including FSM:

> *In general, the high-output breeds introduced to PICTs from temperate regions are not well adapted to heat stress, and milk, egg and meat production, fertility and longevity would all be expected to decline as temperature increases. While existing breeds may be able to cope with temperature projections for 2030, breed and species substitution in some regions might be expected by 2050 and 2090. These shifts will be further exacerbated by the projected gains in temperature extremes. Bos taurus dairy breeds and chickens are particularly vulnerable to these future temperature shifts.*
>
> *Increases in the frequency and intensity of severe heat waves have the potential to cause substantial deaths, as experienced by feedlot animals in the United States in recent years. It might be expected that the estimated 60% of Pacific livestock reared in traditional systems would be more susceptible than the semi-commercial and commercial systems to extreme climate events. The predicted increase in intensity of storm and flood events is likely to lead to increased infrastructure damage and human/ animal health risks associated with waterborne diseases.*
>
> *Rises in sea level will inevitably lead to contraction in land area, which is likely to lead to increased animal– human contact and hence greater exposure to disease, especially in the smaller atoll*

islands. Furthermore, intensification will impose more pressure on remaining water and feed resources. Similarly, saltwater intrusion associated with sea level rise will affect water supplies and could impair the growth of any feedstuffs along coastal areas.

The response to changes in temperature, atmospheric CO2 concentration and water supply will vary with species and their individual environmental tolerances. Suffice to say that future climate change will inevitably lead to changes in the composition and geographical extent of different species. This is expected to lead to a decline in feed quality associated with a shift away from C3 to C4 grass species, the increased lignification of plant tissues and the expansion of generalist species into areas previously dominated by regionally adapted species. In production systems where animals are fed on concentrates, rising grain prices likely under future climate change projections will increase the pressure to use animals that efficiently convert grains into meat, eggs or milk. Thus, within such systems climate change may lead to greater use of poultry and pigs at the expense of ruminants, and greater focus on the breeds that are the best converters of concentrate feed under high external input conditions. Increases in the price of grain may also contribute to the further concentration of production in the hands of large-scale producers. Similarly, the general trends and responses in the geographical extent, population, life cycle and transmission of livestock diseases and pests to future climate change.

Fisheries and Aquaculture – Demographics and Habitat

Fishing and other aquatic activities are additionally important to households throughout FSM for subsistence purposes and occasionally for commercial purposes. In 2016, 55% of households across FSM indicated that they had engaged in fishing activities within the previous 12 months. Households that fished reported that they made on average more than eight fishing trips per month.

FSM has a variety of habitats to fish in including coastal reefs, lagoons, outer reefs, open ocean, mangroves and freshwater. Most fishing households indicated that they most often fished within coastal reefs (75%), and this is consistent across all four States. The dominant fishing method used across FSM is spear fishing, excluding Kosrae where trolling and casting for fish is used most often. However, most households that do fish in FSM indicated that they utilize more than one form of fishing method.

Unsurprisingly, reef fish are the most common species type caught by fishing households in FSM, with 80% of fishing households catching reef fish species. However, this somewhat varies by State with 75% of fishing households in Chuuk catching octopus and squid. Other common species caught include tuna, crab, lobster, turtle, shellfish, ornamental fish and sea cucumber. A summary of the overall catch by classification can be seen below.[89]

Table 15: FSM Fisheries Intake by Classification

Demersal Fish (tonnes)	Percent of Total Catch	Nearshore pelagic (tonnes)	Percent of Total Catch	Invertebrates (tonnes)	Percent of Total Catch	Total Catch (Tonnes)
3,832	72.6	1,166	22.1	282	5.3	5,280

Most of the fish caught by fishing households in FSM is used for subsistence purposes. However, some households do sell a portion of their fishing catch. 24% of households that reported catching coastal reef fish indicated that they sold a portion of their catch, and for all species caught, 15% of fishing households indicated that they sold a portion of their catch. Men make up the majority of individuals in FSM that are engaged in fishing activities, with 84.4% of fishers being male and 15.6% of fishers being female across FSM.

[89] Commonwealth Marine Economies Programme. 2018. Effects of Climate Change on Fish and Shellfish Relevant to Pacific Islands, and the Coastal Fisheries they Support.

Aquaculture is not very commonly practiced across FSM. Only 3.2% of all households across the country indicated that they were involved with aquaculture practices. Clams are the most common species cultivated, with 63% of households participating in aquaculture activities across FSM indicating that they cultivate clams.

Fisheries and Aquaculture – Impacts

Rising sea surface temperatures as well as a projected increase in ocean acidification in the coming decades due to climate change will cause increased occurrences of coral bleaching, damage to migratory fish stocks, and overall decrease the health of the marine environment. [90,91,92,93] This will be especially impactful to near-shore coral reefs and the fish and other marine species that depend on these coral reefs for habitat. A decrease in the health of these habitats could result in less catch for households that utilize these resources and result in an overall reduction in food security throughout FSM. Overall FSM was classified as a group 2 fishery indicating that "Coastal fisheries should be able to produce the fish needed in the future but difficult to distribute to urban centres from remote islands & atolls" (Table 16).[94]

Table 16: Overall Projections for Fishery Production in FSM

Variable	Demersal fish	Nearshore pelagic fish (West 15°N–20°S and 130°E-170°E)	Nearshore pelagic fish (East 15°N–15°S and 170°E-150°W)	Invertebrates	Total Coastal Fisheries (West)	Total Coastal Fisheries (East)
Change in production due to climate change (2050)	-20%	-10%	+20%	-5%	-10 to -20%	-5 to -10%
Change in production due to climate change (2100)	-20 to -50%	-15 to -20%	+10%	-10%	-20 to -35%	-10 to -30%
Main direct and indirect effects of climate change	Habitat loss, and reduced recruitment	Reduced production of zooplankton in food webs for non-tuna species and changes in distribution of tuna		Habitat degradation, declines in aragonite saturation due to ocean acidification		

Recent studies[95] have projected that coastal fisheries in Micronesia are projected to progressively decline due to due to both the direct effects (e.g. increased sea surface temperature [SST]) and indirect effects (changes to fish habitats) of climate change. Catches of demersal fish and nearshore pelagic fish are all expected to gradually decline, due to habitat loss and reduced production of zooplankton as a result of changing sea surface temperature conditions and changes in currents. While the redistribution of bigeye tuna due to climate change is expected to be modest, under high greenhouse gas emissions scenarios, skipjack and yellowfin tuna catches could decline. Biomass of skipjack and yellowfin tuna is also projected to increase in most high-seas areas in subtropical regions, leading to less catches in the FSM EEZ. The tuna license revenue in 2016 in FSM was approximately USD 63.2 million. Under high emission scenarios it is estimated that up to USD 16.4 million in revenue could be lost by 2050, which is a loss of 14.6% relative to 2016.[96] An FAO review[97] of climate vulnerability and fish-based food security highlighted that

[90] FSM. Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change
[91] FSM. Pohnpei Joint State Action Plan for Disaster Risk Management and Climate Change
[92] FSM. Yap Joint State Action Plan for Disaster Risk Management and Climate Change
[93] FSM. Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change
[94] Commonwealth Marine Economies Programme. 2018. Effects of Climate Change on Fish and Shellfish Relevant to Pacific Islands, and the Coastal Fisheries they Support.
95 Bell et al. 2011. Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change: Summary for Pacific Island Countries and Territories. Secretariat of the Pacific Community, Noumea, New Caledonia
[96] SPC Policy Brief #32 2019 Implications of climate-driven redistribution of tuna for Pacific Island economies.
[97] FAO Assessing climate change vulnerability in fisheries and aquaculture (2015)

FSM is likely to see a moderate to high negative impact on longline tuna fishery economics and a low positive benefit for surface fishery tuna economics. The four species of tropical tuna – albacore, bigeye, skipjack and yellowfin – are expected to have relatively low vulnerability to the projected physical and chemical changes from climate change, and to alterations in oceanic food webs, because they can move to areas with their preferred conditions. However, increased stratification of the water column due to increases in SST could make the surface-dwelling skipjack and yellowfin tuna more vulnerable to capture. Projections for changes in tuna distributions in the Pacific can be seen below.[98] Decreases in the biomass of these tuna species will occur in most of the EEZs of Pacific Island countries west of 170°E, and will increase in EEZs east of 170°E. Projected percentage decreases by 2050 and 2100 relative to 2005 are particularly marked for PNG, FSM, Nauru and Palau.

[98] The Nature Conservancy A new climate change vulnerability assessment for fisheries and aquaculture (2018)

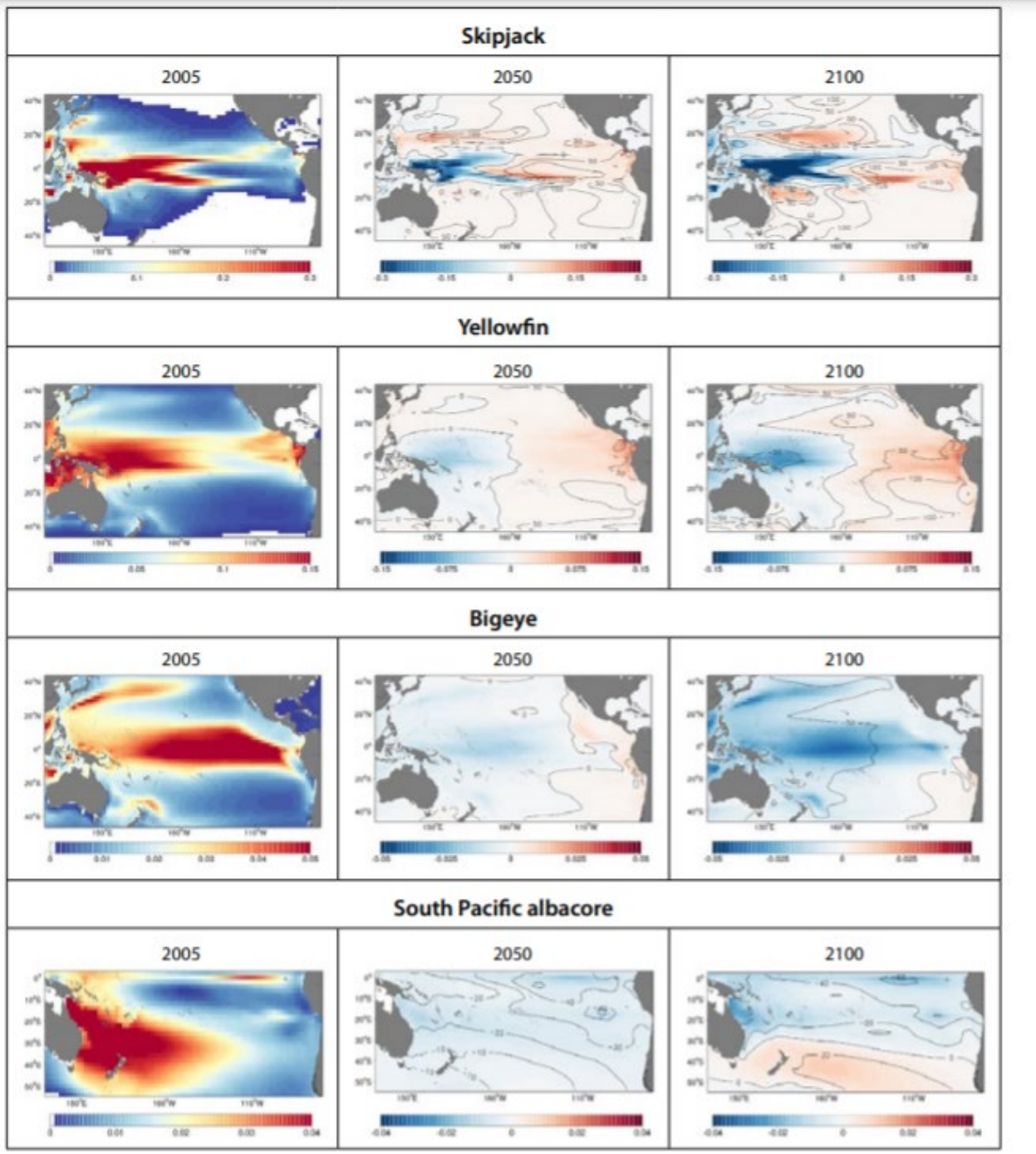


Figure 17: Projected Tuna Distributions for the Pacific

The small-scale fisheries underpinning food and livelihoods across the region have a moderate to high vulnerability to climate change because: (i) increases in SST will progressively drive many target species to higher latitudes; (ii) degradation of coral reefs is expected to reduce the productivity of those fish species able to remain on reefs; and (iii) the majority of the small-scale catch is derived from coral reefs.

An FAO review in 2013 projected declines in catches of tuna in FSM of about 15% also expected to cause reductions of about 0.8–1% in GDP, and about 1–2% in government revenue by 2100. Further the review didn't include FSM in its fish related food-security gap assessment, but other countries in Micronesia are expected to see a 23–34 kg gap in fish supply per person per year.

Estimated changes in percentage contributions of industrial tuna fisheries to GDP and government revenues in Pacific Island countries and territories (PICTs), resulting from projected alterations in the catch of skipjack tuna in 2035, 2050 and 2100, relative to 1999–2008. Lower (L) and upper (U) limits for these projections are estimated for the period 1998–2008 and future times. Only PICTs where industrial fishing or processing contributes >1% of GDP or government revenue are included

PICT	Change to GDP (%)								Change to government revenue (%)							
	1999–2008 (%)		2035		2050		2100		1999–2008 (%)		2035		2050		2100	
	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U
Melanesia																
PNG	1.5	4	0	+0.1	-0.2	-0.4	-0.4	-1.2	0.2	0.8	0	0	0	-0.1	-0.1	-0.2
Solomon Islands	2	5	+0.1	+0.2	-0.1	-0.3	-0.3	-0.8	0.2	5	0	+0.2	0	-0.3	0	-0.8
Micronesia																
FSM	1.5	5	0	+1	0	0	0	-1	6	12	+1	+2	0	+1	-1	-2
Kiribati									30	50	+11	+18	+13	+21	+7	+12
Marshall Islands	10	25	+2	+6	+2	+6	+1	+2	2	5	0	+1	0	+1	0	0
Nauru									10	25	+2	+6	+2	+5	0	0
Palau									2.5	3.2	+0.2	+0.3	0	+0.1	-0.7	-0.9
Polynesia																
American Samoa	20	25	+3	+6	+2	+4	-1	-2	5	20	+1	+4	+1	+2	0	-1
Tokelau									2	15	+1	+9	+1	+10	+1	+9
Tuvalu									10	25	+4	+9	+4	+10	+2	+6

Table 17: Relative vulnerability or benefit for PICT economics to changes in tuna fisheries

Relative vulnerability or benefit for PICT economics to changes in tuna fisheries

PICT	Surface fishery			Longline fishery		
	B1/A2 2035	B1 2100	A2 2100	B1/A2 2035	B1 2100	A2 2100
Melanesia						
Fiji*				- Very low	- Very low	- Very low
New Caledonia*				+ Very low	+ Very low	+ Very low
PNG	+ Very low	- Very low	- Very low	- Very low	- Very low	- Very low
Solomon Islands	+ Very low	- Very low	- Low	- Very low	- Very low	- Very low
Vanuatu	+ Very low	+ Very low	+ Very low	- Very low	- Very low	- Very low
Micronesia						
FSM	+ Low	+ Very low	- Low	- Moderate	- High	- Moderate
Kiribati	+ Very high	+ Very high	+ Very high	- Moderate	- Very high	- Very high
Marshall Islands	+ Low	+ Low	+ Low	- High	- Very high	- Very high
Nauru**	+ Moderate	+ Moderate	- Very low			
Palau	+ Very low	+ Very low	- Very low	- High	- Very high	- Very high
Polynesia						
American Samoa*				- Low	- Low	- Very low
Cook Islands	+ Very low	+ Very low	+ Very low	- Low	- Moderate	- Very low
French Polynesia				- Very low	- Very low	- Very low
Niue*				- Very high	- High	- Moderate
Samoa	+ Very low	+ Very low	+ Very low	- Very low	- Very low	- Very low
Tokelau**	+ High	+ High	+ Very high			
Tonga	+ Very low	+ Very low	+ Very low	- Very low	- Very low	- Very low
Tuvalu	+ Moderate	+ Moderate	+ Moderate	- Low	- Low	- Very low

Notes: Relative vulnerability (–) or benefit (+) for economies of PICTs to projected changes in the surface fishery and longline fishery for tuna under the B1/A2 emissions scenarios for 2035, B1 for 2100 and A2 for 2100. Scores have been classified as very low (0.00–0.05), low (0.06–0.10), moderate (0.11–0.20), high (0.21–0.30) or very high (> 0.30). See Supplementary Tables 12.5–12.10 (www.spc.int/climate-change/fisheries/assessment/chapters/12-supp-tables.pdf) for the exposure, sensitivity, potential impact and adaptive capacity indices used to calculate the scores.

(+) benefit, (–) vulnerability to negative economic impacts.
* PICTs where the surface fishery contributes < 0.01% of GDP.
** PICTs where the longline fishery contributes <0.01% of GDP.

Water Security

Current Water Conditions, Infrastructure, and Access

The supply of freshwater for the four States of Pohnpei, Yap, Kosrae, and Chuuk differs greatly based on their characteristics of rainfall, storage capacities, and in the infrastructure development they have for human use.[99]

The range of size, geomorphology, hydrology, and climates of FSM's inhabited islands have resulted in an extremely diverse range of freshwater systems. Precipitation patterns vary from State to State and, generally, the eastern most States have the highest amount of rain and the western most States have the least amount of rainfall in FSM. There are also yearly variations in rainfall caused by ENSO events. Atolls generally receive considerably less rainfall than the high islands and many communities living on the outer atolls have freshwater supplies that are often extremely poor.

[99]FSM. 2011. Framework National Water and Sanitation Policy for the Federated States of Micronesia.

The use of surface water for household water use contributes to around 60% of the total usage (predominantly on the main, high islands). The surface water mainly comes in the form of small streams that filter through the generally geographically small catchments.[100] Streamflow is generally consistent but becomes quite minimal during the months of the dry season. Groundwater resources (mainly in small zones of dispersed sedimentary deposits) contribute to the remaining 40% of household water resources. In FSM, the topography in the stream basins is not conducive to the construction of economical dams. Furthermore, surface water requires extensive and costly treatment, largely to reduce high turbidity, undesirable taste and odours, and to remove micro-organisms. For groundwater resources, the small, dispersed zones of sedimentary deposits, weathered volcanic and weathered schist formations are not conducive to the development of high yielding wells as drilling through such sediments is expensive.[101]

In the outer atolls, the freshwater is tapped through shallow, hand-dug wells to supplement the rainwater catchments and storage tanks which are widely used and commonly the main source of drinking water in the outer islands. The small low-lying coral islands face severe constraints in terms of both the quality and quantity of freshwater due to limited groundwater resources protected by a thin permeable water lens. [102]

The freshwater portion of the aquifer typically follows the long axis and elongated shape of the islets. The maximum elevation of the water table is near or slightly above mean sea level. The thickest part of the freshwater lens, which may reach several tens of metres, may be located near the centre of the islets in areas where there is a greater abundance of fine-grained and less-permeable sediment; or on the lagoon side if that location is characterized by finer-grained sediment. Fine sediment has reduced permeability and thus retains water. The centre of islets is also typically the lowest point; hence wetlands and open pools of water fed by the aquifer are not uncommon.

The 2010 national census indicated that across FSM, only in Pohnpei do the majority of households obtain drinking water from public water supply systems as their main source of drinking water (see Table 18)[103]. This figure drops to only 14% of households nationwide. The main source of drinking water for households across the country is household rainwater tanks (43% nationwide, as many as 69& in Chuuk), while community water supplies, wells, waterbodies and bottled water are all significant sources of drinking water. Therefore, rainwater is the main source of drinking water for FSM and these communities are heavily dependent on catchment systems for reliable access to safe drinking water.

Table 18. Main source of drinking water for households in FSM and per State.

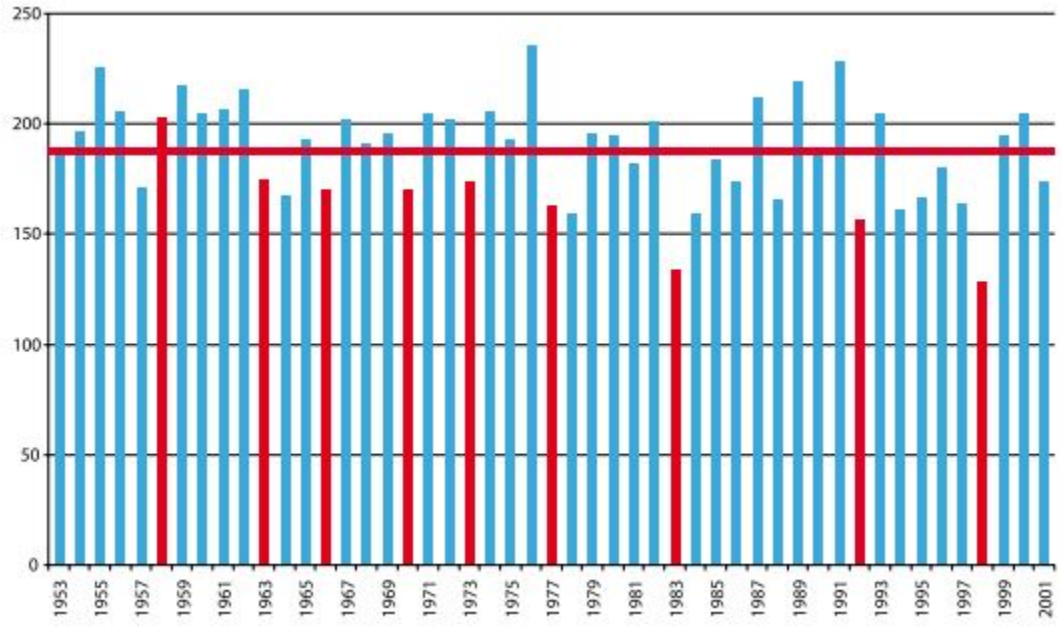
	All FSM		Yap		Chuuk		Pohnpei		Kosrae	
Public supply	2,314	14%	290	13%	47	1%	1,961	31%	16	1%
Community supply	2,799	17%	685	30%	398	6%	1,413	22%	303	27%
Household tank	7,242	43%	1,067	46%	4,877	69%	627	10%	671	59%
Water truck	26	0%	-	N/A	26	0%	-	N/A	-	N/A
Well - protected	1,183	7%	17	1%	399	6%	719	11%	48	4%
Well - unprotected	327	2%	3	0%	194	3%	130	2%	-	N/A
Bottled water	1,390	8%	207	9%	135	2%	1,017	16%	31	3%
Spring, river lake	1,170	7%	8	0%	775	11%	358	6%	29	3%
Other	316	2%	34	1%	173	2%	64	1%	45	4%
Total	16,767		2,311		7,024		6,289		1,143	

[100] FSM. 2011. Framework National Water and Sanitation Policy for the Federated States of Micronesia.
[101] Ibid
[102] Ibid
[103] FSM. Summary Analysis of Key Indicators from the FSM 2010 Census of Population and Housing.

Impacts

The water security of low-lying atolls is especially at risk from climate change impacts. First, low-lying atolls are more susceptible to sea level rise and saltwater inundate from tidal events and storm surge. With enough saltwater inundation, the fragile freshwater lens within an atoll's aquifer can become contaminated and unusable. For example, in 2007 and 2008 communities throughout FSM were flooded due to a combination of large swell events and spring high tides, which resulted in numerous impacts including intruded groundwater aquifers throughout the four States.[104] This resulted in a short supply of drinking water and turned freshwater ponds and wetlands brackish. These freshwater areas are still recovering from the inundation events.

Additionally, although FSM overall is projected to experience increased precipitation due to climate change, the pattern of precipitation events is also projected to change which could result in uncertainty in terms of how much rainfall can be collected from catchments. On the higher islands, increased extreme weather events and precipitation events could result in damage to watersheds from soil erosion and landslide events and result in a reduction in water security to communities that depend on these watersheds. There have been some examples of freshwater resources being impacted by recent climate events. For example, in 2007 a high sea-level event occurred in FSM, in which various islands experienced losses in crop productivity and freshwater resources. A 2008 high tide event also required State governments and the FSM federal government to provide many islands with freshwater supplies to maintain life in the affected islands.[105] Additionally, the 1997–1998 El Niño event caused a major drought throughout FSM, which severely impacted island water supplies. Some atoll communities survived the drought period only because of the importation of bottled water and reverse osmosis pumps.[106] In the largest town in Pohnpei (Kolonia), this resulted in water restrictions where residents were only able to access municipal water for two hours per day.[107] In general, the period immediately following an El Niño event is typically a dry year or drought year in FSM (see Figure 18 below).



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[104] FSM. Second National Communication on Climate Change.
[105] Fletcher et al. 2010. Climate Change in the Federated States of Micronesia Food and Water Security, Climate Risk Management, and Adaptive Strategies. University of Hawai'i Sea Grant College Programme.
[106] Fletcher et al. 2010. Climate Change in the Federated States of Micronesia Food and Water Security, Climate Risk Management, and Adaptive Strategies. University of Hawai'i Sea Grant College Programme.
[107] Pohnpei State JSAP.
[108] Most post-El Nino years (identified in red) are dry years.

Figure 18: Time series of annual rainfall at the Pohnpei Weather Service Observatory (1935-2001)[109]

Additionally, groundwater on low-lying atolls is subject to perceptible reductions due to climate driven droughts. Although hydrologic data is severely lacking in FSM, one analysis was completed in 2011 using available data and numerical modelling to predict atoll freshwater-lens thickness during projected droughts. Results of the analysis indicated that of the 105 atoll islands that were studied, only six would retain enough groundwater to sustain an island's community during a drought with similar conditions to the drought experienced in 1998 (see Figure 19 below).[110]

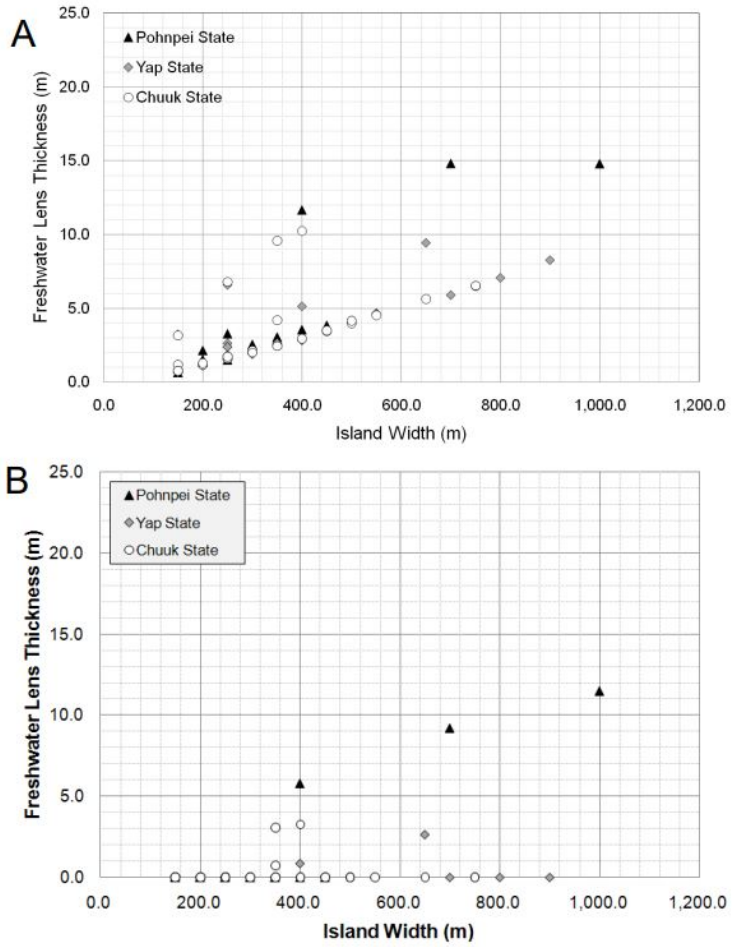

Figure 19: Simulated reduction in freshwater lens thickness for atolls in Pohnpei, Yap and Chuuk[111]

Saltwater intrusion has major effects on shallow freshwater lenses in atolls, and also can impact the coastal groundwater in larger (non-atoll) islands. Such intrusion can happen either through pumping groundwater from the lens at a rate higher than the recharge rate (from rainfall) or through encroachment of water from the sea. In the case of the former, the freshwater lens will generally recover through rainfall recharge if pumping ceases. However, this rate of recovery would be lower in the case of droughts and variable rainfall (e.g. linked to ENSO events).

[109] FSM. Second National Communication on Climate Change.
[110] Bailey et al. Groundwater Resources Analysis of Atoll Islands in the Federated States of Micronesia Using an Algebraic Model.
[111] Panel A: freshwater lens thickness of atolls with average rainfall. Panel B: freshwater lens thickness under drought conditions similar to the 1998 drought in FSM.

Encroachment of seawater into the lens (see Figure 20) can occur through[112,113]:

- Over-topping during storm surges. The seawater ingresses the land and infiltrates the underlying groundwater, causing the lens to become salty until the seawater has migrated through the system by increased rainfall. This will become more common as storm surge extremes and sea levels rise as an impact of climate change.
- Rising sea levels displace freshwater upwards. This results in the freshwater no longer being at the level where it can be used for a specific purpose. For example, well infrastructure is no longer located in fresh part of the lens and now abstracts salt water, or swamp taro pits become saltier where sea level rise causes seawater to reach the root systems of the plants. Coupled with increased evapotranspiration and capillary fringe affects, this becomes detrimental to plant growth and agriculture production.
- Sea level rise and storm surges result in loss of land area. This reduces the size of the freshwater lens and the availability of fresh groundwater.

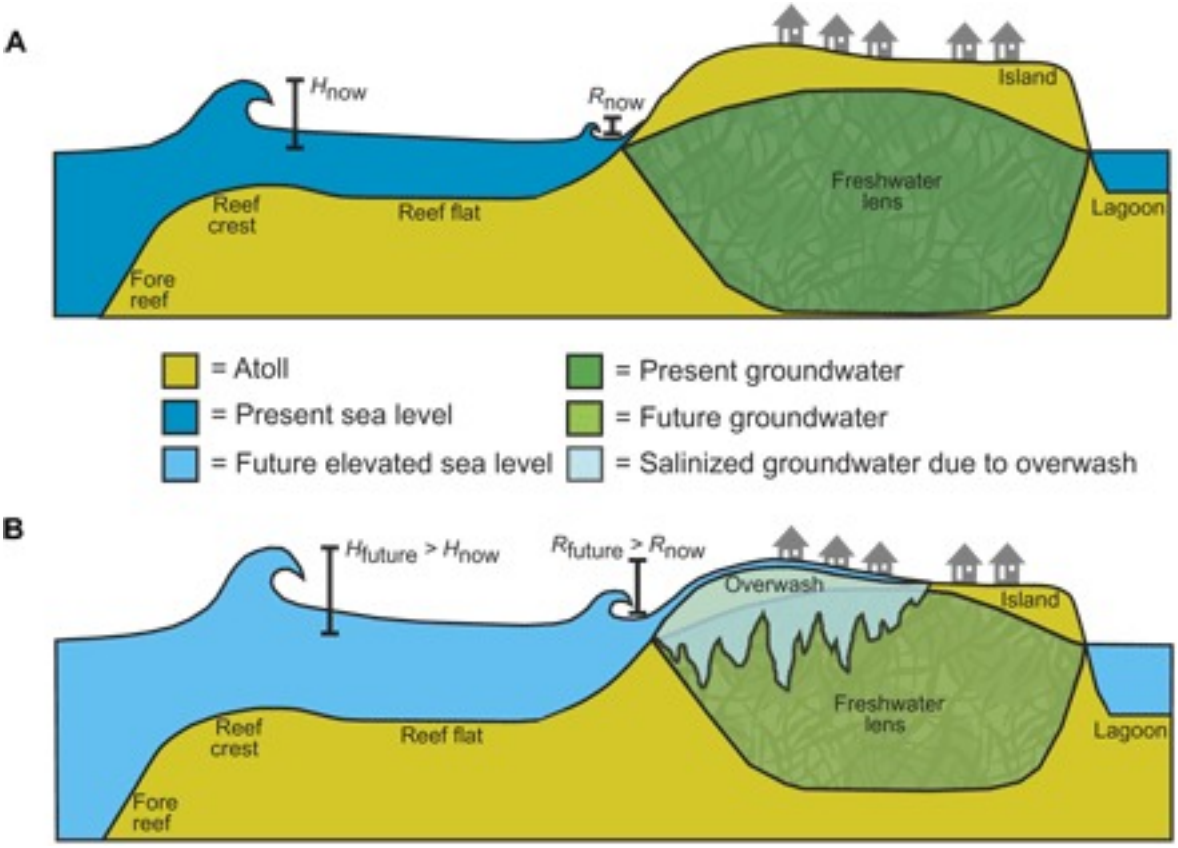

Figure 20. Impacts of sea level rise on wave heights, wave-driven runup and flooding at current sea levels (A) and future elevated sea levels (B) showing how overwash will contaminate freshwater lenses in atolls. H: wave height; R: wave-driven runup[114].

[112] Storlazzi et al. 2018. Most atolls will be uninhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding. Science Advances 4(4): eaap9741.
[113] Aucan, J. 2018. Effects of Climate Change on Sea Levels and Inundation Relevant to the Pacific Islands. Pacific Marine Climate Change Report Card: Science Review 2018, 43–49.
[114] Storlazzi et al. 2018. Most atolls will be uninhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding. Science Advances 4(4): eaap9741.

Projections indicate that the nonlinear interactions between sea level rise and wave dynamics will result in annual wave-driven overwash of most atoll islands by 2050 under current emission scenarios[115]. Such annual flooding will result in atolls becoming uninhabitable because of damaged infrastructure and the inability of freshwater lenses to recharge between overwash events, especially when coupled with drought or variable rainfall. Overtopping also commonly occurs during "King tides" in Pacific atolls such as Majuro[116] and Funafuti[117], which is predicted to become the most frequent cause of island flooding under future sea levels[118,119].

To date here are no comprehensive studies on freshwater resources and climate change in FSM and there remain large data gaps especially for hydraulic modelling of atoll aquifer systems.[120] However, it is clear that with the continued projections for sea level rise, storm surge and inundation events and unpredictable seasonal variations in rainfall and ENSO events outlined in Section 3, freshwater availability in FSM will continue to be negatively impacted due to climate change events in the coming decades. Therefore, there is the need for improved water storage and distribution systems as an adaptation measure to address climate change issues on the water stressed islands.

5. Baseline Capacity of Local Authorities

Overview[121]

FSM has three levels of government: national, State, and municipal. A key objective of this programme is to devolve funding from the national level to LAs, both municipal and State governments, for pragmatic and impact-driven adaptation actions to mitigate the negative consequences of climate change. The initial concept for the EDA was to target funding to the lowest level of government, municipalities, on the assumption that municipalities are comprised most directly of members of the communities and provide direct services to these communities. To determine the feasibility of channelling funding to municipal governments, a rapid capacity assessment was undertaken for a selection of municipal governments across all four States both on the main islands and on the outer atolls. From this rapid assessment, it became clear that in order to channel adequate resources and build the capacity of municipalities, additional support would need to be included. After consultations with the NDA and through previous discussions with communities, municipal and State officials, it was determined that State governments should also be tapped for receiving grants under this EDA programme.

Given the size of FSM, both municipal and State governments are directly comprised of, serve, and interact directly with communities across the country. Moreover, municipal and State governments are closely interconnected and on Yap, municipal governments do not have a formalized Western structure, therefore, all funds directed to the municipal level are managed through the State government.

The structure of government of LAs is important to ascertain what capacities are present and what capacities need to be built to allow municipalities and State governments to implement effective adaptation actions. Pohnpei, Chuuk and Kosrae's municipalities operate under their individual constitutions or charters whereas in Yap, municipalities do not manage funds or implement their own projects. Table 3 and Table 4 in section 2 provide a list of the

[115] Storlazzi et al. 2018. Most atolls will be uninhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding. Science Advances 4(4): eaap9741.
[116] Beetham, E. & Kench, P.S. 2018. Predicting wave overtopping thresholds on coral reef-island shorelines with future sea-level rise. Nature Communications 9:3997.
[117] Beetham et al. 2016. Wave transformation and shoreline water level on Funafuti Atoll, Tuvalu. Journal of Geophysical Research 121(1): 311–326.
[118] Hoeke et al. 2013. Widespread inundation of Pacific islands triggered by distant-source wind waves. Global and Planetary Change 108(0): 128–138.
[119] Merrifield et al. 2014. Observations and estimates of wave driven water level extremes at the Marshall Islands. Geophysical Research Letters 41(20): 7245–7253.
[120] SPC. Federated States of Micronesia – IWRM Outlook Summary and NWTF Report.
[121] Additional gender-disaggregated baseline information is available in Annex 8 (GAAP) of the funding proposal.

municipalities. There are 75 municipalities across all four States, 11 in Pohnpei, 4 in Kosrae, 40 in Chuuk, and 20 in Yap.

Most of the funding for municipalities comes from local revenue, mainly from business licenses operating in their jurisdiction. The municipalities also get funding from a share of the States' revenue, also collected from businesses and will at times receive financial assistance from the national government. There are also cases when municipalities can access outside grant funds for specific projects. These grants tend to be small, usually with a maximum amount of USD 50,000. Yap municipalities, on the other hand, receive support directly from the State Government with the State managing the funds.

This section provides a summary of the municipal and State governments structure on each FSM State and details the results of the rapid capacity assessment carried out.

Pohnpei Municipal Governments

Pohnpei State includes a total of 11 municipalities with 6 located on the main island and 5 municipalities located on the outer islands. Each municipality has its own system of government that complements the State and national government while operating within its own jurisdiction. In general, most of the municipal governments have three branches of co-equal governments the Executive, Legislative and Judiciary branches.

The Executive branch is led by the Chief Minister/Magistrate who is elected by citizens of that municipality with the primary responsibility of executing the laws and administrating the municipal government services. Members of the Legislative Branch consist of elected council members and are led by the Speaker with their primary responsibility to enact municipal laws, policies, and other municipal programs. Members of the municipal council are different among each of the 11 municipalities. Unlike the Executive and the legislative, the Judiciary, which consists of at least one Justice is appointed by the Chief Minister/Magistrate and confirmed by the council who are responsible for interpreting the municipal laws and constitution.

Pohnpei's municipalities have some of the highest capacity of all municipalities, having channelled and managed grant funds and having larger core budgets and staffing.

Kosrae Municipal Governments

There are four municipalities in Kosrae with a system of local government similar to that of Pohnpei. Each municipality has its own system of government with a Mayor heading the executive branch and the legislative branch headed by the Chairman of the council. Although there are three systems of government in their municipal charters, the municipal governments are still in the process of setting up a community court system.

Chuuk Municipal Government

Chuuk has a total of 40 municipalities each with its own system of local government based on their individual local constitutions. Each municipality has an elected mayor (some have both a Mayor and deputy mayor) who is the Chief Executive and depending on the size and population of the municipality, they may also have a legislative branch which consists of elected council members (2 year term) and at large council members (4 year term) and a municipal court headed by one or two judges. The size, structure and capacity of each municipality depends on the size and population of that municipality which can range from two Mayors and more than 20 council members and more than two Judges to just one mayor running the community.

Yap Municipal Governments

Currently, Rull municipality on Yap's main island is the only municipality within Yap State that has been organized as a municipal government under the adopted western democratic governance system and has an office of the mayor and municipal representatives that are elected by Rull municipality voters. All municipalities, including Rull, have the traditional governance system in place that presides and oversees affairs within their respective community(ies) according to customs and traditions. Yap State Constitution recognizes the traditional governance system and has a fourth branch of government incorporated which is comprised of the Council of Pilung and the Council of Tamol. The Council of Pilung consists of traditional chiefs or their appointed representative from each of the 10 municipalities on Yap's main island. The Council of Tamol is comprised of the traditional chiefs or their appointed representative from the outlying islands/atolls (municipalities) of Yap State. The main function for the Council of Pilung and the

Council of Tamol within the Yap State Government is upholding customs and tradition, however, they also play an advisor role and make recommendations to the three branches of Yap State Government, help resolve problems and assist in matters concerning the municipalities, and promote and preserve the traditions and customs of the people of Yap. The two councils at the State level have administrative and clerical staff supporting them and submit an annual operation budget to the State Government for funding consideration. At the municipal level, most have municipal councils which meet regularly and consist of the traditional leadership within the municipality. These councils at the municipal level are not funded by the State Government (assigned and/or inherited responsibility).

The funding channelled to municipalities is done through Yap's Office of Budget and Management (OBM). A rapid capacity assessment was undertaken for OBM as any funding channelled to the municipalities in Yap will be done through OBM. Yap's OBM was assessed under the State agency level assessment (see table 18).

Capacity Gaps and Needs

The capacity of municipalities varies from State to State and between the States' main islands and the outer atolls. Given the COVID-19 situation and lack of ability to travel and bring groups together for larger discussions, a rapid assessment was done via individual semi-structured interviews with municipal government officials. The Rapid Assessment tool designed for this purpose (see Annex 4 for questionnaire) was adapted from UNDP's Rapid Assessment and FAO's institutional capacity assessment approach for national adaptation planning in the agriculture sectors.[122] As defined by UNDP, "a capacity assessment is an analysis of desired capacities against existing capacities; this generates an understanding of capacity assets and needs and serves as input to formulating a capacity development response."

For this feasibility study, the focus of the rapid capacity assessment was to determine whether municipalities have the ability to design, manage and implement sub-grants as defined by this EDA programme. In order to effectively gauge a municipality's capacity to carry out priority adaptation projects under Component 2, an institutional capacity rapid assessment for 16 municipalities in FSM was completed. Out of the 54 municipalities that can channel funding directly, 30% of the these were assessed. Based on the sample, it was determined that there are not enough municipalities with the requisite baseline capacity to channel sub-grants independently. As such, State agencies have also been included as LAs to support communities to implement sub-grants.

The assessment included evaluating the municipalities' organizational capacity, knowledge of climate change threats, and capacity to implement sub-grants. Additionally, the assessment included gathering information on climate change and other environmental threats the municipality is currently facing and priority adaptation projects that the municipality would like to implement.

Based on the assessments conducted, municipalities on the main island of Pohnpei (U, Kitti, Madolenhimw, Nett and Sokehs) have the highest overall capacity across FSM. Total annual core budgets for these municipalities range from USD 101,000 and to over more than USD 500,000.[123] Contrastingly, municipalities assessed on the outer islands in the State of Pohnpei had total annual core budgets that range USD 10,000 to USD 250,000. The State of Kosrae only has four municipalities on the one main island. Total annual core budgets for these municipalities range from USD 10,000 to USD 250,000. Municipalities in the main lagoon of Chuuk have core budgets that range from less than USD 10,000 to USD 50,000 and municipalities in the outer islands of the State have core budgets that are less than USD 10,000 (see Table 19 for summary). As mentioned above, individual municipalities in Yap State were not assessed due to their specific governance system, absence of core budgets, and as they receive funding through the Yap's State agency OBM. For State agencies, core budgets for States within FSM are all greater than USD 500,000 and all State agencies assessed for this study have individual budgets of over USD 250,000.

Table 19: Total Annual Core Budgets for Assessed Municipalities in FSM

State	Total Annual Core Budget Range for Municipalities (USD)

[122] Adapted from: UNDP Capacity Assessment Methodology User's Guide (2008); Institutional capacity assessment approach for national adaptation planning in the agriculture sectors, FAO (2018),

[123] Total annual core operating budgets refers to a municipality total budget for all services and activities performed (i.e. police, municipal staff, operating expenditures, etc.) within a fiscal year.

Pohnpei – main island	101,000 - 500,000
Pohnpei – outer islands	10,000 - 250,000
Kosrae	10,000 - 250,000
Chuuk – main lagoon	<10,000 - 50,000
Chuuk – outer islands	< 10,000

Municipality capacity within each of the following sub-categories: (i) organizational capacity; (ii) knowledge of climate change threats; and (iii) capacity to implement sub-grants varied by State and between the main islands and outer atolls. The larger, more resource rich municipalities on the main island of Pohnpei had the highest capacity in all sub-categories. Utilizing a one through five scoring system, where one indicates extremely low capacity to virtually no capacity and five indicates full capacity to undertake any potential sub-grant, municipalities on the main island of Pohnpei rank from 3.6 (moderate/high capacity) to 4.2 (high capacity). Municipalities assessed on the outer islands rank from 2.7 to 4.2 in overall capacity. Kosrae municipalities had an overall capacity that ranked from 2 (low capacity) to 3.1 (moderate capacity). Municipalities in the main lagoon of Chuuk have capacity that ranges from 2.7 (low/moderate capacity) to 3.6 (moderate capacity). The two municipalities assessed on the outer islands of Chuuk both ranked as below 2 (extremely low capacity).

The majority of municipalities, mainly in the States of Yap and Chuuk, do not have any formal municipal government in place and, therefore, have virtually no capacity to implement any level of sub-grant without considerable outside assistance. These municipalities rely heavily on State-level resources to carry out any formal government processes.

A scoring system was used to assess the capacity in the questionnaire from 1-5, where 1 – Extremely low capacity to none available; 2 – Low capacity; 3 – Moderate capacity; 4 – High capacity; and 5 – Full capacity for any potential sub-grant. Table 20 below shows a summary of the outputs and results of the questionnaire and

Figure 21. Summary of the assessments grouped by average capacity per municipality in each State.

In addition to capacity, an overall municipality risk was determined. Municipality risk was ranked between one and three, with one indicating a low risk and three indicating a high risk. In general, a municipality's risk score inversely mirrored that of its capacity, with relatively high capacity municipalities having a lower risk and municipalities with relatively low capacity having a higher risk category.

Table 20: Outputs and results from Municipality Capacity Assessments [124]

Municipality/LA (including Yap State)	Organizational Capacity Agg. Score*	Ability to Manage Projects Agg. Score	Knowledge of Climate Change Agg. Score	Project Identification etc. Agg. Score	Overall Risk Score**	Overall Capacity Score
U, Pohnpei	4.3	3.3	4	4.75	**2**	**4.1**
Kitti, Pohnpei	4	3	3.3	4.5	**2**	**3.7**
Madolenihmw, Pohnpei	4	3	3.3	4	**2**	**3.6**
Nett, Pohnpei	4.7	3.7	3.7	4.5	**2**	**4.2**
Sokehs, Pohnpei	4	4.3	3.3	4	**2**	**3.9**
Mwokiloa, Pohnpei (outer island)	2.7	2.7	2	3.5	**3**	**2.7**
Pingilap, Pohnpei (outer island)	3.7	4.7	4	4.5	**1**	**4.2**
Lelu, Kosrae	3	2.7	3.3	3.3	**2**	**3.1**
Malem, Kosrae	2	1.7	2.3	2.5	**3**	**2.1**
Tafunsak, Kosrae	3.7	1.7	3.7	2.8	**2**	**3**
Utwe, Kosrae	2	1.7	2	2	**3**	**2**
Siis, Chuuk	4	3.7	3.3	3.5	**2**	**3.6**
Polle, Chuuk	2.6	3	2.7	2.5	**3**	**2.7**
Piis Paneu, Chuuk	2.6	3	2.7	2.5	**3**	**2.7**
Fanpanges, Chuuk	3	2.7	2	2.75	**3**	**2.6**
Oneisomw. Chuuk	3	2	3	2.75	**3**	**2.7**
Eot, Chuuk	2.3	2.3	2.3	3	**3**	**2.5**
Nema, Chuuk (outer island)	3	2	2.3	2.75	**3**	**2.5**
Satowan, Chuuk (outer island)	3	2	2.7	2.5	**3**	**2.6**
Kuttu, Chuuk (outer island)	3	2	2.3	2.75	**3**	**2.5**
Ta, Chuuk (outer island)	3	2	2.3	2.75	**3**	**2.5**
Onoun, Chuuk (outer island)	1	1	1	1	**3**	**1**
Ettal, Chuuk (outer island)	1	1.3	3	1.5	**3**	**1.7**

[124] * Aggregate scores are ranked from 1-5 (1 – Extremely low capacity to none available; 2 – Low capacity; 3 – Moderate capacity; 4 – High capacity; 5 – Full capacity for any potential sub-grant) ** Overall risk scores are ranked from 1-3. Risk scores were identified based on LA history of implementing adaptation projects, monitoring and evaluation of donor funded grants and organizational and financial capacity.

Figure 21: Municipal Rapid Capacity Assessment Visual Summary by State[125]

Although municipality capacity varies within and between States, in general, municipalities were found to have a lack of scientific and technical knowledge and understanding of climate change and adaptation programming, limited operational capacity and limited experience in designing, implementing and managing climate change adaptation projects.

State Agencies' Capacity

State agencies across FSM have access to more resources than municipalities and rank significantly higher in terms of their capacity to manage grants.[126]

States have experience managing millions in dollars of funds appropriated from the FSM national government to implement social and economic development projects. Between fiscal years 2014 and 2017, Yap State appropriated USD 7,375,000, Chuuk State appropriated USD 22,900,000, Pohnpei State appropriated USD 16,350,000 and Kosrae State appropriated USD 7,300,000 from national funds.[127]

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[125] The State of Yap does not have formal municipal governance and so an assessment of its capacity is not included in this.
[126] For this document, State agencies within FSM refer to divisional offices within State-level departments. For example, Pohnpei State has a Department of Land. Within the Department of Land is the Division on Survey and Mapping and Division on Forestry and Marine Enforcement.
[127] FSM. Office of the National Public Auditor. Audit Report No. 2019 - 05.

The rapid capacity assessments were additionally completed for State agencies within Pohnpei, Kosrae, Chuuk and Yap. As can be seen in Table 21 and Figure 22, State agencies on average have higher capacity than their municipal level counterparts. However, some of the more specialized State agencies assessed (such as the Attorney General's Office in Pohnpei) do not have direct experience or knowledge of climate change adaptation and/or implementing projects related to adaptation. These outliers affect the overall capacity score of State agencies in a negative direction. Outside of the State agencies that do not implement project or do not have experience with climate change. State agencies throughout the four States have more direct knowledge of climate change threats and experience managing and implementing projects than municipalities with an overall capacity score between 4 and 5 (high capacity to full capacity).

Table 21: Outputs and results from State Agency Capacity Assessments

State Agency	Organizational Capacity Agg. Score*	Ability to Manage Projects Agg. Score	Knowledge of Climate Change Agg. Score	Project Identification etc. Agg. Score	Overall Risk Score**	Overall Capacity Score
Pohnpei State						
Attorney General	5	2	3	2	**3**	**3**
Department of Education	5	5	5	5	**1**	**5**
Department of Treasury & Administration	5	3	4	3	**2**	**3.75**
Department of Public Safety	5	3	3	3	**1**	**3.5**
Department of Elections	5	2	2	2	**3**	**2.75**
Environmental Protection Agency	5	5	5	5	**1**	**5**
Department of Health	5	5	5	5	**1**	**5**
Department of Land	5	5	3	3	**1**	**4**
Office of Fisheries & Aquaculture	5	5	5	5	**1**	**5**
Public Broadcasting Corporation	4.5	2	3	2	**3**	**2.9**
Pohnpei Housing Authority	4.5	4	3	3	**2**	**3.6**
Department of Resources & Development	5	5	5	5	**1**	**5**
Department of Transportation & Infrastructure	5	5	5	5	**1**	**5**
Kosrae State						
Department of Finance & Administration	5	3	3	3	**2**	**3.5**
Department of Resources & Economic Affairs	5	5	5	5	**1**	**5**
Department of Transportation & Infrastructure	5	5	5	5	**1**	**5**

Kosrae Island Resource Management Authority	5	5	5	5	**1**	**5**
Chuuk State						
Department of Agriculture	4.5	5	5	5	**1**	**4.9**
Chuuk Disaster and Emergency Operation Center	4.5	5	5	5	**1**	**4.9**
Department of Marine Resources	4.5	5	5	5	**1**	**2.9**
Environmental Protection Agency	5	5	5	5	**1**	**5**
Yap State						
Department of Resources & Development	5	5	5	5	**1**	**5**
Department of Health Services	5	3	3	3	**2**	**3.5**
Office of Budget and Management (OBM).	5	4	3.3	3.5	**1**	**4**

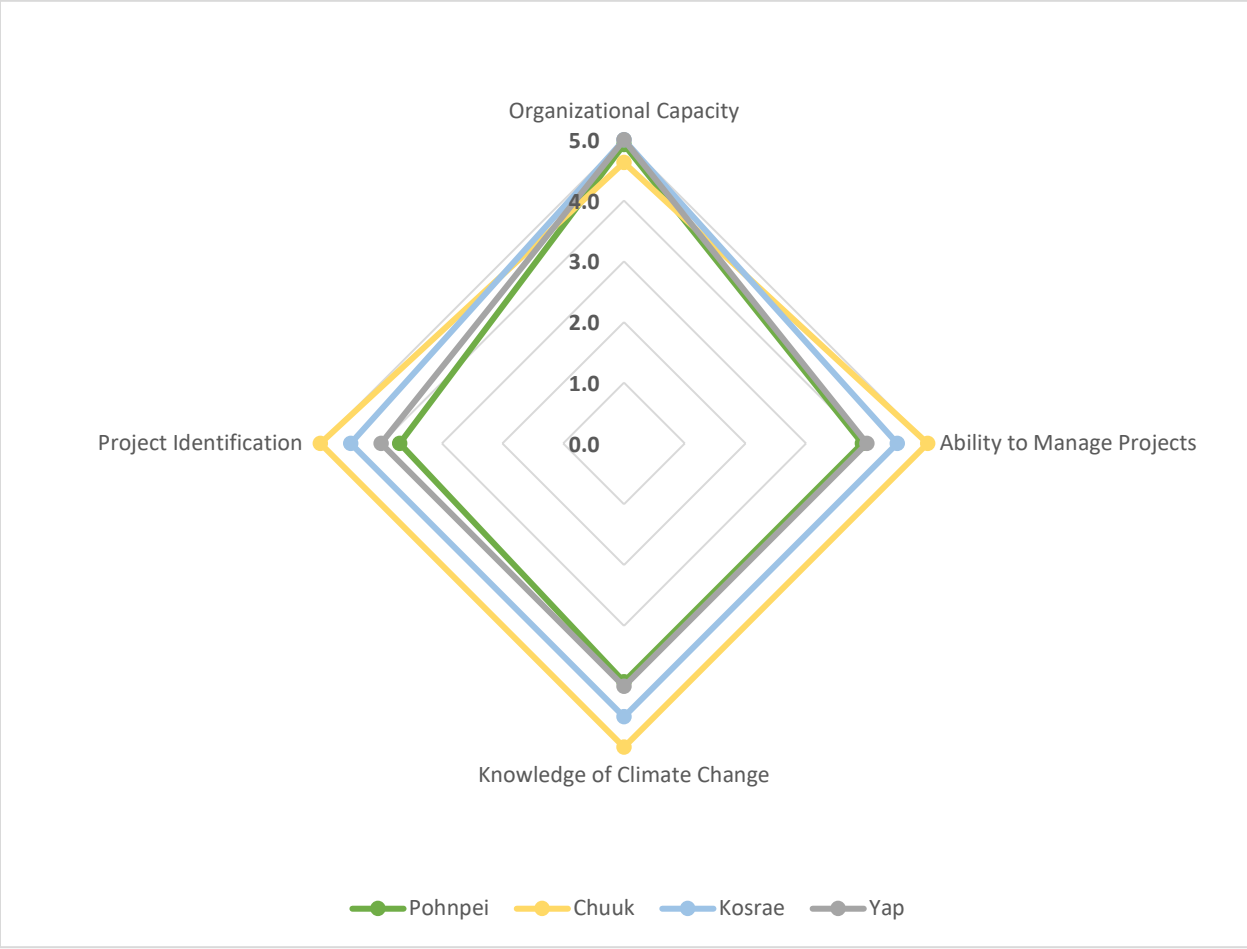

Figure 22: State Agency Rapid Capacity Assessment Visual Summary by State

Given the volume of funding channelled by State governments and their close administrative relationship with municipal governments, the EDA programme will be structured to allow for State agencies to apply for sub-grants, while collaborating closely with municipalities and ensuring that they would benefit from capacity building/knowledge transfer during the sub-grant implementation, for grant amounts up to USD 1 M. Details on the structure of the EDA Facility is provided in Section 11 below.

6. Priority Adaptation Actions

To address the climate change threats, several measures are needed to enhance the resilience of states, municipalities and beneficiary populations in order to build disaster disk reduction as well as food and water security.

Information on what adaptation projects municipalities identified as priorities was also collected. Although there were a range of priority adaptation projects identified, some project themes were cited by a large range of municipalities. The most cited priority adaptation project was adaptation interventions associated with coastal management projects (coastal re-vegetation, coastal barriers, etc.). Food security projects (agroforestry, home gardens, etc.) and water security projects (water infrastructure, watershed management, etc.) were also heavily cited priority adaptation projects. Additionally, climate resilient infrastructure, resilient fisheries management, erosion control and landslide rehabilitation projects were all identified by municipalities as priority projects for their respective areas.

Table 22 below provides a summary of the priority adaptation actions identified by municipalities and communities in FSM through direct outreach to municipalities as well as through a review of Local Early Action Plans (LEAPs) that were completed for one community per each State as part of the International Climate Initiative. LEAPs provide a community-based climate change vulnerability assessment and outline potential management planning activities and other actions to improve community resilience to the impacts of climate change. Local stakeholders, including youth and women's groups, collaborated in the formulation of the LEAPs.

Table 22: Overview of priority adaptation actions identified from LEAPs.

Rank	Priority Adaptation Action	Municipalities/communities that identified the action
1	Coastal management projects (re-vegetation, coastal barriers, soil erosion controls etc.)	U (Pohnpei); Sohkes (Pohnpei); Malem; Mwokilloa (Pohnpei); Pingilap (Pohnpei); LEAP (Kosrae); Walung LEAP (Kosrae); Oneisom LEAP (Chuuk); Eot (Chuuk); Lelu (Kosrae); Malem (Kosrae); Tafunsak (Kosrae); Utwe (Kosrae); Yap State; Onoun (Chuuk); Ettal (Chuuk); Polle (Chuuk); Piis Paneu (Chuuk); Fanapanges (Chuuk); Oneisomw (Chuuk); Nema (Chuuk); Satowan (Chuuk); Kuttu (Chuuk); Ta (Chuuk)
2	Food security projects (agroforestry, home gardens, etc.)	Madolenihmw (Pohnpei); U (Pohnpei); Sohkes (Pohnpei); Kitti (Pohnpei); Pingilap (Pohnpei); Tamil LEAP (Yap); Lelu (Kosrae); Malem (Kosrae); Tafunsak (Kosrae); Utwe (Kosrae); Yap State; Onoun (Chuuk); Polle (Chuuk); Fanapanges (Chuuk); Oneisomw (Chuuk); Nema (Chuuk); Satowan (Chuuk); Kuttu (Chuuk); Ta (Chuuk)
3	Water security projects (water infrastructure, watershed management, etc.)	Madolenihmw (Pohnpei); U (Pohnpei); Sohkes (Pohnpei); Kitti (Pohnpei); Nett (Pohnpei); Mwokilloa (Pohnpei); Pingilap (Pohnpei); Walung

		LEAP (Kosrae); Tamil LEAP (Yap); Oneisom LEAP (Chuuk); Yap State; Piis Paneu (Chuuk); Fanapanges (Chuuk); Oneisomw (Chuuk); Nema (Chuuk); Satowan (Chuuk); Kuttu (Chuuk); Ta (Chuuk)
4	Climate resilient roads/infrastructure projects	Madolenihmw (Pohnpei); Kitti (Pohnpei); Nett (Pohnpei); Pingilap (Pohnpei); Tamil LEAP (Yap); Eot (Chuuk); Malem (Kosrae); Onoun (Chuuk); Ettal (Chuuk); Polle (Chuuk); Piis Paneu (Chuuk); Fanapanges (Chuuk); Oneisomw (Chuuk); Nema (Chuuk); Satowan (Chuuk); Kuttu (Chuuk); Ta (Chuuk)
5	Fisheries management/protection projects	Sohkes (Pohnpei); Pakin LEAP (Pohnpei); Pingilap (Pohnpei); Tamil LEAP (Yap); Oneisom LEAP (Chuuk); Tafunsak (Kosrae); Utwe (Kosrae)
6	Erosion control/landslide rehabilitation projects	Madolenihmw (Pohnpei); U (Pohnpei); Malem (Kosrae); Yap State
6	Waste management projects [128]	Nett (Pohnpei); Malem LEAP (Kosrae); Utwe (Kosrae); Siis (Chuuk)
7	Protected area restoration, management and enforcement	Nett (Pohnpei); Malem LEAP (Kosrae); Pakin LEAP (Pohnpei)
8	Community health projects (e.g. control of insect vectors to reduce incidence of diseases such as malaria, dengue fever, zika and chikungunya that have increased in the Pacific[129,130])	Madolenihmw (Pohnpei); Tamil LEAP (Yap)
9	Livestock management projects (e.g. piggeries)	Pakin LEAP (Pohnpei)

Based on the rapid capacity assessment of the municipalities and the State agencies, it is recommended that the grant facility be opened to State governments as well as municipalities with the capacity to undertake smaller grants (in the range of USD 100,000–150,000). The State level governments in FSM, while having greater capacity than municipalities, are still formed from members of the surrounding local communities and would benefit from accessing finance. Targeting the State governments will allow for channelling a greater amount of finance and increasing the overall absorptive capacity of FSM to tackle climate risks.

However, as indicated in the FSM GCF Country programme (see additional information in Section 8 below), presently none of the FSM States have a high level of adaptive capacity required to ensure adaptation to the effects of climate change. Even though most State agencies have greater capacities than most municipalities, capacity building will still be needed at the State level due to lack of technical knowledge and understanding of climate change and adaptation programming, and limited experience in designing, implementing and managing climate change adaptation projects.

The links between these actions and the key climate change impacts & challenges outlined above are summarized in the Table 23.

Table 23: Key climate change threats, associated impacts and adaptation measures needed

[128] Waste management is listed as a priority adaptation area for municipalities largely because of its impact on water and soil quality when mismanaged. While this can be an important adaptation strategy for Local Authorities, waste management projects will not be funded by this EDA project. Even still it is important to capture the stated priorities of the Local Authorities

[129] Cao-Lormeau, V.M. & Musso, D. 2014. Emerging arboviruses in the Pacific. Lancet 384: 1571–1572.

[130] Filho et al. 2019. Climate Change, Health and Mosquito-Borne Diseases: Trends and Implications to the Pacific Region. International Journal of Environmental Research and Public Health 16(24): 5114.

Key climate change threats in the project area	Major climate change impacts	Adaptation measures needed
Disaster Risk Reduction and Coastal Protection		
• Increased sea level rise, both over the long term, and through acute king tide events • Increase in frequency of extreme hourly and daily rainfall events leading to both landslides and flooding • Unknown changes to ENSO conditions which can lead to major drought and typhoon events in FSM	• Approximately 60% of households in FSM live within 200 yards of the shoreline. • Past king tides and storm surge have led to significant crop losses for staple crops (75-90% damage to taro, breadfruit, coconuts, etc.) and livestock (25% losses). Future events are projected to be more frequent and more severe. • Estimated costs of flooding from extreme rainfall events for a representative village are 15.59 million in 2050 and 23.01 million in 2100 (3% discount rate). • On average, in any one-year FSM is expected to incur USD8 million in losses due to tropical cyclones and earthquakes. The relative contribution from earthquakes is small as most islands of FSM are situated in a relatively quiet seismic area. In the coming 50 years FSM has a 50% chance of experiencing natural disaster losses exceeding USD 105 million. Additionally, there is at least a 10% chance that FSM will experience a loss greater than USD 450 million and fatalities of more than 600 individuals.[131]	• Retrofitting existing buildings to climate-proof against increased storm incidents (e.g. cyclone proofing, solar panels, rainwater tanks) • Watershed reforestation for landslide protection and flooding control • Small-scale coastal infrastructure constructed that will reduce the risk of losses and damages caused by climate-induced disaster events (as appropriate, use of endemic species planting, wave breakers, man-made channels) • Restoration, rehabilitation or substitution of ecosystems relevant for adaptation (e.g. mangrove restoration, re-vegetation, sea-grass beds) • Equipping municipalities with necessary tools to respond to climate-induced disaster, including emergency plans, building shelter, medical and other supplies
Food security		
• Increases in temperature will alter crop and livestock cycles and productivity • Rainfall variability will cause changes to some crop cycles and potentially stress for livestock • Increased sea level rise, both over the long term, and through acute king tide events • Increase in frequency of extreme hourly and daily rainfall events leading to both landslides and flooding • Unknown changes to ENSO conditions which can lead to major drought and typhoon events in FSM	• Specific impacts of temperature increase on crops are difficult to predict based on current knowledge, but temperatures approaching 2°C and beyond will create significant physiological stress for many of the staple crops.[132] • An increase of 25% in mean annual rainfall would have a significant damaging effect on crop production in locations where rainfall is already high to very high, like FSM.[133] • Projections for changing climate in the Pacific generally improves conditions for pest growth and spreading staple crops specifically, fruit flies, mealybugs, scale insects, and whiteflies. [134][135] • Extreme tides are worsening under climate change and cause significant flooding, salinization, and erosion that ultimately damage groundwater resources, taro beds, soil, and	• Promotion and dissemination of climate-resilient crop species and varieties[137] (resilient to drought, waterlogging, saltwater, pests), including techniques for their consistent supply (germplasm collections, nurseries) • Farming and land use techniques facilitating soil and water conservation (e.g. mulching, organic farming, mixed cropping, drainage) • Small scale aquaculture • Fisheries and coastal resources management (local marine protected areas and habitat conservation, sustainable fishing programmes, improved post-harvest practices)[138]

[131] Pacific Catastrophe and Risk Financing Initiative, 2011.
[132] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)
[133] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)
[134] Vulnerability of Pacific Island agriculture and forestry to climate change (2016)
[135] Fourteen Atoll Assessment of Food Security via FSMNC2 pg. 61
[137] Including: salt- and drought-tolerant banana (Miri et al. 2009; Vanhove et al. 2012); salt-tolerant breadfruit (Ragone 1997); salt-tolerant swamp taro (Webb 2007; Rao 2010); and salt-tolerant sweet potato (van Kien et al. 2013; Carretero et al. 2007).
[138] SPC. 2011. Vulnerability of tropical Pacific fisheries and aquaculture to climate change.

• Tidal surges in particular are expected to cause continued and increased crop loss, especially staples like taro and breadfruit • Ocean acidification and sea surface warming are projected to dramatically increase under all emissions scenarios which severely negatively affect coral reefs and marine habitat in FSM.	livestock/agroforestry resources in coastal settings, especially in the low islands. Past events have cause 25% losses in livestock and 75%–90% losses in staple crops in certain areas. • The tuna license revenue in 2016 in FSM was approximately USD 63.2 million. Under high emission scenarios it is estimated that up to USD 16.4 million in revenue could be lost by 2050, which is a loss of 14.6% relative to 2016.[136] • An FAO review in 2013 projected declines in catches of tuna in FSM of about 15% also expected to cause reductions of about 0.8–1% in GDP, and about 1–2% in government revenue.	• Livestock management (introduction of hardy breeds, modified animal feed practices, animal shelter)[139] • Watershed management[140,141] (local conservation areas, forest rehabilitation, sustainable forestry practices, improved land-use planning, ridge-to-reef catchment management, erosion control, fire management) • Establishment of agroforestry demonstration sites integrated with livestock • Building value chains for crops, fisheries, and livestock (e.g. post-harvest and post-catch processing for small-scale and semi-subsistence livelihood practices)
Water security		
• The incidence of drought is expected to decrease over the 21st century, consistent with an overall increase in rainfall for FSM. • El Niño/La Niña events cause significant variability in climate for FSM. El Niño events in FSM tend to cause droughts which have resulted in water and food shortages • Sea-level rise combined with natural year-to-year changes will accentuate the impact of storm surges and coastal flooding. Frequency of extreme high sea level (tidal surges) for FSM are projected to increase dramatically as a result of climate change. [142]	• To date here are no comprehensive studies on freshwater resources and climate change in FSM and there remain large data gaps especially for hydraulic modelling of atoll aquifer systems.[143] However, it is clear that with the continued projections for sea level rise, storm surge and inundation events and unpredictable seasonal variations in rainfall and ENSO events outlined in Section 3, freshwater availability in FSM will continue to be negatively impacted due to climate change events in the coming decades.	• Water infrastructure (e.g. water tanks, solar water pumps) • Procurement and distribution of rain water collection tanks • Capturing and storage of rain and groundwater resources (individual household and community storage capacities) • Reducing leakage of reticulated systems and water storage facilities • Water saving (e.g. introducing compost toilets, demand management through awareness raising) • Water quality enhancement and assurance • Solar water purifiers

7. Policy Context

In the face of current and future impacts from climate change outlined above, FSM has made commitments to improve its disaster risk preparedness, food security and water security through a variety of regional, national and sub-national policies and programs that identify and commit to increasing climate change adaptation capacity building within these and other relevant sectors in FSM. The proposed programme interventions of LA adaptation

[136] SPC Policy Brief #32 2019 Implications of climate-driven redistribution of tuna for Pacific Island economies.
[139] SPC. 2016. Vulnerability of Pacific Islands agriculture and forestry to climate change.
[140] SPC. 2016. Vulnerability of Pacific Islands agriculture and forestry to climate change.
[141] SPC. 2011. Forests of the Pacific Islands: foundation for a sustainable future.
[142] FSM. Second National Communication on Climate Change.
[143] SPC. Federated States of Micronesia – IWRM Outlook Summary and NWTF Report.

capacity building (Component 1) and implementation of priority adaptation projects (Component 2) align with the processes and goals identified in these policies and programs.

Relevant policies and programs and a description of how this programme aligns with these policies and programs are identified in Table 24 below.

Table 24: EDA programme alignment with existing FSM policies and programs

Policy/programme	Level of policy/programme	Overview and key strategy	EDA programme alignment
GCF Country Programme (2017)	National/sub-national	The Country Programme is the strategic and operational framework for FSM's engagement with the GCF.[144] This programme lays the groundwork for FSM's engagement with the GCF and prioritizes the type and scope of interventions and projects that will be undertaken through GCF resources. Priority project types identified by the Country Programme include: • Food and water security projects; • Disaster risk management projects; and • Resilient infrastructure/roads projects The programme also identifies the limited institutional and technical capacity of the country to respond to climate change threats.	This programme will work directly on implementing local-level, priority adaptation projects within the food and water security sectors and with disaster risk reduction. Additionally, this programme will build LA technical capacity, so that LAs can utilize climate change information and implement an informed adaptation response.
Small Island Developing States Accelerated Modalities of Action (SAMOA) Pathway	Regional	The SAMOA Pathway programme is a regional programme that established 300 multi-stakeholder partnerships in support of SIDS and a unique intergovernmental SIDS partnership framework.[145] Priority area (l) for the next five years of the SAMOA Pathway programme implementation indicated in the mid-term review report identifies institutional strengthening and capacity building across SIDS as a priority.[146]	Component 1 of this programme will involve increasing the capacity of LAs in FSM, including through increasing knowledge and understanding of climate change and adaptation options and access to resources.
Micronesia Challenge	Regional	The Micronesia Challenge is a regional commitment to effectively manage at least 50% of near-shore marine resources as well as at least 30% of terrestrial resources across the region of Micronesia by 2030.[147] The Challenge has resulted in the development of numerous connected conservation projects as well as the creation of additional terrestrial and marine protected areas.	This programme will increase adaptive capacity outside of protected areas in local communities.
Strategic Development Plan (2004 – 2023) and associated 2030 Agenda for Sustainable Development	National	The Strategic Development Plan provides a framework for how growth can be achieved in the major sectors in FSM utilizing sustainable pathways.[148] The Plan identifies a number of development goals including the responsible management of fisheries (fisheries Strategic Goal #2), environmentally sound and sustainable production of crops (agriculture Strategic Goal #4), and the mainstreaming of environmental	All the priority adaptation projects implemented by LAs will utilize the programme E&S Action Plan to be in conformance with the Strategic Development Plan and other relevant FSM environmental regulations.

[144] GCF – Federated State of Micronesia Country Programme.
[145] SAMOA Pathway.
[146] SAMOA Pathway – Mid-Term Review.
[147] FSM. Sixth National Report to the Convention on Biological Diversity (2020) (Biology, 2020).
[148] FSM Strategic Development Plan (2004 – 2023).

		considerations and climate change in national policy and planning (environment Strategic Goal #1).	
Second National Communication to the United Nations Framework Convention on Climate Change	National	The Second National Communication documents FSM's change in greenhouse gas emissions, its changing vulnerability to climate change and identifies gaps and adaptation measures necessary to effectively mitigate risks from climate change.[149] The report identifies risks to food and water security and coastal flooding from climate change impacts (sea level rise, saltwater inundation, extreme weather events) as key adaptation initiatives. Additionally, the report cites the opportunity that community-based adaptation offers to institute locally effective adaptation measures.	This programme will involve the implementation of community-based adaptation projects through LAs. Priority adaptation projects will focus on food and water security and disaster risk reduction and coastal protection.
Nation Wide Integrated Disaster Risk Management and Climate Change Policy (2013)	National	The FSM Nation Wide Integrated Disaster Risk Management and Climate Change Policy was developed with the goal of safeguarding FSM's citizens, resources and economy from risks posed by climate change as well as other natural and man-made hazards.[150] Strategic objectives identified in the policy include Objective 2: Promote, facilitate and develop training programs focused on disaster risk management and climate change for scientific, technical, managerial personnel and policy makers and Objective 7: Reduce and manage the risks associated with more frequent, severe and unpredictable extreme weather events.	Component 1 of this programme will include building LA capacity to better understand and utilize information related to climate disasters and risk management. Subsequently, Component 2 of this programme will enable LAs with the necessary resources to design, implement and manage disaster risk reduction projects.
Agriculture Policy (2012 – 2016)	National	The FSM Agriculture Policy provides a framework for both the public and private sector to increase sustainable agriculture in FSM. The policy addresses both small-scale, subsistence farmers as well as commercial farmers.[151] Policy goals include achieving national food security, safety and nutritional health and improving natural resource management (including as how it related to climate change).	Component 2 of this programme will involve the implementation of priority adaptation projects within the climate impact area of food security and Component 1 equip LAs with the knowledge and technical capacity to effectively implement these projects.
Pohnpei JSAP	State	The JSAPs provide a plan for the State governments to adapt to current and projected climate change impacts at the geographic and policy level of the State. Priority objectives identified in the Pohnpei JSAP include Objective 4.1: Strengthen food security in Pohnpei, Objective 5.2: Ensure water security of Pohnpei and Objective 6.1: Improve critical infrastructure in Pohnpei to withstand disasters and climate change.[152]	Component 2 of this programme will involve the implementation of priority adaptation projects within the climate impact areas of food security, water security and disaster risk reduction and coastal protection.
Kosrae JSAP	State	Priority objectives identified in the Kosrae JSAP include Objective 6.3: Improve critical infrastructure in Kosrae to withstand disasters and climate change and Objective 6.8: Strengthen management of freshwater resources.[153]	Priority adaptation projects that will be implemented under Component 2 of this programme will include water security and disaster risk reduction projects.

[149] FSM. Second National Communication on Climate Change.
[150] FSM Nation Wide Integrated Disaster Risk Management and Climate Change Policy.
[151] FSM Agriculture Policy.
[152] FSM. Pohnpei Joint State Action Plan for Disaster Risk Management and Climate Change.
[153] FSM. Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change.

Chuuk JSAP	State	Priority objectives identified in the Chuuk JSAP include Objective 1.2: Improve infrastructure in Chuuk State to withstand disaster risk and climate change, Objective 2.4: Sustain productive agriculture and Objective 4.1: Ensure water security for Chuuk.[154]	Component 2 of this programme will involve the implementation of priority adaptation projects within the climate impact areas of food security, water security and disaster risk reduction and coastal protection.
Yap JSAP	State	Priority objectives identified in the Yap JSAP include Objective 3.1: Improve data and knowledge management to better support disaster risk management and climate change adaptation, Objective 3.5: Address food security issues in Yap and the risks provided by climate change and other events and Objective 6.3: Improve critical infrastructure in Yap to withstand disasters and climate change.[155]	Component 1 of this programme will involve increasing the capacity of LAs, including through increasing knowledge and understanding of climate change and adaptation options. Component 2 of this programme will involve the implementation of priority adaptation projects, including in the areas of food security and disaster risk reduction.
Local Early Action Plans (LEAPs)	Community/ Municipal	As part of the International Climate Initiative, LEAPs were completed in one community per each State in FSM. LEAPs provide a community-based climate change vulnerability assessment and outline potential management planning activities and other actions to improve community resilience to the impacts of climate change.[156]	Component 2 of this programme will involve the implementation of priority adaptation projects, including projects that were identified as priorities in community LEAPs.

8. Past and Ongoing Projects and Initiatives

There have been projects and initiatives previously implemented and currently under implementation in FSM that have additionally sought to overcome some of the key adaptation challenges previously mentioned. However, the majority of these projects have targeted NGOs as both the main beneficiaries of capacity development and the implementing entities of the projects themselves. This programme will fill a much-needed gap in FSM by targeting LAs for both adaptation capacity development and enable them with the resources to implement needed priority adaptation sub-grants throughout the country.

Specifically, the 'Practical Solutions for Reducing Community Vulnerability to Climate Change in the Federated States of Micronesia' Adaptation Fund project, the Pacific-American Climate Fund (PACAM) projects administered through the United States Agency for International Development (USAID), the recently approved 'Climate Resilient Food Security for Farming Households across FSM' GCF project and the Small Grants Programme (SGP) projects administered by the Global Environment Facility (GEF) have all aimed to increase adaptation capacity and implement sub-grants in FSM through NGOs. These projects, their respective goals and activities and how this programme can leverage opportunities from outputs are outlined below. See Annex 3 for a list of additional relevant projects/programs and a description of opportunities to be leveraged for this proposed EDA programme.

- **'Practical Solutions for Reducing Community Vulnerability to Climate Change in the Federated States of Micronesia' – Adaptation Fund**. This is a nationwide Adaptation Fund project that has an overall project goal to build/increase the ecological, social and economic resilience of communities by reducing vulnerability to stressors from climate change.[157] The project focuses on protecting marine ecosystems in FSM and increasing their resilience to climate change. Expected outcomes of this project include improved

[154] FSM. Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change.
[155] FSM. Yap Joint State Action Plan for Disaster Risk Management and Climate Change.
[156] Malem Local Early Action Plan – Kosrae.
[157] Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM.

management of natural assets/ecosystems in designated protected areas, strengthened awareness/ownership of climate risk reduction at the local level and improved knowledge management for protected areas and ecosystem-based adaptation solutions. The project also leveraged an EDA Facility to provide support for 10 communities to implement priority actions identified in their Local Early Action Plans for climate adaptation - demonstrating that the small grants mode of delivery works well in FSM. The present programme proposal will work to leverage the past experience with small grants, particularly utilizing them to support specific local priorities for adaptation as well as the increased capacity of communities that have participated in this project in regard to water conservation and coastal protection.

- **Pacific-American Climate Fund – USAID.** The PACAM regional programme provides grant support to NGOs operating in Pacific island communities in adapting to climate change.[158] The programme includes focus on capacity building through various means (technical training, workshops, purchasing equipment through grants, etc.) and projects are both regional and country/community specific. Relevant recent projects that have been implemented in FSM include 'Climate Change Adaptation through Family Gardens, Food, and Health' and 'Improving Community Climate Resilience in Micronesia'. The family gardens project aims at strengthening the capacity of households and school communities to grow food in FSM. The climate resilience project is a regional project that targets remote outer islands and strengthening community resilience to climate change risks and hazards. The present programme proposal will work to leverage the community knowledge of implementing home gardens and other household level food security projects through the family gardens project and increased capacity for climate change adaptation planning on outer islands through the climate resilience project.
- **'Climate Resilient Food Security for Farming Households across FSM' – GCF.** This additional GCF project is focused on providing a system-wide solution to increasing the resilience of FSM's most vulnerable communities to food insecurity in the face of climate change. Goals of the project include strengthening the enabling environment with the agriculture sector at both the national and State-levels, providing an evidence-base for specific interventions, developing new opportunities for market access and development and targeting climate smart agricultural techniques and opportunities to be used at the household level. Potential areas for leverage with the present programme include utilizing updated data, mapping, and climate information from the food security project to provide better targeted interventions across all three climate impact areas.
- **Small Grants Programme – Global Environment Facility.** The GEF SGP provides financial and technical support to communities in developing countries for small projects that conserve and restore the environment and enhance community well-being and livelihoods. The programme provides grants up to USD 50,000 to beneficiaries for project implementation.[159] Various SGP projects have been implemented in FSM and the region, including a climate food security project in the community of Enimwahn and a coastal and land ecosystem rehabilitation project in the community of Satawan. The present programme proposal will work to leverage the increased capacity to implement various types of adaptation projects throughout FSM that has been increased through the SGP.
- **ADB/GCF Pacific Islands Renewable Energy Investment Program.[160]** The program focuses on building potential for renewable energy deployment in seven SIDS in the Pacific (including FSM). The program specifically develops feasibility studies for renewable energy and works to upscale existing renewable energy sites. In FSM this includes wind, solar, and battery storage in both mini-grids and individual household deployments. The project is in the early stages of implementation, but it can inform the present programme on implementation of a GCF project in FSM and highlight specific challenges for project development in the individual FSM States. Further, to the extent that the States and Local Authorities have developed prior capacity with distributed renewable systems, particularly solar, the programme can

[158] USAID – Pacific-American Climate Fund.
[159] GEF SGP.
[160] ADB/GCF Pacific Islands Renewable Energy Investment Program (2016)

leverage that capacity to support the design, operations, and maintenance of the PV systems envisioned to support adaptation solutions in the EDA sub-projects.

- **FAO El Niño drought: Food insecurity monitoring, preparedness and support in Micronesia and Melanesia.**[161] The project focused on identifying and monitoring food insecurity in the Solomon Islands, Palau, the Marshall Islands, and FSM. The project enhanced national food security clusters' coordination plans through the establishment of clear communication tools, process of declaring a crisis and overall standard operating procedures. The project also trained government officials and guided and assisted government departments to prepare implementation plans for data collection and monitoring capability for household food security and nutrition. This capacity will be helpful in guiding the development and implementation of food security sub-projects.

9. Barriers

Despite what has been done at the regional, national and State levels to adapt to current and future impacts from climate change, FSM has a number of remaining barriers and challenges to overcome in order to strengthen its adaptive capacity to climate change threats and impacts to sectors such as disaster risk reduction, food security and water security. In FSM's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), several "root causes" of adaptation capacity constraints for the country were identified.[162] A lack of information related to climate baseline data, vulnerability and adaptation assessments, and changing environmental, demographic, economic patterns and trends were cited as key knowledge gaps for the country. The report indicates that there is also insufficient scientific and technical knowledge to effectively utilize climate change and adaptation information and data. Additionally, government agencies at all levels are not utilizing climate information that is available and do not have an adequate structure for cooperating and coordinating on climate change projects.

FSM's GCF Country Programme further discusses the low availability of technical capacity at various levels of government and NGOs as a major barrier. The programme concluded that presently none of the FSM States have a high level of adaptive capacity required to ensure adaptation to the effects of climate change. The programme additionally found that institutional capacity to secure sufficient funds and implement coordinated adaptation projects is also lacking. While decision-makers' awareness of climate change is reasonably high, a concrete institutional response is at a very early stage in FSM. States have low adaptive capacity that is further constrained by weak linkages among government institutions nationally and between different levels of government and with communities. Increased adaptive capacity at the State and municipal level would allow local government to build the needed capacity to respond more effectively to climate risks. Adaptive capacity would be further enhanced by facilitating institutional linkages and coordinating multilevel responses across all boundaries of government. Building adaptive capacity would mean fostering the transfer, receipt and integration of knowledge across LAs, and ultimately building long-term collaborative problem-solving capacity in FSM. Additionally, capacity building empowers LAs to address critical climate risks themselves and not solely rely on national and donor assistance. These institutional barriers are compounded by FSM's relative geographic remoteness and the vast extent to which the hundreds of islands that make up the country are spread across the Western Pacific.[163]
The State JSAPs identify the need for additional coordination between federal, State and local level adaptation policies and projects.[164][165][166][167] These State-level documents additionally highlight the lack of community-level action, which they cite as needed to effectively implement adaptation projects.

Additionally, SPC, the Pacific Islands Forum Secretariat (PIFS) and USAID recently published a Climate Change and

[161] FAO. 2017. El Niño drought: food insecurity monitoring, preparedness and support in Micronesia and Melanesia.
[162] FSM. Second National Communication on Climate Change.
[163] GCF – Federated State of Micronesia Country Programme.
[164] FSM. Pohnpei Joint State Action Plan for Disaster Risk Management and Climate Change.
[165] FSM. Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change.
[166] FSM. Yap Joint State Action Plan for Disaster Risk Management and Climate Change.
[167] FSM. Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change.

Disaster Risk Finance Assessment report for FSM. The report found the following gaps and barriers with climate finance in FSM:[168]

- A deficit in government coordination regarding integrating adaptation in FSM's national policy framework;
- Cost estimations for implementing adaptation measures/projects at the State level outstrips current department budgets;
- Climate change considerations are not mainstreamed enough into national policies;
- Lack of project monitoring at the State and national level, which results in discordant climate financing;
- Lack of central mechanism to collect climate change information and disseminate as needed at the State and local level;
- Private sector has limited engagement in adaptation planning;
- Climate finance and adaptation priorities are not coordinated at the State and national levels; and
- Local climate change adaptation capacity is not sustained effectively.

Overall, a summary of the different barrier types can be seen in Table 22 below.

Table 25: Summary of the adaptation barriers (information, technical, social, financial and institutional barriers) and how the project will address them

	Barriers to adaptation	**How the project will address specific barriers**
Information barrier	Limited scientific and technical knowledge and understanding of climate change and adaptation programming	The Programme is working directly with LAs to build technical capacity for climate change, particularly climate change adaptation planning through particularly the climate adaptation decision support framework and training (Activity 1.1.1, 1.1.2) and the project preparation trainings (1.2.1, 1.2.2). SPC will develop a framework for LAs to identify and screen for climate change adaptation risks in their communities. The framework will include intensive community engagement to allow for inclusive identification and prioritization of adaptation solutions, as well as develop tools and frameworks which will allow LAs to match needs with potential sources of funding both national and international. Examples of resources which could be used to train the LAs include the Pacific Adaptation Tool[169], the UNDP Toolkit for Practitioners- Designing Climate Change Adaptation Initiatives, the Community Based Risk Screening tool

[168] FSM Climate Change and Disaster Risk Finance Assessment.
[169] https://apt.pacificclimatechange.net/

	Barriers to adaptation	How the project will address specific barriers
	Limited central mechanism to collect climate change information and disseminate as needed at the State and local level	– Adaptation and Livelihoods (CRiSTAL) and the USAID's Pacific Islands Development Program Small Grants Guide[170]. At least two (2) representatives per municipality will be trained (approximately 140 persons). At least two (2) representatives from relevant State agencies will also be trained (approximately 80). Areas for training will include but not be limited to (i) Problem Analysis- Defining and identifying the specific climate change related issues, (ii) Identifying key possible adaptation responses or preferred solutions, (iii) Barrier Analysis and Potential Solutions, (iv) Cost-Benefit Analysis (CBA), and (v) Stakeholder Consultation Techniques. There is no single and central mechanism to collect and disseminate climate change information, but there are some platforms regularly used in FSM to disseminate climate change information. Under the EU GCCA project, a climate change portal was created171 that has been used by the Government of FSM and others. It has also been linked with the INFORM portal172, overseen by DECEM. Further strengthening of the climate change portal will be undertaken under the EU GCCA SUPA project. The Government of FSM – and in particular DECEM – is thus in the process of strengthening information dissemination on climate change. This EDA project will contribute to the dissemination of information through these initiatives.
Technical barriers	Limited local awareness of climate change from households and community members which leads to limited buy-in for climate adaptation priorities	LAs and community stakeholders have been engaged throughout the initial project design to build awareness of climate change and identify key adaptation priorities. The Stakeholder Engagement Plan (Annex 7) details the ongoing stakeholder engagement and risk mitigation strategies, particularly awareness of climate change and integration of all community concerns into sub-grant design.
	Limited operational capacities (e.g., human resources, equipment, tools, finance and procurement systems, etc.)	To address the limited operational capacities, all of the LAs are receiving direct technical training and capacity building for project development and operations, as well as continued technical assistance through trainings on service delivery and project management/financial management support from SPC. The direct training for the LAs specifically includes capacity building for designing, implementing, managing, and monitoring climate adaptation projects. The Programme will also be deploying specific support capacity to continue to guide the LAs throughout the sub-grant implementation. Strengthening of capacities and systems for monitoring and evaluation of adaptation measures will support informed decision-making,
	Lack of project monitoring at the State and national level, which results in discordant climate financing	
	Limited experience in designing, implementing and managing climate change adaptation projects	

[170] USAID Pacific Islands Development Program "Small Grants Guide"; Available here.
171 https://fsm-data.sprep.org/dataset/fsm-national-climate-change-data-portal
172 https://www.sprep.org/inform/data-portals

	Barriers to adaptation	How the project will address specific barriers
	Private sector has limited engagement in adaptation planning	prioritisation and resource allocation on climate change at the national and sub-national levels. While this will mostly be at the municipal government and state level, this will be a strong foundation for building national level experience. The private sector is fully engaged in terms of consultations on climate change in FSM. For example, the private sector was extensively consulted for the development of the States Joint State Action Plans (JSAPs) for disaster risk management and climate change. The private sector is generally supportive of government decisions and initiatives on climate change. However, the lack of capacity and scale/fragmentation of local private sectors in Pacific countries present challenges. LAs will be able to include the private sector and academia as part of their sub-grant applications – this has been included in the RCGF application process and relevant forms. The private sector can be included within the sub-grants from the RCGF as participants in an application. Similarly, academia can be included where there is a requirement for technical expertise within bids. Moreover, academia will be encouraged to contribute to and support the development of the various capacity building materials. There is also potential for academia to serve as facilitating agents, where the expertise within FSM's academia matches the requirements for the facilitating agents. Finally, lessons learned and other information from the project will be shared with COM. Information will be shared with academia. They will also learn from interventions. By increasing the local ownership of and responsibility for sub-grant design and outcomes and coupling this with direct training and sustained technical assistance throughout the project cycle, the EDA Programme increases the likelihood that the local capacity is sustained over time.
	Local climate change adaptation capacity is not sustained effectively	
Financial barriers	Cost estimations for implementing adaptation measures/projects at the State level outstrips current department budgets	The Programme provides an influx of critical financing opportunities for state agencies and municipal governments to accelerate the addressing adaptation priorities that currently cannot be financed by existing budgets or alternative sources of financing. The direct access mechanism also ensures that the new financing is directly supporting adaptation priorities rather than more general development outcomes.
	Insufficient available financing from alternative sources to develop and implement locally relevant adaptation projects	

	Barriers to adaptation	How the project will address specific barriers
Social barriers	Land ownership and other social structures can create complexities for the implementation of certain adaptation projects	As explained in the barrier analysis above, individual communities will have differing structures and systems, but since private land ownership is varied, but mostly limited in much of FSM, the Programme will be focused on conducting extensive community engagement and co-development of sub-grant proposals to ensure that any potential barriers that can arise for activities like siting/distribution of resources and interventions are managed proactively with communities. The Programme will comply with FSM government legislation with regard to land ownership/land tenure for sub-grants implemented in public locations. The Programme is deliberately working to address issues of gender equity and gender mainstreaming by providing for balanced representation and empowered decision making/training for women in project design and implementation and ensuring effective screening and technical expertise is in place to effectively support positive gender outcomes both in project design and throughout its implementation.
	Socio-cultural and educational barriers coupled with limited representation leads to gender-blind design of climate adaptation policies and projects	
Institutional barriers	A deficit in government coordination regarding integrating adaptation in FSM's national policy framework	The Programme's bottom-up approach to mainstreaming climate adaptation priorities as well as the direct LA financing through the EDA mechanism create a strong foundation for state and local level coordination of climate finance and adaptation priorities and addresses the current deficit in the national policy framework. GCF Focal points at the State level and the central government are currently working on improving coordination between entities through the Readiness II project. The proposed programme will support this coordination effort by leveraging the GCF State Focal Points to support the ECU and the NDA in the dissemination of information on the results of the programme. Specifically, under Component 1, the training activities (Output 1.1) along with the adaptation decision support framework and tools will help streamlining adaptation priorities.
	Climate finance and adaptation priorities are not coordinated at the State and national levels	

Given the adaptation challenges outlined above, this EDA programme seeks to overcome the following barriers for LAs, both at the State and municipal level:

1. Limited scientific and technical knowledge and understanding of climate change and adaptation programming;
2. Limited operational capacities (e.g. human resources, equipment, tools, finance and procurement systems, etc.);
3. Insufficient available financing from alternative sources to develop and implement locally relevant adaptation projects; and
4. Limited experience in designing, implementing and managing climate change adaptation projects.

10. EDA Programme

Theory of Change and SWOT

To address the identified barriers, the programme will work to systematically build the capacity of LAs in FSM to effectively understand and respond to climate change and empower them to develop localized projects for disaster risk response, food security, and water security tailored to their unique priorities and needs. This will help to shift the status quo for communities in FSM from a pathway characterized by heightened health risks and socioeconomic impacts stemming from extreme vulnerability and limited capacity to respond to climate change, to a new paradigm in which local communities have improved adaptive capacity, food/water security and enhanced disaster risk response from initial sub-grants, as well as sustained absorptive and planning capacity coupled with a track record of project success that can help to catalyze additional climate projects and sustain long-term climate resiliency.

As identified above, FSM communities are faced with a variety of challenges from the impacts of climate change. Specific vulnerabilities to climate change and its effects varies significantly state to state and even community to community. By improving the capacity of LAs to identify, plan for, and design projects to address climate vulnerabilities and opportunities for resilience, this component is helping to improve the adaptive capacity of local communities and FSM as a whole to the impacts of climate change.

Component 1 conducts a variety of capacity building and capacity assessment activities to ensure that LAs are well-positioned and well-supported to access EDA resources to develop and implement effective projects tailored to their communities' local adaptation and resiliency priorities. It will also provide training and technical assistance to ensure long-term sustainability of project outcomes. The principle adaptation outcomes will include number of municipalities/people trained in resilience planning and development of priority adaptation projects. Mostly though, this component provides a specific foundation for the adaptation outcomes achieved through the priority adaptation projects in Component 2.

Component 2 leverages this foundation and focuses on implementing priority adaptation projects in the LAs. These projects will be tailored to local needs and priorities, but in general will build adaptive, anticipatory, and absorptive capacity in these communities in three critical sectors based on the prioritization process identified in Section 5 above. The first sector is disaster risk reduction and coastal recovery which will include measures like improvement of shelters, mangrove restoration and endemic species planting, watershed reforestation, etc. to respond to the critical climate threats of sea level rise, tidal/storm surge, increased rainfall flooding, extreme storm events, etc. The second sector is food security and will include measures like livestock management, marine protected areas and coastal resources management, agroforestry and value chains enhancement, etc. to respond to food insecurity expected as a result of climate change's impacts on availability, accessibility, utility, and stability of food, particularly local food sources in FSM. The final sector is water security which will include measures like rain water collection tanks, solar-powered water pumps (for surface water mostly, but groundwater as well in some cases, particularly on the outer islands), rehabilitation of water catchments, etc. to respond to threats for freshwater availability from climate change particularly sea level rise, storm surge, decreasing rainfall, etc. Adaptation outcomes for these projects will vary, but in general will include improved uptake of diversified, climate resilient livelihood options, improved food security and water security for vulnerable households, local coordination mechanisms, reduction of economic and human costs from disasters/climate change, and overall improved resiliency for target communities.

Overall, the EDA programme will proactively work to address the shortfalls in adaptive capacity in FSM by establishing a dedicated facility to strengthen the capacity of LAs in FSM to adapt to climate change and to address urgent priority vulnerability issues, with support and facilitation from the NDA. The facility will empower all interested LAs by providing them with organizational and individual capacity-building in resilience and priority adaptation project development. LAs will then develop priority adaptation projects which will support building adaptive capacity in local communities.

Figure 23 presents the Theory of Change of this programme and demonstrates how the current barriers can be removed through the programme activities to achieve transformational change.

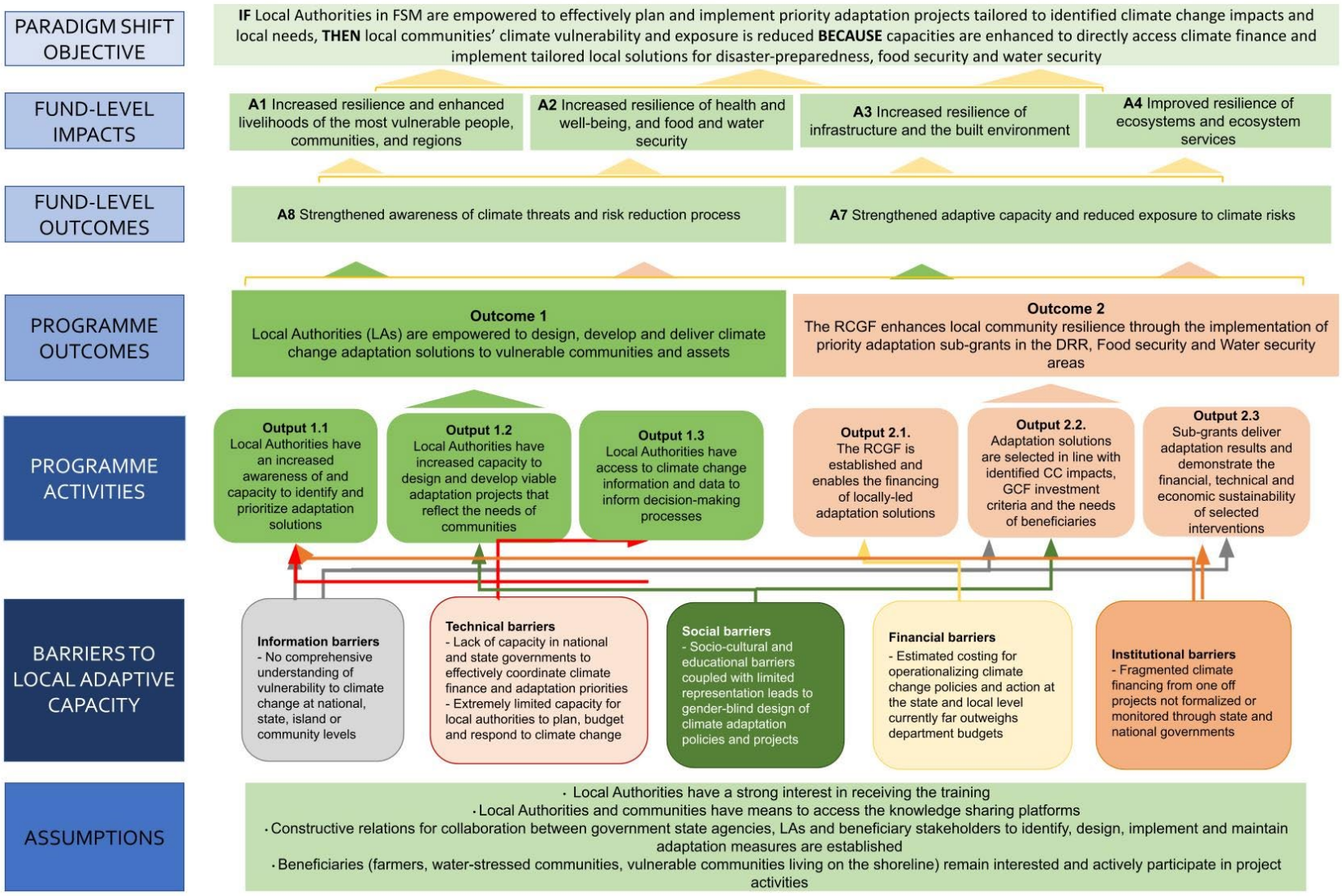

Figure 23: EDA Programme Theory of Change

An initial assessment of the programme's strengths, weaknesses, opportunities, and threats can be seen in Figure 24 below.

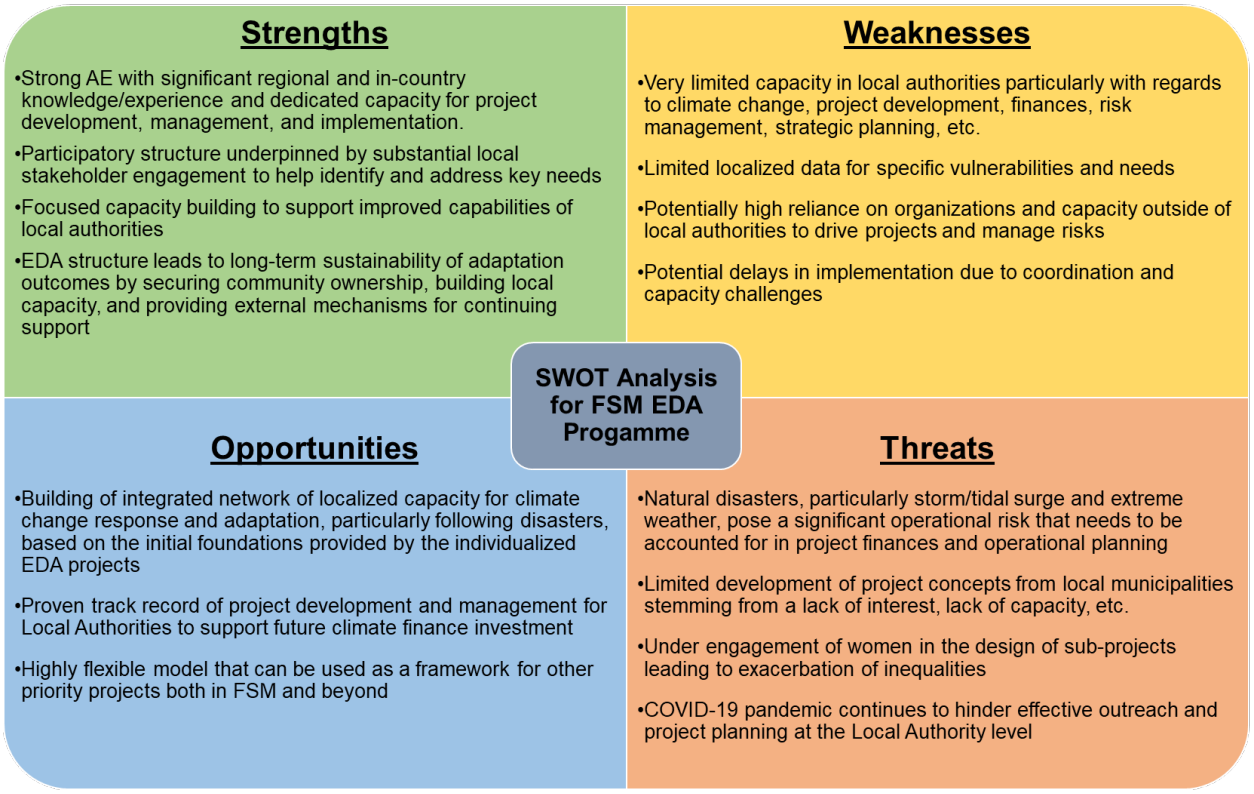

Figure 24: EDA SWOT Analysis

Local Capacity Building in FSM

Adaptive capacity to climate change is needed at all levels of both government and non-governmental organizations in order for countries to comprehensively respond to climate change threats. Many organizations do not have the internal resources and knowledge available to adequately assess climate change threats, and then design, implement and manage solutions. When an organization or entity lacks capacity to adapt to climate change threats, capacity building is a necessary next step. Capacity building in the context of climate change adaptation is the process by which organizations acquire, advance or retain information and knowledge, specialized skills, tools and equipment as well as other resources in order to efficiently and successfully implement climate change adaptation measures, policies, programs and projects.[173]

As highlighted above, capacity building for climate change adaptation is not a new concept for Pacific Island Countries (PICs) such as FSM. There have been numerous capacity building projects (i.e. AF[174], PACAM[175], SGP, etc.) in the region targeted at non-governmental organizations (NGOs). In addition to NGO capacity building projects, FSM has several national level policies and plans that are designed to increase the country's adaptive capacity to existing and projected impacts from climate change. These include the FSM GCF Country Programme, the FSM Strategic Development Plan 2004 – 2023 and the 2014 Climate Change Act. The GCF Country Programme identifies the need for and lays out a strategy for capacity building of national level institutions (such as the Department of

[173] Climate ADAPT – Capacity building on climate change adaptation (2019).
[174] Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM.
[175] USAID – Pacific-American Climate Fund.

Finance and Administration) in the context of climate change adaptation.[176] This includes the development of a Capacity Building Plan under the National Adaptation Plan, which is currently in the process of being developed. Both the Strategic Development Plan 2004 – 2023 and the 2014 Climate Change Act additionally identify adaptation capacity building as components of FSM's national level climate change strategy.

Additionally, each State in FSM has a Joint State Action Plan for Disaster Risk Management and Climate Change (JSAP). The JSAPs provide a plan for the State governments to adapt to current and projected climate change impacts at the geographic and policy level of the State. Many of the action items included in these reports identify capacity building (e.g. increasing and streamlining State-level GIS capabilities, staff trainings, etc.) as measures needed for successful State-wide adaptation.[177]

Although these national and State level policies and plans provide a good general roadmap for climate projections and identified adaptation interventions in FSM, implementation of climate change adaptation efforts are often most effectively undertaken at a local scale. LAs are able to respond to climate change impacts that are specific to their geography, natural environment and socio-political context.[178] Further, LAs are also in a position that enables them the responsibility to manage and regulate land use planning, infrastructure and construction regulation and the management of natural resources.[179] These authorities are additionally positioned to efficiently coordinate between on-the-ground stakeholders and key sectors in the area. UN Sustainable Development Goal 13 on climate action indicates that local governments are critical to strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.[180] The recent IPCC special report also emphasizes the important role that subnational governments play in developing and reinforcing measures for reducing weather- and climate-related risks.[181]

However, as highlighted in the beneficiary assessment section above, LAs in FSM currently lack (i) critical knowledge to understand climate change and the specific threats facing their communities[182], and (ii) resources and capacity to design, implement and manage needed adaptation projects. A recent USAID evaluation report of the organization's Pacific Islands Global Climate Change Portfolio specifically found that local governments currently have low financial and technical capacity and need additional support to sustain adaptation projects and activities implemented under USAID's portfolio.[183]

Given the important role that LAs have to play in supporting and implementing climate change adaptation in FSM and their relative lack of capacity as it relates to climate change adaptation, LAs in FSM are in critical need of a capacity building programme that will allow them to effectively respond to climate change threats. The first part of this EDA programme will need to address knowledge gaps and provide formal technical trainings to LA staff so that they have a solid foundation of climate change adaptation from which to work from (Component 1). Within the arena of climate change adaptation, learning from previous projects and past experiences is a key element in the adaptation process.[184] The second part of this programme involves communities 'learning-by-doing' through LAs designing, implementing and managing priority adaptation projects in their respective communities (Component 2).

This proposed EDA programme links the capacity needs of LAs and their need to gain experience designing, implementing and managing adaptation projects that are within the context of the above-identified climate impact areas. Figure 25 below identifies how Components 1 and 2 of the proposed programme will result in FSM communities that are more resilient to climate change threats.

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[176] GCF. Country Programme – Federated States of Micronesia.
[177] FSM. Pohnpei Joint State Action Plan for Disaster Risk Management and Climate Change.
[178] OECD – Integrating Climate Change Adaptation Into Development Co-Operation Policy Guidance.
[179] UNDP, UNCDF & UNEP - Local Governance and Climate Change.
[180] UN Sustainable Development Goals.
[181] IPCC Climate Report 2018.
[182] Interview with director of Micronesia Conservation Trust (MCT) – a regional conservation and environmental NGO.
[183] USAID – Evaluation Report – Performance Evaluation of USAID/Pacific Islands Global Climate Change Portfolio.
[184] GCF Programming Manual.

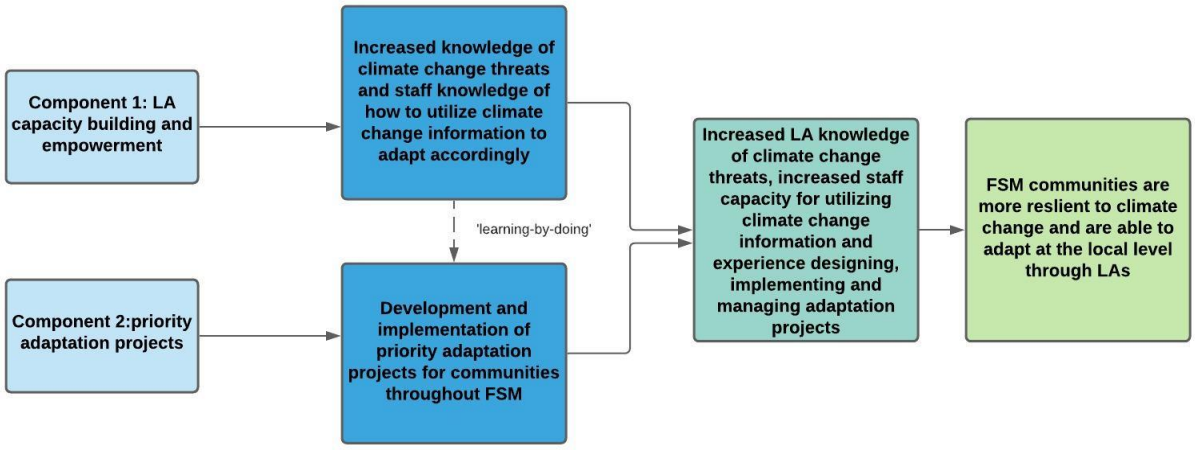


Figure 25: Programme process for climate resilient communities in FSM

11. EDA Programme Interventions

This EDA pilot programme will establish a dedicated Grant Facility to strengthen the capacity of LAs in FSM to adapt to climate change and to address urgent, top priority vulnerability issues. The facility will empower all interested LAs by providing them with organizational and individual capacity-building in resilience and priority adaptation project development. The programme has two components. The first is to build the technical capacity of government officials at both the municipal and State levels to support the identification and prioritization of adaptation solutions and turn communities' highest priorities into concrete project proposals. The second component will set-up the Grant Facility and allow access to all LAs to access funding around three high priority adaptation areas.

Each of the components and their associated outputs and activities are discussed in detail below.

Component 1. Local authorities empowered to deliver climate change adaptation services to their populations

Outcome 1: Local authorities are empowered to deliver climate change adaptation services to their populations

Across FSM, LAs (municipalities and the State-level governments) are well-situated to coordinate and develop local responses to climate change, to enable participatory decision-making, and to ensure financial and technical assistance resources reach beneficiary communities. The beneficiary assessment (see Annex 4) identified that capacity of LAs to respond to climate change in FSM is limited along a number of dimensions, which can be categorized by the availability of different forms of human, financial, and environmental capital[185]. Component 1 is structured to address barriers to increased human capital to respond to projected climate impacts outlined in B.1, while the financial flows and access supported under Component 2 support the protection and resilience of the environmental capital of vulnerable communities.

Component 1 delivers three outputs to strengthen the capacities of LAs across FSM:

- Output 1.1 will directly address barriers such as the lack of scientific and technical knowledge and understanding of climate change vulnerability and insufficient knowledge to effectively utilize climate change and adaptation information for adaptation programming;
- Output 1.2 will provide direct technical support on how to prepare climate change adaptation projects targeting the project's Resilient Communities Grant Facility (RCGF) to improve access to climate financing.

[185] A Method for Enhancing Capacity of Local Governance for Climate Change Adaptation (May 2020)

- Finally, Output 1.3 will create a knowledge management network for cooperation and sharing among different LAs (municipalities and State-government agencies) to share experience and develop solutions to local adaptation problems.

Component 1 activities will be supported by a dedicated ECU that will be established under component 2 and hosted within SPC's Micronesian Regional Office (MRO) in FSM. The ECU will have the dual responsibility to run the day-to-day operations of the EDA Programme and manage the RCGF.

Output 1.1 Build technical expertise to identify and prioritize adaptation solutions

Activities under output 1.1 will deliver climate adaptation decision support tools and training to local authorities empowering them with the scientific and technical knowledge and understanding of climate change vulnerability and adaptation options to identify and prioritize adaptation actions.

Activity 1.1.1 Develop climate adaptation decision support framework and training curriculum including interactive case studies targeting government officials

To ensure a transformation in the way LA's and state agencies identify and prioritize appropriate local adaptation measures, SPC will develop an adaptation measure prioritization framework, climate risk screening tools and a training curriculum informed by scientific data and analysis that will support LAs to identify and screen for climate change adaptation risks and identify appropriate adaptation measures. Intensive LA and community engagement will present approaches from existing and successful toolkits that be adapted into a national "FSM Adaptation Measure Prioritization Framework" which will then be presented to the Climate Change and Sustainable Development Council for potential endorsement. Existing toolkits that will be adapted include the Pacific Adaptation Tool[186], the UNDP Toolkit for Practitioners- Designing Climate Change Adaptation Initiatives[187], CRiSTAL[188] and USAID's Pacific Islands Development Program Small Grants Guide[189].

Gender-responsive activity: Activity 1.1.1. Gender Responsive design incorporated into sub-grant development training, localized strategies for gender mainstreaming, gender criteria, and implementation are developed

Activity 1.1.2 Climate adaptation decision support training for local authorities (2 trainings per State)

SPC will train LAs on the framework and resources identified and provide an introduction to the EDA Facility to familiarize local government officials with the objectives of the facility, the process, eligibility criteria, and details of the three thematic areas for adaptation sub-projects. At least two (2) representatives per municipality will be trained (approximately 140 persons). At least two (2) representatives from relevant State agencies will also be trained (approximately 80). Each State will have two trainings, one for municipalities and one for State agencies.

Areas for training will include but not be limited to (i) Problem Analysis- Defining and identifying the specific climate change related issues, (ii) Identifying key possible adaptation responses or preferred solutions, (iii) Barrier Analysis and Potential Solutions, (iv) Cost-Benefit Analysis (CBA), and (v) Stakeholder Consultation Techniques.

Gender-responsive activity: Activity 1.1.2. Resilience training, includes training on gender-mainstreaming for climate resilience, for local authorities' staff and elected and appointed officials

Activity 1.1.3 Develop train-the-trainer's module and conduct training for national consultants and/or local NGOs in each State to become Facilitating Agents

[186] PCCP – Adaptation Project Tool
[187] Designing Climate Change Adaptation Initiatives: A Toolkit for Practitioners
[188] Community-based Risk Screening Tool – Adaptation & Livelihoods
[189] USAID Pacific Islands Development Program "Small Grants Guide".

NGOs and national consultants from all four states will be selected by SPC through a competitive process to serve as technical support Facilitating Agents (FAs) and will provide capacity and project implementation support. SPC will develop and deliver a train-the-trainer's module to ensure FAs can support LAs in the prioritization and development of climate change projects, particularly for the EDA Facility. FAs will be added to a roster of experts and paired with LAs by SPC based on FAs expertise and experience.

Gender-responsive activity: Activity 1.1.3 Organizational audits of local authorities including gender data and policies and the capacity to integrate gender into sub-grant design

Activity 1.1.4 Facilitating Agents to support LAs prioritize adaptation actions for Grant Facility

Based on the beneficiary assessment, municipalities and State government agencies will need tailored support to catalyze relevant project ideas that will be channeled through the EDA Facility in component 2. FA's will conduct site-visits to State agencies and individual municipalities (approximately 70-80 site visits will be conducted) to provide support to LAs for consultations with communities and to prioritize adaptation actions under the FSM Adaptation Measure Prioritization Framework.

Gender-responsive activity: Activity 1.1.4 Integration of gender considerations into the development of sharing mechanisms and a community of learning and practice

Output 1.2. Technical support on project preparation

Once project priorities have been identified under output 1.1, training will be provided by FAs (locally) and international experts (remotely) to LAs on how to develop adaptation sub-projects targeting the EDA Facility. This will be done through deploying FAs directly to municipalities and State governments to conduct targeted training.

Activity 1.2.1 Project Preparation Trainings and Mentoring

Two to three (2-3) workshops per State will be held on eligible activities, project preparation and development, targeting around five (5) FAs per State for a total of twenty (20).[190] Training will support municipalities and State-government agencies to submit an expression of interest (EOI) through activity 2.2.2 and a full sub-grant proposal through activity 2.2.46. A guideline will be developed to explain how GCF investment criteria and results management framework, gender and environmental and social safeguards is to be incorporated into the sub-grant design. The guide will also incorporate USAID's Guide to Climate Change Adaptation Project Preparation. [191] Areas of training will include: (i) Elements of project design and formats; (ii) Community Engagement Processes (ii) Budgeting and Economic and Financial Aspects, (iii) Implementation and management arrangements and (iv) Monitoring, Evaluation and Reporting.

Gender-responsive activity: Activity 1.2.1a Capacity support to local authorities to strengthen ability of staff to integrate gender considerations into project design and gender-responsive project design in local authorities based on audits

Gender-responsive activity: Activity 1.2.1b Ensure inclusive stakeholder consultations for identifying adaptation priorities

Output 1.3. Knowledge sharing mechanisms to develop and foster a network of local government authorities

[190] The number will vary depending on the breakdown of individual consultants versus non-governmental organizations that are selected. For example, an NGO may be able to support a greater number of LAs than an individual and the number of individual consultants would therefore be less.

[191] USAID – Guide to Climate Change Adaptation Project Preparation. [f]

Activity 1.3.1 Develop a knowledge platform and ensure the Programme is connected to regional platforms across the Pacific

A web portal will be developed to host all materials developed for the project including the guide (activity 1.2.1) and FSM Adaptation Measure Prioritization Framework (activity 1.1.1) all training materials, webinars, and communication tools and information on FSM adaptation approaches, methods and tools that facilitate the planning and implementation of adaptation actions. The platform will also host the knowledge portal including monitoring and reporting results (activity 2.3.3) and lessons learned collated (activity 2.3.4). Additionally, to encourage remote working where possible, the platform will connect users via relevant and appropriate social media accounts and cross-platform messaging and teleconference services. Learning exchanges and a national FSM conference on adaptation action (activity 1.3.3) will support integration of the knowledge platform. The web portal will also connect to the data portals and knowledge communities that already exist in the Pacific such as SPC's Pacific Data Hub, the Pacific Climate Change Portal, and SPREP's Pacific Environment Portal.

Activity 1.3.2 Learning exchanges and site visits

To promote cross-learning and create a network of climate change advocates and practitioners among local government officials across FSM, this activity will support learning exchanges between LAs as well as site visits to ongoing projects funded through the EDA Facility. SPC hosted learning exchanges (one (1) at midterm and one (1) at end of the project) allow for regional dissemination and lessons sharing between Pacific island officials regarding similar issues through site visits by local government officials to other countries and relevant workshops and conferences.

Activity 1.3.3 Climate change adaptation local authorities conference

One conference will be organized toward the end of the overall EDA Programme implementation to allow LA officials to showcase implemented projects and reflect on challenges, successes and lessons learned and to revisit the projects exit and sustainability strategy as well as progress of recapitalization of the EDA facility.

Component 2. Priority project implementation-Grant Facility for Enhancing local community resilience

Outcome 2: Grant Facility for Enhancing local community resilience through priority adaptation projects implementation

Under Component 2, the EDA project will establish a Resilient Communities Grants Facility (RCGF) (output 2.1) to address the long-term vulnerabilities of communities in FSM. The RCGF will provide sub-grants for sub-projects prioritized under Component 1. The RCGF will award grants and provide targeted technical assistance to LAs and State governments across all four FSM States including outer atolls (output 2.2). It will support 30-40 sub-grants in the range of 75,000-1,000,000 USD. An estimated breakdown of size of projects is provided in Table 3 below:

Table 26 Indicative Breakdown of Sub-grants by grant size

Number of Projects	Sub-grant Range (USD per project)	Total Average Amount*	Municipal/State Implemented
15-20	75,000-250,000	2,550,000	Municipal
10-15	250,000-500,000	4,500,000	Municipal and State
5	500,000-1,000,000	3,750,000	State
Totals: 30-40	**75,000-1,000,000**	**10,800,000**	

*Taking average of the range x the average of the number of projects within the sub-grant range

The stakeholder consultation process, climate change vulnerability analysis and other studies conducted identified three priority thematic areas and a list of indicative intervention prototypes across disaster risk reduction and coastal protection, food security and water security (see Annex 5).

In addition to building climate resiliency, the EDA Facility, through the awarded grants, will assist in strengthening the local managerial and financial capacity so that local recipients develop sufficient capability to implement adaptation sub-projects and sustain the country's climate-resilient development in the long term.

Sub-projects will be informed and selected based on past viability of similar projects and interventions in FSM and other Pacific communities. Modelling, feasibility analysis and design of sub-projects will ultimately be driven by the context and needs of the LAs requesting sub-grants as **prescriptive preselection of sub-projects ex-ante weakens the EDA approach of building the capacity of LAs to identify, prioritize and develop projects themselves.** As such, the EDA Programme provides FAs and specialized consultants support to technical assessment and design of sub-grant activities (e.g. engineering design for solar water pumping, planting environmental management plans for mangrove restoration). Alignment with GCF funding requirements will be ensured through stringent approval criteria of sub-grant proposals and screening processes conducted by the ECU (activities 2.2.2, 2.2.6). The three thematic areas and their indicative sub-project interventions are outlined below.[192]

Table 27: Thematic areas and indicative adaptation interventions for the EDA Programme

Thematic area description	Indicative adaptation interventions
Climate-induced Disaster Risk Reduction (DRR) and Coastal Protection	
Climate impacts: Including interrelated coastal erosion, sea level rise, storm surges associated with typhoons and tropical storms as well as flooding and landslides due to extreme rainfall and storm events. **DRR sub-projects:** Community-led, that can safeguard lives, livelihoods and infrastructure. Depending on the climate change projections for the area, such projects could prepare for extremes ranging from flash floods to typhons. **Coastal protection sub-projects:** Ecological infrastructure can in some cases play a role in buffering extremes, and as such be incorporated as part of climate-proof small infrastructure projects. Such interventions will need to be linked to projected climate change related impacts on communities being reduced or prevented as a result of healthy and functioning ecosystems.	• Retrofitting existing buildings to climate-proof against increased storm incidents (e.g. cyclone proofing, solar panels, rainwater tanks) • Watershed reforestation for landslide protection and flooding control • Small-scale coastal infrastructure constructed that will reduce the risk of losses and damages caused by climate-induced disaster events (as appropriate, use of endemic species planting, wave breakers, man-made channels) • Restoration, rehabilitation or substitution of ecosystems relevant for adaptation (e.g. mangrove restoration, re-vegetation, sea-grass beds) • Equipping municipalities with necessary tools to respond to climate-induced disaster, including emergency plans, building shelter, medical and other supplies
Food Security	
Climate impacts: Climate change-induced extreme weather events and sea-level as well as the projected impacts of warmer atmospheric and open water temperatures, erratic rainfall intensity and distribution, more frequent and more intense tropical cyclones etc and their effect on land, soil and water resources, agricultural production systems (including	• Development and use of climate-resilient crop species and varieties (resilient to drought, waterlogging, saltwater, pests), including techniques for their consistent supply (germplasm collections, nurseries)

[192] The indicative list of interventions for each thematic area will be refined by the governing bodies at the outset of the Programme.

those of livestock and fisheries), infrastructure, and social (community) systems. **Food security sub-projects:** Address the management of cropland, livestock, forests and fisheries. Sub-projects that aim to support food security under the new realities of climate change through sustainable and equitable transitions for agricultural systems and livelihoods as well as access to markets and value chains. Specifically, to target increased productivity (i.e., produce more food and boost local incomes) and enhanced ability of communities to adapt to climate change and weather extremes. In FSM, it is important to also support benefits to coastal ecosystem (e.g., by reducing sediment into the coastal zone through taro swamps, reducing pressure on wild-caught fisheries, reducing pollutants from fertilizers).	• Farming and land use techniques facilitating soil and water conservation (e.g. mulching, organic farming, mixed cropping, drainage) • Small scale aquaculture • Fisheries and coastal resources management • Livestock management • Watershed management • Establishment of agroforestry demonstration sites integrated with livestock • Building value chains for crops, fisheries, and livestock protecting
Water Security	
Climate impacts: Climate-induced disturbances in water supply and security including reduced aquifer recharge from hydrological disturbances, salinization and contamination of aquifers from sea-level rise and flooding. **Water security sub-projects:** interventions that address increased impacts of droughts in Yap and Chuuk; shortages in freshwater supplies, especially in the outer islands; increased incidence of lowland flooding and seawater inundation, especially in the steep topographies of Chuuk, Pohnpei and Kosrae.	• Water distribution infrastructure (e.g. solar water pumps) • Procurement and distribution of rainwater collection tanks • Reducing leakage of reticulated systems and water storage facilities • Water saving (e.g. introducing compost toilets, demand management through awareness raising) • Water quality enhancement and assurance • Solar water purifiers

Output 2.1 Establishment of Resilient Communities Grant Facility (RCGF)

This output will establish the EDA Facility that will openly and competitively fund applications for adaptation measures. The output will focus on putting in place the relevant requirements, rules, and regulations for the RCGF**.**

Activity 2.1.1. Governance structure for RCGF established and formalized

SPC's MRO, in partnership with FSM Department of Finance and Administration (the GCF NDA) will establish all committees, review panels (including expertise for E&S and gender assessment reviews) during the first six months of Programme implementation. SPC and the NDA will identify and recruit personnel for committees from relevant organizations and plan steering committee meetings (see B.4 for detailed structure).

Gender-responsive activity: Activity 2.1.1 Establishment of inclusive and representative EDA Programme Board (EPB) and Grants Technical Evaluation sub-committee

Activity 2.1.2 RCGF guidelines and procedures developed and finalized

Based on the Operations Manual (annex 21 of the funding proposal), the guidelines and procedures of the RCGF will be reviewed by the ECU for endorsement by the EPB as the governance mechanism for the EDA project. The Operations Manual details the overall procedures, guidance documents and forms for LAs to access the RCGF. Figure 21 below and output 2.2 provide an overview of the EDA Facility, sub-grant review criteria, and details eligibility criteria.

Gender-responsive activity: Activity 2.1.2.a Development of tender documents for the technical support to ensure adequate gender expertise for EDA programme and EDA Facility

Gender-responsive activity: Activity 2.1.2.b Refinement of gender review criteria for sub-grant selection

Output 2.2 Grant award selection

Under this output the ECU will operate the RCGF. Calls for expressions of interest (activity 2.2.1) and full proposals will be launched (activity 2.24). Grants for adaptation investments will be screened (activities 2.2.2 and 2.2.6) and awarded (activity 2.2.7) to LAs for priority adaptation sub-projects worth USD 75,000 – USD 1,000,000 across disaster risk reduction and coastal protection, food security, and water security thematic areas. The EDA facility will also support LAs through technical assistance activities. A capacity assessment (2.2.3) will determine whether the applicant has the necessary capacity to implement the proposed sub-grant. Based on the audit and sub grant screening selection, targeted technical assistance will then be provided to a) improve LA's service delivery of adaptation interventions (activity 2.2.4), and b) prepare subgrants, to ensure sufficient capacity to identify, prioritize and design a range of adaptation investments. To ensure no LA is left behind, additional targeted technical assistance will be provided by FAs appointed by the ECU to support LAs who fail to meet RCGF funding criteria.

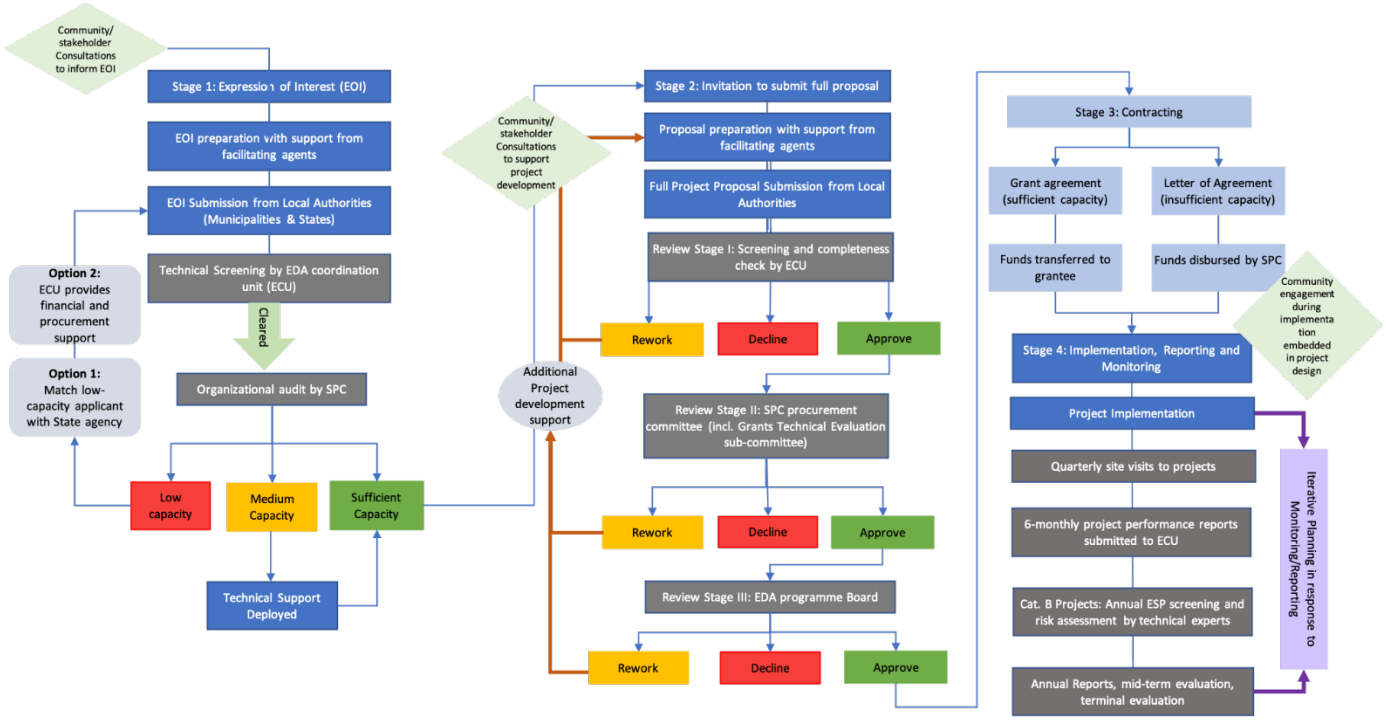


Figure 26 EDA Facility grant award procedure overview

The Programme also prioritizes funding for LAs that are considered the most vulnerable to climate change based on an assessment of: 1) potential climate impacts; and 2) adaptive capacity assessment. As such, the ECU will ensure that at least 40–50% of the grants will go to LAs with a capacity rating of less than 3.6 (for prioritization see Section 5). Details on the types of eligible projects under these three thematic windows are detailed in Annex 5. The procedures for submissions of applications are in the Operations Manual (annex 21 to the Funding Proposal).

Activity 2.2.1 Initial call for expressions of interest

Based on priority adaptation solutions identified under Activity 1.1.2 and Activity 1.1.3, ECU will release an initial call for EOI all LAs. Four (4) further calls for EOI will occur every six months after the initial call (5 total). Additional

technical assistance to improve EOI applications will be provided by FAs to encourage LAs that did not submit an EOI to submit in the next round.

Gender-responsive activity: Activity 2.2.1 Inclusive sub-grant design process

Activity 2.2.2 Screening of Expressions of Interest

The EOI process will allow the ECU to pre-screen sub-grants against the GCF investment criteria, eligibility under the EDA Facility's three thematic areas, E&S risk level and level of community input/engagement. The ECU will allocate targeted technical assistance support to LAs to align their EOIs application with pre-screening criteria, particularly if they failed. Sub-grant alignment with GCF investment criteria is outlined in the table below.

Gender-responsive activity: Activity 2.2.2 Sub-grants reviewed and directed technical assistance provided for sub-grants, to ensure appropriate gender mainstreaming as needed

Table 28 Sub-grant Alignment Matrix for GCF Investment Criteria

GCF Investment Criteria	Description	Intake Form
Impact Potential	Overall adaptation potential; Results based on GCF Impact Indicators	"Potential for Impact" section addresses overall climate adaptation potential and impact across selected GCF adaptation metrics
Paradigm Shift	Potential for transformative change from the status quo including the specific innovations leveraged, learning potential, sustainability and replicability of results	"Innovation, Change, and Sustainability" section addresses shift from status quo, innovation, learning potential, and project sustainability
Sustainable Development	Environmental, Social, Economic, and Gender-Sensitive development co-benefits	"Other Benefits" section includes expected benefits for environment, social systems, and economic systems. The "Gender" section assesses gender-sensitive development impact.
Needs of Recipients	Alignment with the specific community/beneficiary needs and priorities	"Community Needs and Priorities" section assesses community needs/priorities and the specific community engagement processes that have been utilized
Country Ownership	Alignment with relevant FSM, State, and local policies and plans	"Community Needs and Priorities" section includes question on alignment with specific plans/policies
Efficiency and Effectiveness	Financial and operational efficiency and effectiveness of grant resources	"Efficiency" section assesses the sub-grant's approach to using grant resources effectively and utilizing best available technologies.

Activity 2.2.3 Organizational audit of sub-national entities/LAs undertaken

Once the EOI is cleared by ECU, the ECU will initiate an organizational audit under activity 2.2.3 to determine the capability of the LA to manage and implement the proposed sub-grant and initial E&S risk level. If the LA is evaluated as "medium-capacity", it will mean that technical training (2.2.4) and support from FAs will be considered sufficient to develop and implement the sub-project. In addition to training under 2.2.4, municipalities who are evaluated as "low capacity" will be able to choose to receive additional support either from a State agency or from SPC as outlined below:

- Option 1 - The lower capacity LA (in this case, usually a municipality) would be matched with a higher capacity LA (usually a State agency) to collaborate on the sub-grant and resubmit the EOI with the higher capacity LA as the lead agency.

- Option 2 - The ECU would serve as the financial and procurement provider and directly support project implementation in collaboration with the LA (in this case, usually a municipality).

Specific conditions will apply to the LAs that are State agencies to make sure local communities, through municipalities, will remain the target beneficiaries of sub-grants and further capacity building/skills transfer will be provided to municipalities during project implementation.

A summarized audit report will inform a training manual to improve sub-national entity service delivery of climate adaptation interventions under activity 2.2.4. The report will also inform the training manual and training conducted for project management, reporting, finance and procurement where appropriate for applicant entities under activity 2.3.1

Gender-responsive activity: Activity 2.2.3 Portfolio of gender-responsive sub-grants funded by granting mechanism

Activity 2.2.4 Invitations to submit full proposal

The selection committee will issue invitations to the local authorities to submit project proposals if an EOI passes screening and there is no duplication with other ongoing support in FSM. The ECU will prepare and share invitation documents for local authorities including full proposal document templates and guidelines.

Activity 2.2.5 Sub-grant preparation support provided

Applicants invited to submit a full proposal may request support for full project preparation. SPC and the ECU will deploy Consultants and NGOs trained under activity 1.2.1 as FAs to support applicants in their preparation of full proposals. Support can be provided, among others, to develop the proposal further, sub-grant climate rationale, logical framework, conduct further stakeholder engagement processes with target communities, undertaking a gender analysis, conduct an E&S screening. If the sub-grant is deemed to be a medium risk project (Category B) SPC will deploy an independent contractor to conduct an Environmental Impact Assessment (EIA) and associated E&S Management Plan (ESMP) for the project (Based on the Full Proposal).

Activity 2.2.6 Sub-grant screening and selection

Following training (Activity 2.2.5), LAs will be invited by the ECU to submit their full proposal and will have 3-4 weeks to prepare it, with potential support from FAs (Activity 2.2.5). Under this activity, full proposals will undergo a three-stage review process:

I. *Proposals pre-screened by the ECU against a set of review criteria* (see EDA Facility section below) and an E&S screening will be done by the SER (social and environmental responsibility) support from SPC. If necessary, applicants will be invited to improve their proposal with further support from FAs. Potential areas for support may include E&S safeguard screening and strengthening, gender mainstreaming, and monitoring and evaluation frameworks.

II. *Proposals reviewed by the SPC procurement committee.* A Grants Technical Evaluation sub-committee will firstly provide an advisory report on both technical and financial sides of the proposals. Then, this report and the organizational audit (Activity 2.2.3) will be used by the procurement committee to assess if the proposal needs to be reworked or can be sent to the Board. FAs will be made available for additional project development support at various stages where necessary.

III. *Proposals reviewed by the EPB* who will make the final decision of the approval process.[193]

[193] Further information on the composition of bodies is provided in the Implementation Arrangements section (Section 12).

Activity 2.2.7 Awarding of grants in the three thematic areas, of food security, climate-induced disaster risk reduction and coastal protection, and water security

The final step will be to award grants to applicants. All awarded grants will be announced publicly, and successful proposals will be posted on the Programme web portal (1.3.1). An initial catalogue of tailored and gender-sensitive adaptation measures in the three thematic areas will be developed and uploaded to the web portal.

Output 2.3 Sub-project/grant award implementation

Under this output, awarded grants will be implemented, monitored and evaluated. To ensure LAs have the required project management skills necessary for the implementation of sub-grants, targeted project management training (2.3.1) will be provided. A sub-grant agreement will be entered into between LA applicants and SPC for the sub-projects to be implemented (2.3.2). During the implementation of sub-projects will be monitored and reviewed, evaluated and lessons learned gathered (2.3.3). During execution, SPC will engage with development partners to identify resources for re-capitalization of the EDA fund, preparing a resource mobilization strategy and preparing and securing application funding requests.

Activity 2.3.1 Training to improve sub-national entity service delivery of adaptation interventions

Based on the organizational audit (activity 2.2.3), if it is determined that the applicant requires additional training in order to enhance their capacity to implement the proposed sub-grant, training tailored to specific gaps will be provided to strengthen governance structures including areas such as improving the effectiveness of risk management, control, and governance processes. “Fit for purpose” coaching and potential reorganization recommendations will be provided to LAs to address the allocation of tasks and responsibilities, coordination and control mechanisms, rules and procedures, and financial management. This would require specialized expertise that would be outside of the scope of FAs and would be procured separately. Once training on these issues is complete, a grant agreement can be entered (2.3.2). Based on the capacity assessment, it is estimated that 10-15 municipalities may be eligible for training under this activity with an additional 2-3 State agencies per State (total targeted training estimate 18-27).

Activity 2.3.2 Grant agreements entered, implemented, monitored and reviewed

Under this activity, SPC will sign a grant agreement with the applicants for the implementation of selected projects. The Programme will target issuing 30-40 grants across FSM. Sub-grants will be implemented and actively monitored by the ECU through the support of FAs. For Category B projects, an E&S specialist will be assigned by SPC to undertake E&S risk monitoring. A FA will be assigned to each project to undertake quarterly site-visits, support reporting processes, and flag any risks or implementation issues to the ECU.

Activity 2.3.3 Sub-projects evaluated, and lessons gathered

At the conclusion of implementation, all grant awards will be evaluated, and lessons gathered and codified into a catalogue format with tailored and gender-sensitive adaptation measures, completed lessons learned reports and design documents of projects located uploaded to project knowledge portal (1.3.1) and other regional portals/websites. As detailed in Section 6 Financial and progress reporting of the Operations Manual, the evaluation of sub-projects may be carried out either by the ECU or through as a service from a Facilitating Agent.

Lessons learned will be gathered through the reporting on the sub-grants by LAs and FAs. This will be supported and systematized by the ECU (reference MEL capabilities from finalized budget). Information will be disseminated through a range of climate change and other information platforms available including the

FSM climate change portal[194], the INFORM portal, the FSM DECEM Geoportal, the Pacific Data Hub[195]etc. This will be undertaken by the ECU in partnership and coordination with DECEM and FSM's NDA office.

This will incorporate the following gender-responsive sub-activity from the Gender Action Plan[196]:

- Activity 2.3.3 Implementation, monitoring, and evaluation of priority adaptation sub-grants to track gender elements

Activity 2.3.4 Continued resource mobilization

As expressed in letters of support, SPC will continue to engage with development partners throughout the project cycle to re-capitalize the RCGF fund. Engagement will include site visits, meetings with bi-lateral and multilateral donors. The mid-term review evaluation report will include a clear and costed action plan for the resource mobilization strategy (including GCF exit strategy), and the identification and confirmation of funding commitments. The plan will build on the initial results and lessons learned from the Programme facility. In the last two years of the project, SPC will prepare funding application requests with the aim for acceptance before or during the final year of implementation to ensure the smooth transition to new sources of climate finance.

The Micronesia Conservation Trust (MCT) and various sources of bilateral and other development assistance embassies are already offering provide funds for on-granting funds for in FSM, including for climate change adaptation and resilience-building measures at the local level. As part of the resource mobilization activities, discussions will be held with such partners to solicit the re-direction of a proportion of such funds into the RCGF – they might be able to commit to the facility. Once the RCGF has demonstrated its value in terms of delivering efficient and effective climate action, it is expected that crowding in of such sources of funds would be possible.

In addition, the resource mobilization activities will include assessing the extent to which regular government expenditure for resilience building activities might be re-directed into the RCGF. For example, this would allow for funds from the Department of Environment, Climate Change and Emergency Management to be funneled through the RCGF to achieve the objectives of the Department's annual workplans. Similar engagement with State-level governments will be undertaken.

EDA Facility Mechanism

The EDA programme will establish a Resilient Communities Grants Facility (RCGF) to support the implementation of adaptation solutions measures in vulnerable communities across all four FSM States including outer atolls through a suite of interventions that will support 30-40 sub-grants in the range of USD 75,000–1,000,000. An estimated breakdown of size of projects is provided in the Table 29 below:

Table 29: Indicative Breakdown of Sub-grants by grant size

Number of Projects	Sub-grant Range (USD per project)	Total Average Amount*	Municipal/State Implemented
15-20	75,000-250,000	2,550,000	Municipal
10-15	250,000-500,000	4,500,000	Municipal and State
5	500,000-1,000,000	3,750,000	State
Totals: 30-40	**75,000-1,000,000**	**12,000,000**	

*Taking average of the range x the average of the number of projects within the sub-grant range

194 (https://fsm-data.sprep.org/dataset/fsm-national-climate-change-data-portal
195 https://pacificdata.org/data/organization/fsm-data),
196 See Table 7 in Annex 4: GCF Gender Assessment and Action Plan GAAP

Thematic Areas and Indicative Interventions

The RCGF will support three specific thematic areas that have been identified by local communities and by the FSM government as areas requiring urgent resources to combat climate risks and impacts. As above, these interventions will be selected based off of past viability in projects and interventions in FSM and other Pacific communities. The tables below highlight where these activities have been deployed successfully in FSM and the broader Pacific. Specific modelling of individual activities will ultimately be driven by the context and needs of the LAs developing the sub-grants, and prescriptive modelling ex-ante weakens the EDA approach of building the capacity of LAs to identify and develop projects. This in mind, the EDA programme has dedicated capacity to support technical assessment and design of sub-grant activities (i.e. engineering design for solar water pumping, environmental management plans for mangrove restoration, etc.) which will be leveraged to ensure effective activity design in line with GCF requirements and needs of local communities. Further, the scale and complexity of the applications for these indicative activities are small given the envisioned sub-grants. This supports the ability for the programme to leverage existing applications/projects to demonstrate technical feasibility, while still preserving the EDA approach and ultimately building out the specifics within the individual sub-grants. The indicative list of interventions for each thematic area will be refined by the governing bodies at the outset of the programme. Below is a discussion of the three thematic areas and their indicative activities.

1. **Climate-induced Disaster Risk Reduction and Coastal Protection:** Projects that fall within this thematic area will address the effects of coastal erosion, sea level rise, storm surges associated with typhoons and tropical storms as well as flooding and landslides due to extreme rainfall and storm events. Specifically, coastal ecosystems, like coral reefs, sea grass beds and mangroves, can help defend against wave action and storm surges, thus protecting coastal populations and infrastructure. Moreover, coastal ecosystems support numerous livelihood activities, particularly with regards to fishing and tourism. Grants provided under this theme might include development of climate-proofing infrastructure to address increased frequency and intensity of climate extremes; ecological infrastructure to serve as a buffer to extremes linked to projected climate change related impacts; or equipping municipalities with necessary supplies and storage facilities to respond to disaster (i.e. medicines, provisions, food storage lockers).

Theme 1: Climate-induced Disaster Risk Reduction and Coastal Protection		
DRR sub-grants: community-led, that can safeguard lives, livelihoods and infrastructure. Depending on the climate change projections for the area, such projects could prepare for extremes ranging from flash floods to typhons. **Coastal protection sub-grants:** ecological infrastructure can in some cases play a role in buffering extremes, and as such be incorporated as part of climate-proof small infrastructure projects. Such interventions will need to be linked to projected climate change related impacts on	***Indicative interventions*:** • Retrofitting existing buildings to climate-proof against increased storm incidents (e.g. cyclone proofing, solar panels, rainwater tanks) • Watershed reforestation for landslide protection and flooding control • Small-scale coastal infrastructure constructed that will reduce the risk of losses and damages caused by climate-induced disaster events (as appropriate, use of endemic species planting, wave breakers, man-made channels) • Restoration, rehabilitation or substitution of ecosystems relevant for adaptation (e.g. mangrove restoration, re-vegetation, sea-grass beds) • Equipping municipalities with necessary tools to respond to climate-induced disaster, including emergency plans, building shelter, medical and other supplies The above DRR indicative interventions align with the following GCF adaptation performance measurement indicators:[197] **Adaptation Indicator 1.1** Change in expected losses of lives and economic assets (USD) due to the impact of extreme climate-related disasters in the geographic area of the GCF intervention.	**Studies, projects and resources supporting feasibility of indicative interventions in FSM:** • **UNEP Asia Pacific Adaptation Technology Database** (Wetlands restoration/creation, mangrove restoration and regeneration, mangrove conservation and planting, sea grass improvement, coastal protection forest, cyclone shelters, etc.) • **UNDP PACC Interventions** (protective coastal structures, coastal vegetation, coastal resource management)

[197] GCF Mitigation and adaptation performance measurement framework.

communities being reduced or prevented as a result of healthy and functioning ecosystems.	**Adaptation Indicator 3.1** Number and value of physical assets made more resilient to climate variability and change, considering human benefits. **Adaptation Indicator 4.1** Coverage/scale of ecosystems protected and strengthened in response to climate variability and change. **Adaptation Indicator 5.1** Institutional and regulatory systems that improve incentives for climate resilience and their effective implementation. **Adaptation Indicator 5.2** Number and level of effective coordination mechanisms. **Adaptation Indicator 6.2** Use of climate information products/services in decision-making in climate-sensitive sectors. **Adaptation Indicator 7.1** Use by vulnerable households, communities, businesses and public-sector services of Fund supported tools, instruments, strategies and activities to respond to climate change and variability. **Adaptation Indicator 8.1** Number of males and females made aware of climate threats and related appropriate responses.	• UNDP Enhancing Disaster and Climate Resilience in FSM through improved Disaster Preparedness and Infrastructure (pg. 7-10 of project document - disaster risk planning for municipalities, etc.) • Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM (pg.50-61 of project document - coastal resource management, disaster risk outreach, etc.).

2. **Food Security**[198]: Projects that fall within this thematic area will address the management of cropland, livestock, forests and fisheries that aim to support food security under the new realities of climate change through sustainable and equitable transitions for agricultural systems and livelihoods as well as access to markets and value chains. Specifically, to target increased productivity (i.e., produce more food and boost local incomes) and enhanced ability of communities to adapt to climate change and weather extremes. In FSM, it is important to also support benefits to coastal ecosystem (e.g., by reducing sediment into the coastal zone through taro swamps, reducing pressure on wild-caught fisheries, reducing pollutants from fertilizers).

Theme 2: Food Security		
Food security sub-grants: interventions that address climate change–induced extreme weather events and sea-level as well as the projected impacts of warmer atmospheric and open water temperatures, erratic rainfall intensity and distribution, more frequent and more intense tropical cyclones etc and their effect on land, soil and water resources, agricultural production systems (including those of livestock and fisheries),	***Indicative interventions*:** • Development and use of climate-resilient crop species and varieties (resilient to drought, waterlogging, saltwater, pests), including techniques for their consistent supply (germplasm collections, nurseries) • Farming and land use techniques facilitating soil and water conservation (e.g. mulching, organic farming, mixed cropping, drainage) • Small scale aquaculture • Fisheries and coastal resources management • Livestock management • Watershed management • Establishment of agroforestry demonstration sites integrated with livestock • Building value chains for crops, fisheries, and livestock	**Studies, projects and resources supporting feasibility of indicative interventions in FSM:** • UNDP PACC Interventions (enhanced land-use and agriculture techniques, enhanced aquaculture techniques, etc.) • Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM (pg. 50-61 of project document - Sustainable fisheries development, etc.)**.**

[198] The FSM government has also submitted a SAP on Food Security, which aims to establish an enabling systems-wide approach focused on the agriculture sector across FSM. The updated and de-scaled data, mapping, and climate information from the SAP can be utilized by grantees under the grant facility to provide better targeted interventions across all three thematic areas. Through the RGCF communities can request food security funding for resources needed to address areas that are outside of the scope of the SAP (fisheries, livestock etc.) including higher risk interventions.

infrastructure, and social (community) systems.	The above food security indicative interventions align with the following GCF adaptation performance measurement indicators: **Adaptation Indicator 1.2** Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.). **Adaptation Indicator 1.3** Number of Fund-funded projects/programmes that supports effective adaptation to fish stock migration and depletion due to climate change. **Adaptation Indicator 2.2** Number of food secure households (in areas/periods at risk of climate change impacts). **Adaptation Indicator 5.1** Institutional and regulatory systems that improve incentives for climate resilience and their effective implementation. **Adaptation Indicator 5.2** Number and level of effective coordination mechanisms. **Adaptation Indicator 6.2** Use of climate information products/services in decision-making in climate-sensitive sectors. **Adaptation Indicator 7.1** Use by vulnerable households, communities, businesses and public-sector services of Fund supported tools, instruments, strategies and activities to respond to climate change and variability. **Adaptation Indicator 8.1** Number of males and females made aware of climate threats and related appropriate responses.	• **UNEP Asia Pacific Adaptation Technology Database** (Agroforestry, tree plantation for reduced land erosion, coastal fisheries, forest/fish/fruit strategies, crop substitution, integrated soil nutrient management, etc.) • **USAID Climate Resilient Adaptation and Mainstreaming** (soil management, livestock farming, agricultural livelihood development, water harvesting, sustainable water use) • **USAID Climate Change Adaptation and Income Diversification in Pohnpei, Federated States of Micronesia** (fishery management, small scale aquaculture, protected areas, etc.) • **USAID Foundation for Rural Integrated Enterprises and Development (FRIEND)** (agriculture value chains, market development)

3. **Water Security**: Projects that fall within this thematic area will increase the resilience of water resources in the FSM and will target climate-induced disturbances in water supply and security. Planned interventions could include improving household and community rainwater harvesting and storage structures; securing groundwater resources from seawater intrusion; rehabilitating water catchments; and installing solar-powered water pumps.

Theme 3: Water Security		
Water security sub-grants: interventions that address increased impacts of droughts in Yap and Chuuk; shortages in freshwater supplies, especially in the outer islands; increased incidence of lowland flooding and seawater inundation, especially in the steep topographies of Chuuk, Pohnpei and Kosrae.	***Indicative interventions*:** • Water infrastructure (e.g. water tanks, solar water pumps) • Procurement and distribution of rainwater collection tanks • Capturing and storage of rain and groundwater resources (individual household and community storage capacities) • Reducing leakage of reticulated systems and water storage facilities • Water saving (e.g. introducing compost toilets, demand management through awareness raising) • Water quality enhancement and assurance • Solar water purifiers	**Studies, projects and resources supporting feasibility of indicative interventions in FSM:** • **Adaptation Fund - Enhancing the Climate Resilience of vulnerable island communities in Federated States of Micronesia** (pg. 37-73 of project document - watershed management, water security measures including water harvesting and storage systems, water conservation, etc.)

	The above water security indicative interventions align with the following GCF adaptation performance measurement indicators: **Adaptation Indicator 2.3** Number of males and females with year-round access to reliable and safe water supply despite climate shocks and stresses. **Adaptation Indicator 5.1** Institutional and regulatory systems that improve incentives for climate resilience and their effective implementation. **Adaptation Indicator 5.2** Number and level of effective coordination mechanisms. **Adaptation Indicator 6.2** Use of climate information products/services in decision-making in climate-sensitive sectors. **Adaptation Indicator 7.1** Use by vulnerable households, communities, businesses and public-sector services of Fund supported tools, instruments, strategies and activities to respond to climate change and variability. **Adaptation Indicator 8.1** Number of males and females made aware of climate threats and related appropriate responses.	• **UNDP Enhancing Disaster and Climate Resilience in FSM through improved Disaster Preparedness and Infrastructure** (pg. 7-10 of project document - emergency management of water supplies, water security) • **Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM** (pg. 50-61 of project document -emergency water management, etc.)**.** • **UNDP PACC Interventions** (rainwater capture and storage, water saving measures, watershed management, water purifiers) • **UNEP Asia Pacific Adaptation Technology Database** (rainwater harvesting, solar disinfection, solar water pumps, etc.) • **IFAD Outer Island Food and Water Project** (pg. 47-57 of project document - rainwater harvesting, solar pumping etc,) • Annex 5 has additional overview details for rainwater harvesting and solar water pumping activities.

EDA Facility Structure

Through the EDA Coordination Unit (ECU), an EOI will be issued initially nine months after the start of implementation and then four additional rounds will be issued every six months thereafter to determine the level of technical and capacity support needed by each of the applicants. The EOI will be open to any municipality across FSM as well as State governments. As outlined in the beneficiary assessment, the majority of the municipalities across FSM will not have the capacity to implement a small grant on their own (even following capacity building efforts) and, as such, will have access to grants through the State agencies or through support from SPC.

To streamline the process, the EOI will be issued to all eligible State agencies for grant amounts ranging from USD 75,000–1,000,000. The first EOI will be issued approximately nine months after the EDA programme implementation. Prior to the issuing of the EOI, Output 1.1. and 1.2 of Component 1 will be completed (see Programme Interventions Section above). These two outputs will support LAs to identify and prioritize adaptation solutions and to select a sub-grant for an EOI submission. The prioritization and selection process will include extensive stakeholder consultations and input. The EOI submission will require proof of consultations and lists of those consulted.

Activities under these two outputs will also provide support to State agencies to work with smaller, less resourced municipalities to develop EOIs on behalf of one or more municipalities for larger grant amounts. State agencies may apply directly to the EDA Facility but must demonstrate support from municipalities in their jurisdiction for the sub-grant.

The RCGF proposed process is divided into four stages as seen in Figure ***27*** below.

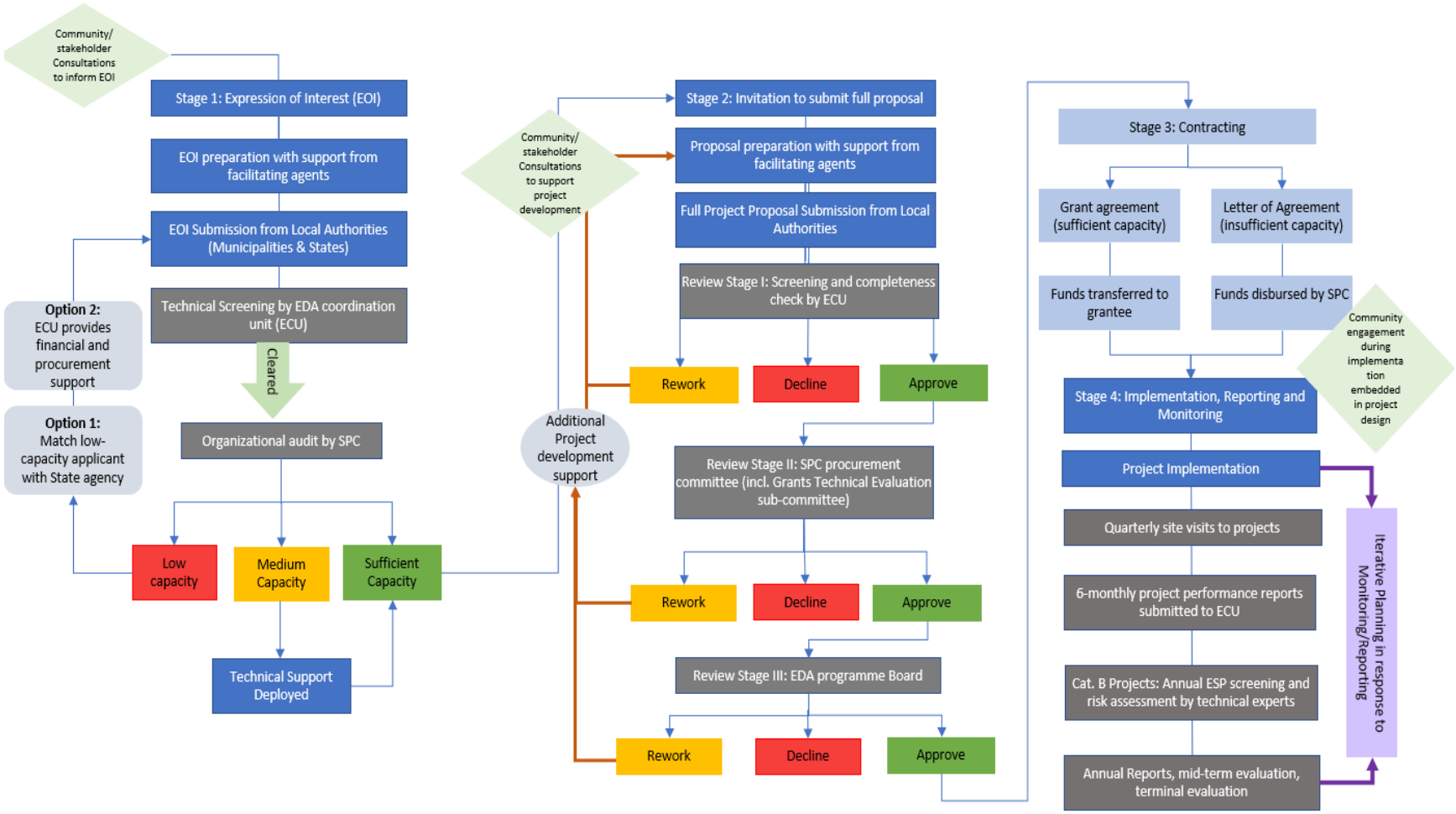


Figure 27: RCGF EDA Facility

Pre-Stage 1: Initial Community Involvement

Prior to submitting an EOI, extensive community engagement and involvement in the selection and prioritization process will take place. All EOI's must demonstrate engagement and input from community stakeholders. Under Output 1.1 and 1.2, support for prioritizing adaptation solutions will include training (delivered by FAs) for how to conduct and document stakeholder consultations.

State agencies that submit an EOI must demonstrate that their sub-grants will address climate risks faced by municipalities and that interventions are endorsed by local communities.

Stage 1: Expression of Interest

As described above, in this first stage, prospective grant recipients will be required to submit a short EOI outlining their proposed adaptation intervention (see the Operations Manual for the EOI form).

Central to the approach will be the processes to empower LAs to identify best practice adaptation solutions themselves through training and site-visits included under Outputs 1.1 and 1.2. Through these trainings, briefing sessions on the grant process, the EOI, and the full proposal development will be provided by FAs.

The ECU will issue a call for EOIs to all municipalities and State agencies. The call will be supported by briefing sessions that will be convened through the trainings under Component 1. These sessions will provide an opportunity for potential recipients, including members of municipal communities, to learn more about the RCGF opportunity and to obtain initial support to develop appropriate local level responses and input around their project ideas. These sessions will form a unique opportunity to integrate scientific and local knowledge, and to develop a base of priority interventions from which sub-grants can be identified and developed.

EOI's will be screened by the ECU to determine project eligibility, alignment with GCF criteria, level of E&S risk and ensure local community engagement has taken place. For State agencies, an endorsement letter from one or more municipalities must be included as part of the EOI. If a project falls within the appropriate thematic areas, aligns with the GCF investment criteria and there is no duplication with other ongoing support in FSM, the EOI will be cleared and an organizational audit of the applicant launched.

If the EOI is not cleared, feedback will be provided as to why the EOI was not cleared. The applicant will be supported by a facilitating agent to support the development of another more suitable EOI or to refine the EOI to meet the eligibility criteria for submission into a later EOI call.

The ECU, with support from SPC's Procurement Committee, will conduct an organizational audit for applicants whose EOI has been cleared for full proposal development (an external consultant or firm may be procured to undertake the organizational audit if needed). The audit will determine whether the applicant has the capacity (financial and organizational) to implement the proposed project. SPC's current capacity assessment is included as part of the operations manual. Upon completion of the audit, three options are available:

(i) If it is determined that the applicant has sufficient capacity, the applicant will be invited to submit a full proposal (see the Operations Manual for the application form);

(ii) If it is determined that the applicant has minor organizational, managerial or financial gaps (medium capacity), then technical assistance will be offered to improve capacity along those lines (Activity 2.2.3); and

(iii) If it is determined through the audit that the applicant has severe gaps (low capacity), the ECU will suggest two options for submission:

a. Option 1. The LA (in this case usually a municipality) would be matched with a higher capacity LA (usually a State agency) to collaborate on the sub-grant and resubmit the EOI with the higher capacity LA as the lead agency.

b. Option 2. The ECU would provide financial and procurement support to the implementation of the sub-grant, in collaboration with the municipality.

Under both options, the LA will still be provided with training on organizational, managerial and financial gaps by specialists (procured to provided managerial and financial training). Additionally, the LA will be able to choose its preferred option.

The call for EOIs will be issued on a six-monthly basis until such time as all project funds are allocated. It is envisaged that at least five total calls will be made. The first will be after 9 months of implementation, and the others every six months until month 33 of implementation.

Stage 2: Invitation to submit full proposal

Once an applicant has cleared its organizational audit, the applicant will be invited to develop a full proposal. As part of this process, applicants will be offered support for project preparation (Activity 2.2.5). Consultants and NGOs (FAs) trained under Activity 1.2.1 will be deployed to support applicants in their preparation of full proposals. Specialist E&S safeguard and gender expertise has been provided for in the budget and will be available if necessary.

Prospective applicants will submit detailed project proposals to the ECU within 3-4 weeks following trainings (Activity 2.2.4). For State agencies, a letter of endorsement from the municipality(ies) that will be supported through the grant will be required. The funding proposal should provide information on how municipality(ies) will benefit from the sub-grant and detail how knowledge/skill transfer will occur. The ECU will note the submission of the documentation, acknowledge receipt, and review it for completeness. Particular attention will be paid to whether stakeholder input and engagement has been continued through the full proposal development (from the EOI stage).

Once pre-screening and completeness check has been conducted by the ECU, the proposals will be reviewed by SPC's Grants Technical Evaluation sub-committee (using criteria provided in the Operations Manual). The Grants Technical Evaluation sub-committee will include an E&S safeguard and gender and social inclusion expert, who will provide a specific screening on whether the proposal appropriately identified E&S risks and sufficiently incorporates gender elements.

Reviewers will evaluate detailed project proposals against the agreed checklist (which includes the GCF investment criteria). The specific review process/criteria for E&S screening and review of the sub-grants is included in the Operations Manual. An initial sub-grant gender assessment is included as part of the Gender Analysis and Action Plan (Annex 8 of the funding proposal). The proposals will then be reviewed by SPC's Procurement Committee which will look at the advisory report from the Grants Technical Evaluation sub-committee and the organizational audit.

The ECU will then compile the reviewers' comments into an integrated review, and make recommendations to the EPB as whether to approve, not to approve or call for additional work on the detailed project proposal. All reviews will be made available to proponents.

The EPB will then decide whether to approve the full proposal, reject it, or refer it back for further modifications. The record of the EPB meeting will capture the EPB's recommendations and the reasoning behind the decision. In the cases of conditional approval, the meeting record would detail the conditions that need to be met for approval.

The ECU will notify prospective applicants of the recommendations of the EPB. Applications that are approved will enter into the contracting stage. Projects that are referred back to proponents for further modification will have an opportunity to be resubmitted during the next call for proposals.

Stage 3: Contracting

Once approved by the EPB, the ECU will prepare and enter into contract with the LA.

The legal agreements between SPC and the grant recipient will be negotiated and finalized based on the nature of the activity and of the anticipated funding flows. This process will include internal processing as well as compliance and additional due diligence screening as needed. The agreements will contain all relevant details regarding the terms and conditions of the RCGF financing.

Contracts will specify the annual project work plan and associated budgets, deliverables and disbursement schedules, in line with SPC's Procurement and Grant Policies. They will also specify monitoring, evaluation and reporting requirements. Baselines will need to be established within the first three months of grant sub-grant inception.

This stage will conclude with the signing of legal agreements between SPC and the grant recipient.

Stage 4: Implementation, monitoring and reporting

Grant recipients will be expected to implement their sub-grants according to the schedules and deliverables that are set out in their contracts. A milestone approach to sub-grant awards and payment schedules will be utilized and is discussed further in the operations manual. FAs will be assigned to each sub-grant (the NGOs and national consultants trained under activity 1.2.1) and will conduct a site-visit once each quarter, and support the reporting and monitoring processes. The FAs will be responsible for advising the ECU on project progress, making recommendations to the ECU for the disbursement of funds and in the event of any requests for deviations from the agreed project plan. Particular attention will be given to the monitoring and mitigation of any risks identified through Stages 1-3, and of any unanticipated environmental and social risks that may arise during implementation.

Every six months, project performance reports will be submitted by the FAs to the ECU that summarize project progress and risk management related activities. For Category B projects, every six months an ESP screening and risk assessment by an Environmental and Social Safeguard Expert will be conducted. Templates for reporting will be developed during the first year of project implementation.

Annual financial and narrative reports will be submitted by the grant recipient with support as needed from the Facilitating Agent. The ECU will review annual performance reports, provide recommendations, and discuss any corrective action needed. The FAs will be responsible for working with grant recipients to ensure that these recommendations are integrated into the relevant project risk management plans, and into future implementation activities. The FAs will also be responsible for monitoring of the iterative management actions that arise from the recommendations of the ECU.

Where risks are detected, the ECU may propose the redirection of project funds to risk management activities, or the withholding of the next tranche of payment until satisfactory risk management actions are determined and agreed. In this regard, it is noted that every effort will be made to support grant recipients to positively respond to and manage unanticipated risks. The ECU will undertake the necessary internal procedures to validate and complete the contracted payments.

Throughout the implementation of the EDA programme, opportunities will be created for grant recipients to meet and share lessons and experiences with each other, and with other local and national stakeholders (Output 1.3).

At project closure, all grant recipients will be expected to submit final financial and narrative reports which will need to include a project sustainability plan.

Sub-Grant Intake Form and Review Criteria

As part of the RCGF mechanism, working drafts of the relevant forms and review criteria have been developed (see the Operations Manual). These however will need to be endorsed by the EPB as the project's governance mechanism during the first several months of programme implementation (Activity 2.1.1). Input from the Grants Technical Evaluation sub-committee will need to be incorporated and the final approval of the entire mechanism including intake form and review criteria will be taken by the EPB. Additional adjustments could be considered following the stakeholder engagement and stakeholder capacity building efforts as part of Component 1.

12. Implementation Arrangements

Overall EDA Programme

SPC's Climate Change and Environmental Sustainability programme, Manager of EDA Facility: The EDA programme will be managed by SPC's Climate Change and Environmental Sustainability (CCES) Division housed within SPC's Headquarters in Noumea, through its Climate Finance Unit, which is also SPC's GCF focal point. The Climate Finance Unit will be responsible for the overall programme management, with a GCF Programme Manager, GCF Programme Officer and GCF Finance and Administrative Assistant in charge of overall reporting to the GCF, procurement, finance, and MEL. SPC will sign a letter of agreement with FSM covering the entire EDA programme duration and stating each partner's responsibility.

EDA Programme Coordination Unit: A dedicated ECU will be hosted at SPC's MRO in FSM, with a Programme Coordinator, Programme Administrative Assistant, Finance and Procurement Officer and supported by other part-time staff including a Grants Officer, MEL expert, gender experts and a communication expert. The ECU will run the day-to-day operations of the EDA programme and will manage the grant facility (more details below).

FSM Department of Finance and Administration: The NDA acts as the official GCF focal point in-country. The agreement signed with the FSM government will cover the NDA's role in the facility, including as appropriate: local recruitment of one staff at the NDA office to support the States GCF focal points and to serve as liaison between LAs, the NDA and SPC; domestic travel; office equipment (laptop etc.). The NDA works alongside SPC's CCES and ECU to establish the EDA programme's governing bodies and will also assist in the supervision of sub-grant design and implementation.

State GCF Focal Points: Each of FSM's four States has a GCF focal point. The State GCF Focal Points will support the ECU and NDA to disseminate information about the programme to local government officials and to support the local organizing of meetings, trainings and workshops. Additionally, the Focal Points would be part of the EPB.

EDA Programme Board: The EPB will be a national body chaired by the NDA and responsible for taking corrective action as needed to ensure the EDA programme achieves the desired results. In case consensus cannot be reached within the Board, the SPC Representative (or their designate) will mediate to find consensus and, if this cannot be found, will take the final decision to ensure project implementation is not unduly delayed. The EPB will meet once a year with the possibility to hold *ad hoc* or virtual meetings for final sub-grant approvals or other issues, as needed.

Specific responsibilities of the EPB include:

- Provide overall guidance and direction to the programme, ensuring it remains within any specified constraints;
- Address programme issues as raised by the programme coordinator;
- Provide guidance on new project risks, and agree on possible mitigation and management actions to address specific risks;
- Advise on major and minor amendments to the project within the parameters set by SPC-CCES;
- Ensure coordination between various donor and government-funded projects and programmes;
- Ensure coordination with various government agencies and their participation in programme activities;

- Track and monitor co-financing for this project;
- Review the programme progress, assess performance, and appraise the Annual Work Plan for the following year;
- Provide direction and recommendations to ensure that the agreed deliverables are produced satisfactorily according to plans;
- Address programme-level grievances;
- Approve the project Inception Report, Mid-term Review and Terminal Evaluation reports and corresponding management responses;
- Review the final project report package during an end-of-project review meeting to discuss lesson learned and opportunities for scaling up

The Board members will include representatives from the following groups:

- NDA (Chair)
- State GCF Focal Points (for the four states)
- Representative from national level government (climate expert on the three thematic areas from the Department of Environment, Climate Change and Emergency Management (DECEM))
- Representative from FSM's Women's Council

SPC-CCES will serve in the quality assurance role and will support the EPB and ECU by carrying out objective and independent programme oversight and monitoring functions. This role ensures appropriate project management milestones are managed and completed. The programme assurance role is totally independent of the programme coordination function. Figure 28 below presents an overview of the programme implementation arrangements.

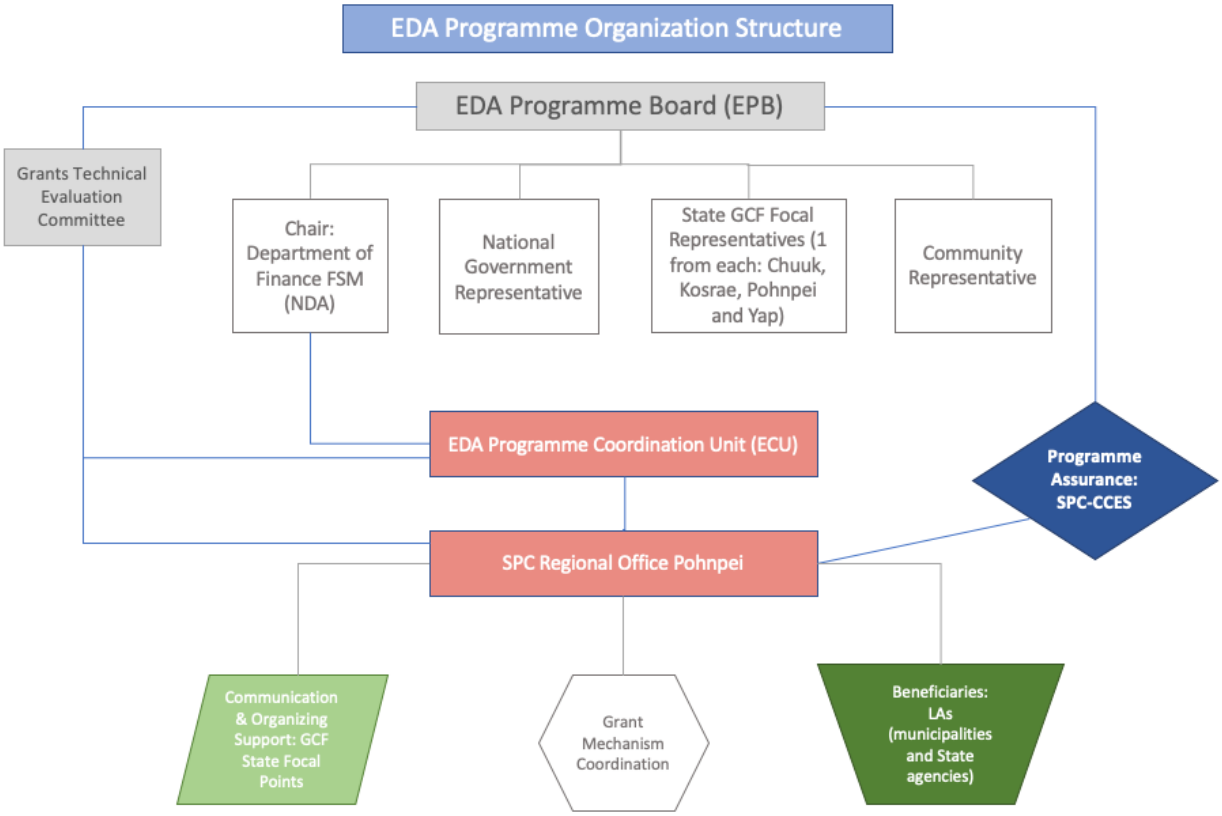


Figure 28: Overall EDA Programme Organization Structure

EDA Facility Mechanism

In addition to the overall programme structure, the grant facility (Component 2) will have a separate implementation structure to review, screen and approve sub-grant proposals. The proposed structure will include the ECU, the EPB, SPC's Procurement Committee (which includes a Grants Technical Evaluation sub-committee), and FAs.

EDA Coordination Unit: The ECU will be responsible for putting out the call for EOIs to initiate proposal submissions to the RCGF. EOI's will be screened by the ECU to determine project eligibility. If a project falls within the appropriate thematic areas and there is no duplication with other ongoing support in FSM, the EOI will be cleared and an organizational audit of the applicant launched.

The ECU, with support from an external consultant or firm may be procured to undertake the organizational audit, if needed. The audit will determine whether the applicant has the capacity (financial and organizational) to implement the proposed project. See Figure 29 below for the ECU's role in the EOI process.

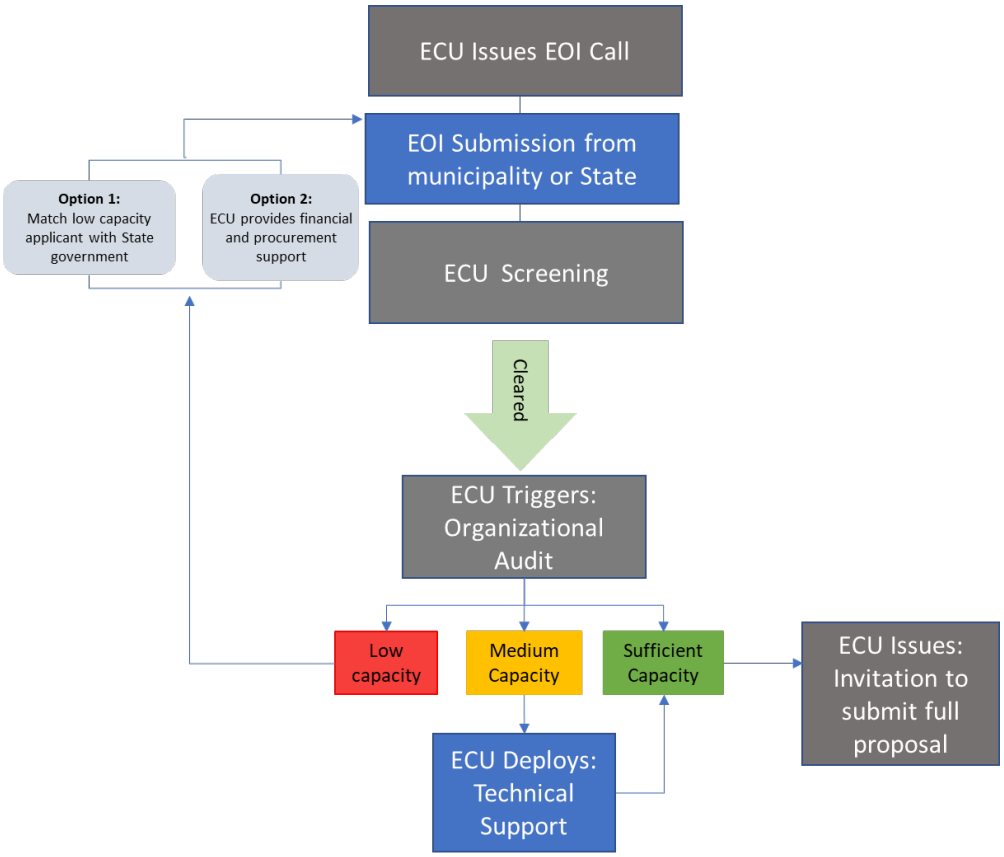


Figure 29: ECU Role EOI Process

EDA Programme Board: The EPB will be chaired by the NDA and will include State-level representation as well as national departments that reflect the different themes the RCGF will fund (disaster risk and costal protection, food security and water security). Based on stakeholder consultations, the dedicated body would be composed of a climate expert from DECEM, the NDA, State GCF focal points, and a representative from FSM's Women's Council.

Grants Technical Evaluation sub-committee (under SPC Procurement Committee): An independent technical sub-committee will be assembled of individual experts through a competitive bidding process. At least 5 experts will be appointed to the sub-committee: it will consist of one external expert from each of the thematic areas, an E&S and gender expert, a national expert with an understanding of the local community context in FSM to ensure the voice of vulnerable communities will be heard, one representative from the ECU and one representative from the SPC Procurement team. The Committee will undertake a full technical and financial review of full proposals and provide recommendations to the SPC Procurement Committee to approve, reject or modify. The final decision will be made by the EPB.

SPC Procurement Committee: The SPC Procurement Committee (PC) is composed of an SPC Division Director (Chair), a Procurement Team representative who will provide secretariat support to the PC, a representative from the ECU who will act as the Submitting Officer and provide any clarification or information relevant to the procurement action, and two other representatives from other SPC divisions. The PC members are responsible for carrying out evaluations of proposals, ensuring that SPC's procurement policy is duly followed (especially the obligations to act ethically and with due diligence), ensuring that a consistent and equitable method has been used for evaluation and making recommendations if necessary.

Facilitating Agents: A cohort of FAs will be selected through a call for tenders. FAs will be national organizations (NGOs/CSOs) or individual national consultants. FAs will be trained through Component 1 to provide project development support as well as project implementation support once projects are approved. Once a project is approved, FAs will be assigned to each project and will conduct a site-visit once each quarter, and support the reporting and monitoring processes.

Figure 30 below outlines the ECU, EPB, Grants Technical Evaluation sub-committee, and FAs decision roles in the full proposal process.

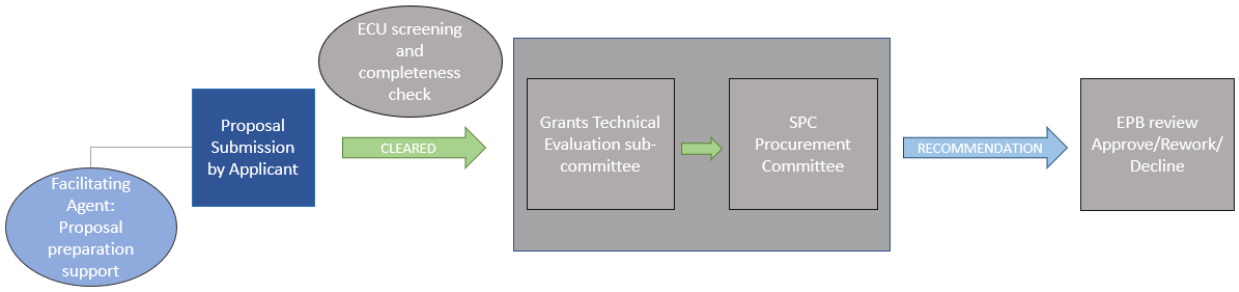


Figure 30: RCGF Governing Bodies Roles

The entire EDA Facility will have a grievance mechanism that is aligned with SPC's policies and frameworks (https://www.spc.int/accountability). Further details of the specific grievance mechanism process for E&S issues are outlined in Annex 6 of the funding proposal. Additional detail for processes is included in the Operations Manual for the EDA programme.

13. GCF Investment Performance

This section explores the alignment of the EDA programme, its sub-grants, and governing mechanisms with the overall investment criteria for the GCF. The actual final impact and alignment with GCF investment criteria will be contingent on the proposed sub-grants from the LAs, but every sub-grant will have to provide details specific to each investment criteria (see the Operations Manual). Likewise, the review process (see the Operations Manual) will systematically support and control this alignment and all of the capacity building trainings will include focused training on developing projects that support and advance results aligned with the GCF investment criteria.

The total proposed GCF investment is USD 16,591,556. The allocation of this amount to the various components of the programme is detailed in the funding proposal.

Impact Potential

The EDA programme contributes to increasing the resilience of vulnerable people and communities, infrastructure and the built environment as well as ecosystems at LA levels. It does so by empowering municipalities and States in FSM to foster climate change adaptation at their operating scale, and by addressing top-priority vulnerabilities through local projects implementation.

Through Component 1, the EDA programme will support three main outputs to strengthen the capacity of local government agencies across FSM to cope with climate-induced disaster as well as food and water security issues. The first will support LAs' understanding of climate change adaptation and support the prioritization of adaptation actions. The second will provide direct technical support on how to prepare bankable climate change adaptation projects targeting the EDA programme's Grant Facility to improve access to climate financing. The third will create a knowledge management network for cooperation and innovation sharing among different LAs. Component 1 will

target all 75 municipalities (including council of chiefs and other equivalents for smaller municipalities) through the capacity building trainings and knowledge management.

Component 2 then creates a grant facility that provides direct funding for local climate change priority projects in three key sectors: disaster risk reduction and coastal protection, food security, and water security. Through the EDA Facility, a select number of municipalities (based on the organizational audits and initial EOI) will then develop their own projects following capacity building and technical support for project development and project management, and the remaining municipalities with more limited capacity will be supported by State led projects.

Both components target all 75 municipalities of FSM, which encompass the entire FSM population. The capacity assessments concluded that over 19 municipalities do not have formal registrations as separate governance bodies (on Yap). However, the EDA facility has been structured to allow for any of the municipalities, even those without formal governance structures to benefit through support from State agencies or SPC directly. As such, the programme will aim to include representatives from every municipality to engage in capacity support under component 1, while realistically targeting 80% of the municipalities as direct beneficiaries of Component 2. The municipalities with the highest capacity to undertake sub-grants correspond to the most populated ones with a total of around 95,000 inhabitants and a resident population ranging from around 400 inhabitants to around 14,000 inhabitants for each municipality (see Table 3 and Table 4 above). Around 54,300 inhabitants (that is around 47% of FSM population), including at least 50% women, would then be benefiting directly from priority projects implemented as part of Component 2. Some communities may also be indirect beneficiaries from other sub-grants as well (i.e. downstream/integrated effects from watershed management, market development with spillover effects, DRR activities etc.).

The envisioned sub-grants under Component 2 will align with a number of GCF impact indicators as highlighted in Table 30 below.[199]

Table 30: Sub-Grant Alignment with GCF Impact Indicators

Disaster Risk Reduction	Water Security	Food Security
A 1.1 Change in expected losses of lives and economic assets (USD) due to the impact of extreme climate-related disasters in the geographic area of the GCF intervention	A 1.1 Change in expected losses of lives and economic assets (USD) due to the impact of extreme climate-related disasters in the geographic area of the GCF intervention	A 1.1 Change in expected losses of lives and economic assets (USD) due to the impact of extreme climate-related disasters in the geographic area of the GCF intervention
A 3.1 Number and value of physical assets made more resilient to climate variability and change, considering human benefits (reported where applicable)	A 1.2 Number of males and females benefiting from the adoption of diversified, climate-resilient livelihood options (including fisheries, agriculture, tourism, etc.)	A 1.2 Number of males and females benefiting from the adoption of diversified, climate-resilient livelihood options (including fisheries, agriculture, tourism, etc.)
A 4.1 Coverage/scale of ecosystems protected and strengthened in response to climate variability and change	A 2.3 Number of males and females with year-round access to reliable and safe water supply despite climate shocks and stresses	A 1.3 Number of Fund-funded projects/programmes that supports effective adaptation to fish stock migration and depletion due to climate change
A 4.2 Value (USD) of ecosystem services generated or protected in response to climate change	A 7.1 Use by vulnerable households, communities, businesses and public-sector services of Fund supported tools,	A 2.2 Number of food-secure households (in areas/periods at risk of climate change impacts)

[199] While the project may support solar pumping and livestock management, potential GHG reductions from these activities are marginal because baseline emissions are very small (e.g. most communities use surface-/-rainwater with zero emissions.

A 7.1 Use by vulnerable households, communities, businesses and public-sector services of Fund supported tools, instruments, strategies and activities to respond to climate change and variability A 8.1: Number of males and females made aware of climate threats and related appropriate responses	instruments, strategies and activities to respond to climate change and variability A 8.1: Number of males and females made aware of climate threats and related appropriate responses	A 3.1 Number and value of physical assets made more resilient to climate variability and change, considering human benefits (reported where applicable) A 7.1 Use by vulnerable households, communities, businesses and public-sector services of Fund supported tools, instruments, strategies and activities to respond to climate change and variability A 8.1: Number of males and females made aware of climate threats and related appropriate responses
Key Potential Activities (from above): Retrofitting existing buildings, watershed reforestation for landslide protection and flooding control, small-scale coastal infrastructure, restoration, rehabilitation or substitution of ecosystems relevant for adaptation (e.g. mangrove restoration, re-vegetation, sea-grass beds), and equipping municipalities with necessary tools to respond to climate-induced disaster, including emergency plans, building shelter, medical and other supplies.	**Key Potential Activities (from above):** Water infrastructure (e.g. water tanks, solar water pumps), procurement and distribution of rain water collection tanks, capturing and storage of rain and groundwater resources, reducing leakage of reticulated systems and water storage facilities, water saving, water quality enhancement and assurance, and solar water purifiers	**Key Potential Activities:** Development and use of climate-resilient crop species and varieties, farming and land use techniques facilitating soil and water conservation, small scale aquaculture, fisheries and livestock management, watershed management, coastal resources management, building value chains for crops, fisheries, and livestock, establishment of agroforestry demonstration sites integrated with livestock

Rationale for the calculation of beneficiaries

As the exact nature and scale of the sub-grants to be supported by the EDA Grant Facility is unknown, the estimates for the number of direct beneficiaries to be targeted by the Programme were built on the assumptions below. As a whole, it is anticipated that the Programme will indirectly benefit 80% of FSM LAs through the increased capacity of Local Authorities to effectively plan, develop and implement community-led adaptation measures. All calculations were made based on a population of 115,021 comprising 56,541 (49.2%) women and 58,480 (50.8%) men[200]

For food security, the share of the total population depending on agricultural occupations for their livelihoods was derived using the share unpaid agricultural workers from the 2016 IAC. Adaptation measures would aim to address impacts related to increased temperatures, rainfall variability and sea level rise. Based on this assumption, the number of potential beneficiaries for food security adaptation interventions is **19,819 people** (of which 10,077 males and 9,742 females)

[200] Using World Bank's World Development Indicators data for 2020 (https://databank.worldbank.org/source/world-development-indicators/).

For water security, beneficiaries' estimates were derived using the share of surveyed households who had reported drought as the main barrier to agricultural production. Based on this assumption, the potential number of direct beneficiaries for water security adaptation interventions is **20,679 people** (of which 10,514 males and 10,165 females).

For DRR and coastal protection adaptation measures, aiming at addressing impacts from sea-level rise and extreme climate events, direct beneficiaries were derived by considering the share of the total FSM population living within 180 meters[201] from the shoreline. In line with the share of beneficiaries compared to the total FSM population to be targeted under the water security and food security interventions, and assuming that 20% of people living within 180 meters of the shoreline will benefit from DRR interventions, the potential number of direct beneficiaries for DRR interventions is **13,803 people** (of which 7,018 males and 6,785 females).

The breakdown of the calculations for beneficiaries per adaptation area is provided in Table 31 below.

Table 31 Rationale for the calculation of beneficiaries

EDA Facility Sectors	Climate drivers addressed	Rationale	Number of beneficiaries	Sources
Food security	• Increases in temperature will alter crop and livestock cycles and productivity • Rainfall variability will cause changes to some crop cycles and potentially stress for livestock • Increased sea level rise, both over the long term, leading to **saltwater intrusion**	Share of population depending on agricultural occupations for their livelihoods derived using the share of unpaid agricultural workers[202] = 19,819	Potential number of beneficiaries for food security adaptation interventions: 19,819 (17.2% of total population) Male = 10,077 Female = 9,742	Integrated Agricultural Census 2016 World Bank Data (World Development Indicators) 2020 (for male/female population share)

[201] 200 yards.

[202] These workers include, according to the IAC: managers, professionals, technicians, clerical support workers, service and sales workers, skilled agricultural forestry and fisheries workers, craft and related workers, plant and machine operators, elementary occupations.

EDA Facility Sectors	Climate drivers addressed	Rationale	Number of beneficiaries	Sources
Water security	• Increases in temperature will alter crop and livestock cycles and productivity and • Rainfall variability will cause changes to some crop cycles and potentially stress for livestock, causing **drought**	Share of surveyed households reporting drought as the main barrier to agricultural production = 20% (calculated using average for all four states)[203]. Number of households surveyed in the IAC 2016 = 16,677 Number of households reporting drought = 3,335 Average household size = 6.2 (weighted total) Number of people affected by drought and water scarcity for agricultural production = 20,679	Potential number of beneficiaries for water security adaptation interventions: 20,679 (18.0% of total population) Male = 10,514 Female = 10,165	Integrated Agricultural Census 2016 World Bank Data (World Development Indicators) 2020 (for male/female population share)
Disaster Risk Reduction	• Increased sea level rise, both over the long term, and through acute king tide events, leading to **loss and damage**	Share of total FSM population living within 200 yards of the shoreline = 60% Total FSM population (2020) = 115,021 115,021 x 60% = 69,012 people living within 200 yards of the shoreline In line with the share of beneficiaries to be targeted by interventions under the food security and water security thematic area, assuming that 20% of people living within 180 meters of the shoreline will benefit from DRR interventions = 13,803	Potential number of beneficiaries for DRR adaptation interventions = 13,803 (12.0% of total population) Male = 7,018 Female = 6,785	World Bank Data (World Development Indicators) 2020 (for total population and male/female population share)

Disaster Risk Reduction	Food security	Water security	Direct beneficiaries	Share of total population	Indirect beneficiaries	Share of total population
13,803	19,818	20,679	54,301	47.2%	92,016	80%

[203] Share of households reporting drought as the main barrier to agricultural production: Yap (45%), Chuuk (21%), Pohnpei (9%), Kosrae (3%).

Paradigm shift

By addressing the main barriers that hamper LAs' action in FSM (lack of capacity and financial resources for climate change adaptation), supporting the development of climate change projects tailored to local priorities and needs, and creating a proven bankable track record for future project development, the EDA programme goes beyond one-off project investments and creates an enabling environment for LAs and sustained climate action. Ultimately, the programme will work to shift the status quo from a pathway of climate vulnerability, elevated health risks and limited socioeconomic development for vulnerable communities in FSM to one of improved food/water security, enhanced disaster risk reduction and recovery, and improved socioeconomic development by building local capacity to respond to climate change. Within the GCF paradigm shift framework, the project supports the following:

- **Innovation:** This project represents only the 3rd Enhanced Direct Access programme to be developed within the GCF framework, and as such it can play a critical role in developing and supporting innovative pathways and mechanisms for engaging vulnerable communities and co-developing priority projects for climate change. Further FSM's complex and dispersed structure will drive the programme and sub-grants to develop new innovative approaches for coordination and knowledge/innovation sharing.
- **Potential for Scale-up and Replication.** There is a number of elements of this programme that are well positioned for scale-up and replication following successful implementation. First, the EDA model itself is dynamic and can be utilized in other countries in the Pacific and indeed around the world. Lessons learned from this project can help to frame future efforts, particularly with regards to training and engagement of LAs and supporting project development and implementation. Further, the sub-grants will be proving out the viability of small-scale deployments of specific adaptation strategies and providing key operational/design considerations for future projects. The individual sub-grants will also lead to new approaches and technologies for DRR, food security, and water security that can be utilized to scale climate adaptation in other FSM communities as well as in communities around the Pacific and the world. The project specifically creates pathways to facilitate this innovation sharing through the learning exchanges in Component 1. Second, SPC as the Accredited Entity also provides an established vehicle (member countries and partners) to disseminate outcomes, lessons learned and model itself to LAs in other Micronesian countries (Republic of Marshall Islands and Palau) and across other Pacific island countries. If successful, the operating capacity of the EDA facility could be expanded in a second phase in which the number of countries and LAs could be multiplied. Finally, Activity 2.3. includes the development of a resource mobilization strategy to identify funding sources to recapitalize the EDA Facility and potentially replicate across other countries in the Pacific.
- **Potential for Knowledge and Learning.** The EDA programme also has substantial potential for knowledge and learning. Lessons learned in the design and implementation of the Component 1 capacity building trainings as well as the needs and responses of participants can help inform development of future EDA and local capacity building projects. The sub-grant development, review, and implementation process can likewise help enhance both the other sub-grants within this EDA as well as priority adaptation projects in other communities. Activities within the DRR, food security, and water security sub-grants will create lessons learned for selecting appropriate technologies and approaches for Pacific communities and importantly tailoring the application of those technologies and approaches to specific community needs. To facilitate this, Component 1 organizes learning exchanges, site visits, and a LAs conference to facilitate knowledge and innovation sharing. SPC will also be aggregating and synthesizing these lessons learned to help drive other projects in their portfolio and operations across the Pacific. Finally, the programme will also connect to the data portals and knowledge communities that already exist in the Pacific such as SPC's Pacific Data Hub, the Pacific Climate Change Portal, and SPREP's Pacific Environment Portal.
- **Contribution to an enabling environment and regulatory framework.** Component 1 of the programme extensively builds direct capacity for LAs to understand and effectively support the identification of key climate priorities, stakeholder engagement, project development and implementation, and financial management. All of this creates an enabling environment for future climate action projects and efforts in these communities. Further, by empowering communities and LAs to develop and implement their own priority projects, the EDA programme is driving more direct community ownership of and buy-in for the

climate and socioeconomic outcomes which will help to support the long-term sustainability of these outcomes, particularly as it relates to long-term maintenance (i.e. green/blue/grey coastal infrastructure, rainwater systems, etc.) and behaviour change (i.e. fisheries and livestock practices). For livestock and fisheries activities, the programme will also be supporting market development and transformation within local communities and States which will help to support additional beneficiaries and replicated activities in other communities. By supporting LAs to build their capacity and implement priority projects, the EDA programme and sub-grants will also help to develop local frameworks and strategic plans for disaster risk reduction, recovery, and response as well as new local frameworks supporting food and water security, particularly the deployment of specific technologies and approaches. All of these frameworks can support bottom-up advocacy at the national and State level, particularly for DRR.

- **Overall contribution to climate-resilient pathways.** Overall, the programme helps to build the adaptive capacity of LAs and communities in FSM to climate change by developing new capacity, plans, and infrastructure (green, grey, and blue) for improving disaster risk reduction and recovery, improving water security and access for vulnerable households, and improving livelihoods and food security. All of the activities and approaches are also highly replicable and scalable, as identified above, which builds the magnitude of impact that this programme can have on influencing future climate-resilient pathways. Further, the pathways envisioned by the programme and sub-grants help to advance the critical idea of local co-development and engagement for effective response to climate change which is a significant contribution to future climate-resilient development in FSM and beyond.

Sustainable development

Overall, the EDA programme will support a wide variety of economic, social, and environmental co-benefits, as well as an overarching gender inclusive approach which will help to support gender sensitive development impact. The specific co-benefits will depend on the activities included in the sub-grants developed under Component 2.

In addition to the sub-grant specific benefits discussed in Table 32 below, Component 1 will also support people centred development impact by integrating mainstreaming gender, youth, disability and human rights elements into capacity building efforts and specifically working to empower stakeholders through trainings and integration into leadership, planning, decision-making, and project development/implementation at the local and State authority level. Details for the specific targets are included in Annex 8 to the funding proposal.

Table 32: Sub-Grant Alignment with Sustainable Development Criteria

GCF Category	Disaster Risk Reduction	Water Security	Food Security
Economic co-benefits	Economic co-benefits from DRR activities mostly centre on avoided economic losses from enhanced disaster resilience and improved recovery timelines. Specifically, the sub-grants will be supporting new grey and green coastal infrastructure, watershed rehabilitation, and flooding control to help limit economic damage to LAs and communities. Further the sub-grants will also be training and equipping LAs for improved emergency preparedness.	Water security activities will help to lower costs of water for households and communities by improving access and availability through new catchment systems and distribution.	By targeting livestock and fisheries as well as some specific crop value chains, the sub-grant activities will be helping to improve financial inclusion, income streams and income security for farmers in FSM by improving efficiency and output, but also developing and scaling market value chains and support for households.
Social co-benefits	The DRR activities are expected to lead to improved health outcomes from reduced disaster risk, particularly flooding. Further by reducing disaster risk and improving response times, social/community recovery can be improved. Finally, DRR activities can also help to preserve cultural sites and resources.	The principal social co-benefit from the water activities in the sub-grants will be improved access to and quality of water for vulnerable households through new catchment, pumping and distribution assets. Reduced	Social co-benefits from food security activities focus on improved nutritional outcomes, especially for young children, and food security for vulnerable households.

		morbidity related to water borne disease and unsafe drinking water?	
Environmental co-benefits	To the extent that sub-grants utilize watershed management/restoration and green and blue infrastructure for climate resiliency and disaster risk reduction, additional co-benefits for reforestation (particularly coastal mangroves), coastal/marine resource conservation, and biodiversity co-benefits will be realized.	Watershed management and restoration activities will help to improve water quality, ecosystem biodiversity and coastal resources. Solar water pumping will potentially lead to marginal GHG/air quality benefits as well depending on the baselines for pumping.	The activities focused on supporting improved coastal resource conservation and sustainable utilization will help to sustain biodiversity and improve habitat area. Depending on the activities improved agroforestry and livestock management can also lead to improvements in ecosystem conservation and water quality. Improved livestock management and agroforestry may also lead to marginal GHG benefits.
Gender-Sensitive Development Impact	In FSM, climate change is likely to lead to an increase in the intensity of disasters such as cyclones, floods, droughts and severe storms. Both men and women play a critical role in the preparation and recovery process, but women may not have the same capacity to influence decision-making. Men, particularly those with greater levels of power and authority, are usually the ones informed and consulted by response agencies, including governments, and they directly participate in the decision-making and management processes for disaster risk management. This could mean that women's needs and priorities are not properly addressed in early warning systems, preparedness, and during the recovery process. Further, women and girls also experience a number of secondary impacts, including violence and trauma, loss or reduction in economic opportunities, and an increased workload, all contributing to anxiety and stress. However, viewing women as victims exacerbates their vulnerability; they have unique knowledge and practical skills that are critical for climate change and disaster adaptation. Women and girls represent half the population and their equal participation and skills will lead to a more effective overall response to climate change. The sub-grants will be directly addressing these underlying vulnerabilities through its activities. Specifically, by supporting specific DRR activities implemented within the gender mainstreaming framework outlined in the Gender Action Plan (Annex 8 of the funding proposal) the project will help to	Water availability, access, and security in FSM is expected to be impacted by changing climate particularly with alterations to rainfall patterns and salinization of groundwater from storm surge and sea level rise. The causes of water scarcity and reduced water quality are not solely climate-related and also include unsustainable use of water, lack of maintenance of equipment, and pollution of underground water because of activities like livestock production and poor sanitation and waste management. There is often a clear division of labor between men and women in water resources management. These different roles and responsibilities vary, but in general women are tasked with managing household water for drinking, cooking and other uses as well as making sure catchments are clean. Understanding the needs and responsibilities of men and women within their specific context is very important in identifying and addressing climate change impacts on all community members. Women have critical skills and knowledge, which, if used effectively, can contribute to the development of more effective water management plans, policies and programmes. Their contributions to developing	Climate change is expected to have a drastic impact on food security and agriculture in FSM including by decreasing the availability of local food through a reduction in agricultural yields, reducing availability of arable land and fresh water, creating food shortages due to extreme events, and straining existing systems due to population displacement. In FSM, women play a critical role in food production both through subsistence farming to feed their families as well as growing cash crops for income and cultural ceremonies. Despite this, women often face barriers to accessing agricultural land, training, credit and services. The agricultural and fisheries (gleaning etc) production that women and girls perform also tends to be considered part of "women's household responsibilities". Alongside these challenges, climate change will make it more difficult to make a living from agriculture and women may also struggle more than men to find alternative livelihoods, enter the formal employment sector, or migrate due to cultural barriers and lack of opportunities and education or their care obligations (ie that they have children and dependents).

	identify and integrate key considerations for differing skills and capacity for DRR between men and women, improve access to resources for women, improve gender-responsive leadership by both men and women at the community and national level for disaster response, increase coordination and consultation with women stakeholders in planning and implementing effective gender-balanced strategies for disaster response, etc.	effective solutions can help governments and other stakeholders improve the social benefits and economic returns from their investments. The sub-grants will be directly addressing these underlying vulnerabilities through its activities by supporting improved participation and decision-making for women in watershed management as well as access to, ownership, and maintenance of new assets like solar water pumps, rainwater harvesting and other catchment systems which can increase water security and decrease collection times and associated risks for women. All of the activities will be conducted within the gender mainstreaming framework outlined in the Gender Action Plan (Annex 8 of the funding proposal).	The sub-grants will be directly addressing these underlying vulnerabilities through its activities. Within the gender mainstreaming framework outlined in the Gender Action Plan (Annex 8 of the funding proposal) the programme will support improved participation in decision making, control over financial resources, asset ownership, etc. for women on a variety of food security issues mostly related to fisheries and livestock.
	SDG 1: No Poverty SDG 3: Good Health and Well-Being SDG 5: Gender Equality SDG 6: Clean Water and Sanitation SDG 8: Decent Work and Economic Growth SDG 10: Reducing inequalities SDG 11: Sustainable Cities and Communities SDG 13: Climate Action SDG 14: Life Below Water SDG 15: Life on Land	SDG 3: Good Health and Well-Being SDG 5: Gender Equality SDG 6: Clean Water and Sanitation SDG 13: Climate Action SDG 14: Life Below Water SDG 15: Life on Land	SDG 1: No Poverty SDG 2: Zero Hunger SDG 3: Good Health and Well-Being SDG 5: Gender Equality SDG 8: Decent Work and Economic Growth SDG 10: Reducing inequalities SDG 13: Climate Action SDG 14: Life Below Water SDG 15: Life on Land
Sustainable Development Goals	DRR sub-grants will primarily be working to reduce the risk and impact of climate change and other disasters for LAs in FSM which will help to reduce mortality risk, improve health recovery timelines, and reduce the economic damage of disaster events for built and social systems. Further, by utilizing green/blue infrastructure and improved watershed management, the sub-grants will help improve ecosystem services and resilience while also supporting biodiversity. As highlighted above, the activities will be conducted within a focused gender mainstreaming framework (Annex 8 of the	The water security sub-grants will focus on watershed management and development of new capacity/assets for water catchment, pumping, and distribution both of which will help improve access to clean water and water security for households. This will not only support improved health outcomes, but will also help to make the communities more resilient to climate change. Depending on the activities, improved watershed management can also improve overall water	Food security sub-grants will support new and improved livelihoods and income security particularly for household farmers and vulnerable communities through livestock, fisheries, and some agricultural development. Expanded agricultural production, particularly for subsistence households will also help to improve food security, health, and nutritional outcomes for LAs. As highlighted above, the activities will be conducted within a focused gender mainstreaming framework (Annex 8 of the funding proposal)

funding proposal) which will help to improve gender equality.	quality and ecosystems for terrestrial systems and marine ecosystems (i.e. Ridge to Reef). As highlighted above, the activities will be conducted within a focused gender mainstreaming framework (Annex 8 of the funding proposal) which will help to improve gender equality.	which will help to improve gender equality. By focusing on food security and livelihoods in response to climate change, the sub-grants are directly improving adaptive capacity of beneficiary communities. For those projects that develop MPAs and/or opportunities for agroforestry there is strong potential for supporting both life on land and life below water.

Needs of recipients

The entire focus of the EDA programme and its sub-grants is centred on empowering local communities and States to develop and tailor climate change projects based on their specific needs and priorities. The programme initially builds capacity for the LAs to actually identify and develop priority sub-grants and then provides technical assistance to implement the projects.

- **Vulnerability of the country** – According to the Notre Dame Global Adaptation Initiative (ND GAIN), FSM is the fourth most vulnerable country to climate change and the 78th least ready country in the world (FSM scored 0.640 on the vulnerability scale and 0.360 on the readiness scale).[204] The FSM GCF Country Programme[205] concluded that at present, none of the FSM States have a 'high' level of adaptive capacity required to ensure adaptation to the effects of climate change. As highlighted in the climate rationale above, climate change is expected to severely threaten FSM across all sectors of its economy, particularly through increased sea level rise, increased variability of rainfall, increased severe weather events and king tides, and increased temperature. Past inundation, surge and storm events have caused significant damage to communities (see discussion above) including through lasting impacts to households, community infrastructure, coastal resources, and agriculture/water systems. Currently, approximately 60% of households in FSM live within 180 m of the shoreline with millions of dollars' worth of agriculture, buildings, etc. exposed to climate threats. Further, the vast majority of FSM is reliant on underdeveloped agriculture, livestock, and fisheries value streams both for subsistence consumption as well as for primary income streams, and climate change is expected to limit these systems further constraining livelihoods and threatening community food security. Water security is likewise constrained due to insufficient technology like catchment systems and mismanaged watershed resources both of which are made more difficult due to future climate change.
- **Economic and social development level of the country** – In FSM in 2013/2014, meeting essential caloric needs required an average of USD 1.84 per adult per day; meeting both food and non-food basic needs required on average USD 4.34 per day. At the national level, about 10% of people in FSM are below the food poverty line and 41% are below the total poverty line. The poverty gap index, which indicates the extent to which average adult equivalent expenditures fall short of the poverty lines, is estimated at 3.6% at the food poverty line and 15.1% at the total poverty line. In addition to this, FSM is an under-resourced country that is highly dependent on the US Compact of Free Association (COFA) funding. The COFA currently funds 80% of State budgets and over 90% of its funding is allocated for health and education. After 2023 when the current phase of financial support is due to expire, and if not renewed this funding source will be severely curtailed leading to an estimated annual financing gap of about USD 41 million (35-45% of current national government expenditures). Negotiations for renewal of the COFA are underway, but it is uncertain what amounts will be available for what purposes at this stage. This level of socioeconomic development highlights a key need for outside funding to support projects to address impacts from climate change.

[204] ND GAIN Country Index
[205] FSM GCF Country Programme

- **Absence of alternative sources of financing** – FSM local, State and national financial and technical capacity is extremely constrained, particularly when considering the magnitude of potential climate change impacts. Specifically, a previous capacity assessment for FSM from USAID[206] highlighted that estimated costing for operationalizing climate change policies and action at the State and local level currently far outweighs department budgets and that there is a lack of capacity in national and State governments to effectively coordinate climate finance and adaptation priorities. Outside funding has been leveraged in this space, but the funding amount is still inadequate to meet adaptation needs and further, more than 60% of the funds go "uncoordinated" by national decision makers which creates a void for effective and coordinated financing for climate adaptation in FSM communities.
- **Need for strengthening institutions** – The barrier assessment above highlights a number of capacity constraints for FSM. The FSM GCF Country Programme[207] concluded that at present, none of the FSM States have a 'high' level of adaptive capacity required to ensure adaptation to the effects of climate change. Despite some variation in their adaptive capacities, all States are highly vulnerable due mainly to a combination of capacity issues to respond to climate impacts in a timely manner and the wide dispersion of the islands in the FSM which poses transportation, communication and development challenges for the nation, particularly for costs of goods and services, costs of energy and transportation, and scalability and connectivity of markets. [208] Further, institutional capacity to secure sufficient funds and implement coordinated adaptation and mitigation projects is also inadequate, making progress slow and challenging. This makes those living in rural areas, outer islands, and coastal communities especially vulnerable, given the long distances, at times unfavourable weather, logistics and challenges with the high cost of inter-island transportation making it particularly difficult to deliver assistance and implement projects. These constraints are echoed in the USAID Financial Assessment of Climate Change and Disaster Risk for FSM which identified several additional barriers and challenges[209] including: lack of government coordination on climate adaptation, limited budgets for operationalizing climate change, fragmented climate finance, a lack of capacity in national and State governments to effectively coordinate climate finance and adaptation priorities, and limited ability to build and sustain local capacity in a manner that is consistent and builds corporate knowledge. All of this highlights the need to improve capacities for climate adaptation particularly at the local level of governance which is the primary focus of Component 1.

Country ownership

As highlighted in the policy section above, this EDA programme is aligned with several national strategic plans and policies for climate change. The FSM Strategic Development Plan[210] includes goals for the responsible management of fisheries (Fisheries Strategic Goal #2), environmentally sound and sustainable production of crops (Agriculture Strategic Goal #4), and the mainstreaming of environmental considerations and climate change in national policy and planning (Environment Strategic Goal #1). The Second National Communication identifies risks to food and water security and coastal flooding from climate change impacts (sea level rise, saltwater inundation, extreme weather events) as key adaptation initiatives and highlights the need to support community-based adaptation projects to institute locally effective adaptation measures. The GCF Country Programme also specifically identifies the need for food and water security projects, disaster risk management projects, and resilient infrastructure/roads projects.[211]

The Joint State Action Plans for Disaster Risk Management and Climate Change all also identify strategic objectives aligned with the proposed EDA programme.

[206] FSM Climate Change and Disaster Risk Finance
[207] FSM GCF Country Programme
[208] Pacific Possible: Long-term Economic Opportunities and Challenges for Pacific Island Countries. World Bank.
[209] FSM Climate Change and Disaster Risk Finance Assessment
[210] FSM Strategic Development Plan (2004 – 2023).
[211] GCF – Federated State of Micronesia Country Programme.

- Pohnpei - Objective 4.1: Strengthen food security in Pohnpei, Objective 5.2: Ensure water security of Pohnpei and Objective 6.1: Improve critical infrastructure in Pohnpei to withstand disasters and climate change.[212]
- Kosrae – Objective 6.3: Improve critical infrastructure in Kosrae to withstand disasters and climate change and Objective 6.8: Strengthen management of freshwater resources.[213]
- Chuuk – Objective 1.2: Improve infrastructure in Chuuk State to withstand disaster risk and climate change, Objective 2.4: Sustain productive agriculture and Objective 4.1: Ensure water security for Chuuk.[214]
- Yap – Objective 3.1: Improve data and knowledge management to better support disaster risk management and climate change adaptation, Objective 3.5: Address food security issues in Yap and the risks provided by climate change and other events and Objective 6.3: Improve critical infrastructure in Yap to withstand disasters and climate change.[215]

In addition to this strategic alignment, the EDA programme has been co-developed by SPC and the NDA, with strong support and inputs from other FSM stakeholders, including all four States and civil society organizations. Even despite complications from the pandemic, initial needs assessments were conducted for a number of FSM municipalities (see above) and through this specific adaptation priorities were identified through direct stakeholder meetings. The NDA, which will also be the official focal point, and the four States will be fully involved and play a key strategic role in the programme implementation. Resources will be provided to the NDA and LAs to guarantee ownership by developing key strategic partnerships between SPC, the NDA and LAs. Further, a national decision-making body made up of representatives from key stakeholders will endorse key milestones and lead key programme implementation including the selection of sub-grants as part of Component 2.

Efficiency and effectiveness

The EDA programme will demonstrate a strong cost effectiveness and financial soundness. The proposed financial structure of the facility is deemed adequate and reasonable in order to achieve the programme's objectives while minimizing transaction costs, in particular given the high complexity of targeting all municipalities in each of the States to include particularly vulnerable populations living in rural areas and outer islands. Indeed, the long distances, at times unfavourable weather, logistics and high-cost challenges of inter-island transportation in FSM make it particularly difficult to deliver assistance. A description of the programme's alignment with GCF's efficiency and effectiveness criteria can be seen below:

- **Necessity of Financial Structure and Past Projects** – As above, FSM has extremely limited capacity to leverage other sources of financing which highlights the necessity of the proposed GCF grant structure and concessionally to directly support local communities. Further, mechanisms like this from other donors including the Adaptation Fund[216], GEF Small Grants Programme[217] and USAID PACAM[218] that have been shown to be both effective and efficient at supporting LAs and community groups in developing projects and delivering local climate change outcomes (including in DRR, ecosystem-based adaptation, food security, and water security) in FSM. Table 33 below outlines the cost-benefit-analysis (CBA) completed on DRR, food security and water security adaptation projects implemented throughout Pacific Island Countries through various funding mechanisms.

Table 33: CBA Summary for Adaptation Projects in Pacific Island Countries

Project	Location	Description	CBA Conclusion

[212] FSM. Pohnpei Joint State Action Plan for Disaster Risk Management and Climate Change.
[213] FSM. Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change.
[214] FSM. Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change.
[215] FSM. Yap Joint State Action Plan for Disaster Risk Management and Climate Change.
[216] Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM.
[217] GEF Small Grants Programme – Micronesia OP 5 Strategy
[218] USAID PACAM Performance Evaluation Report (2017)

Disaster Risk Reduction			
Improved strength and durability of harbour structures[219]	Cook Islands	The Mangaia-Avarua Harbour on Mangaia island is vulnerable to damage from relatively low intensity cyclone events. Increased cyclone intensity and sea level rise from climate change pose increased risks to the harbour. A harbour infrastructure improvement project (including relocation of a boat ramp and construction of a beach spending zone) was assessed for cost-effectiveness.	Under the initial assessment, the improvement project was found to be cost-effective. Costs to improve strength and durability of the wharf were estimated at USD 414,451 and measures to improve safe access were estimated at USD 270,192. Net Present Value (NPV) benefits for each component of the project were estimated at USD 574,203 and USD 19,660, respectively. However, under other conditions included in the sensitivity analysis, the project was found to be prohibitive in terms of cost.
Seawall construction[220]	Samoa	The village of Upolu is vulnerable to coastal erosion. This coastal erosion is expected to be exacerbated by climate change due to sea level rise and the potential for more frequent and severe storms. The construction of a seawall was assessed as a cost-effective solution to the issue of coastal erosion.	Under the primary scenario and the sensitivity analysis scenario, the seawall was found to be cost-effective in reducing coastal erosion. Costs for the primary scenario were estimated at USD 630,402 and NPV benefits were estimated at USD 747,346. Results were found to be extremely sensitive to assumptions regarding the baseline rate of coastal erosion, seawall effectiveness and land value.
Food Security			
Taro adaptation[221]	Palau	Palau faces stress across all dimensions of food security. One component driving food insecurity is declining taro production. Saltwater intrusion is a major impact resulting in reduced production. Evaluation of taro varieties for saline resistance and improved taro plots to reduce losses from saltwater intrusion were assessed.	Analysis indicated that improved taro plot engineering and the cultivation of more salt-resistant taro varieties (cost of USD 4,135 under the primary scenario) would result in NPV benefits (USD 25,595 under the primary scenario) under the primary scenario and all sensitivity analysis scenarios (including utilizing a 4% and 10% discount rate).

[219] Pacific Adaptation to Climate Change (PACC) programme - Experiences and lessons learned in the application of CBA to PACC demonstration projects.
[220] PACC programme - Experiences and lessons learned in the application of CBA to PACC demonstration projects.
[221] PACC programme - Experiences and lessons learned in the application of CBA to PACC demonstration projects.

Soil and food production environment modification[222]	Solomon Islands	The low-lying outer atolls of Ontong Java are facing increasing food security stresses, including declining subsistence food production. Saltwater intrusion into garden plots from extreme sea level and high tide events, which is expected to be exacerbated due to climate change, is a dominant factor in declining production. The modification of soil and food production (including improved composting and agroforestry techniques) were assessed for effectiveness.	Analysis indicated that the proposed package of modification measures was cost effective to improve the soil and food production environment on the atoll under the primary analysis and all sensitivity analysis scenarios utilized. Costs were estimated at USD 2,637,792 under the primary scenario and NPV benefits were estimated at USD 3,722,049.
Water Security			
Household rainwater tanks[223]	Niue	A groundwater lens is the primary source of freshwater in Niue. This lens is highly vulnerable to groundwater contamination risks, including from climate change events such as increased cyclones and extreme rainfall events. As a potential solution, two rainwater tank options for households throughout Niue were identified and analysed for cost effectiveness: 5,000 litre tank and 10,000 litre tank.	Analysis results indicate that the 5,000 litre tank would be cost-effective given a 20-year timeframe, but not a 10-year timeframe. Costs for the 5,000 litre tank option were estimated at USD 6,058 and NPV benefits were estimated at USD 138.
Enhanced water infrastructure[224]	Marshall Islands	Water supply to households in the capital city of Majuro is inadequate. This shortfall has been estimated at 253,000 m^3 of additional water required to meet demand. The scarcity problem has a number of sources, including contributions from climate change (namely extreme tide events and changing rainfall patterns and drought events). Multiple different water infrastructure enhancement projects were considered.	Project options focused on the repair/enhancement of rainwater catchments at the Majuro airport. Analysis results indicated that all water infrastructure enhancement projects (costs ranging from approximately USD 50,000 to approximately USD 2,000,000) resulted in NPV benefits (benefits ranging from approximately USD 200,000 to USD 3,400,000), even under various sensitivity analysis scenarios.
Community rainwater cistern[225]	Tuvalu	The primary source of freshwater in the village of Lofeagi is rainwater. Rainwater tanks are dry for approximately 4-5 months per year and longer during drought years.	Analysis indicated that the cistern would be a worthwhile investment under the primary scenario (costs estimated at USD 148,978 and NPV benefits

[222] PACC programme - Experiences and lessons learned in the application of CBA to PACC demonstration projects.
[223] PACC programme - Experiences and lessons learned in the application of CBA to PACC demonstration projects.
[224] PACC programme - Experiences and lessons learned in the application of CBA to PACC demonstration projects.
[225] PACC programme - Experiences and lessons learned in the application of CBA to PACC demonstration projects.

		Water scarcity issues are exacerbated by climate change, including from changing rainfall patterns and drought frequencies. The construction of a cistern to utilize catchment availability was considered.	estimated at USD 50,601) and all sensitivity analysis scenarios. The cistern was seen as a viable option for reducing dependency on desalinated water over the longer term.
Community rainwater tank rehabilitation[226]	FSM	The community of Ifalik is located on a small coral atoll and faces challenges securing reliable and safe freshwater supplies. Sea level rise is seen as potentially the greatest risk from climate change due to the increased likelihood of salinization of the groundwater lens. A community rainwater tank rehabilitation and education and monitoring project was assessed.	The project was found to be cost-effective under the primary analysis (costs estimated at USD 234,356 and NPV benefits estimated at USD 1,200,340) and sensitivity analysis scenarios. Project implementation was found to significantly reduce the need for relatively expensive emergency water supplies.

Through the EDA Facility, the proposed project includes similar sub-grant components to those outlined in the examples above. These sub-grants are additionally expected to be cost effective and result in NPV benefits following execution. Implementation of 10 DRR project sub-grants is estimated to result in up to USD 533,333 in savings per year from avoided DRR costs.[227] Although an estimate is not available for the net benefits of implementing food and water security sub-grants throughout FSM, recent literature has indicated that the benefits of investment in food and water security adaptation initiatives often outweigh the initial costs associated with implementation.[228,229]

Summarizing the comparable costs per beneficiary for sub-projects of the PACC grant mechanism presents the following:

- Cook Islands: cost per direct beneficiary: USD 4,000
- FSM: cost per direct beneficiary: USD 8,415
- Samoa: cost per direct beneficiary: USD 436
- Vanuatu: cost per direct beneficiary: USD 2,291

Based on an estimate of 54,301 direct beneficiaries through the implementation of sub-grants through this EDA programme with a total programme cost of USD 15 M, **the cost per direct beneficiary is approximately USD 363.** The EDA programme favours well against these benchmarks and is well below comparable sub-grant costs per direct beneficiaries.

- **Degree of Innovation:** As above, this programme represents only the 3rd Enhanced Direct Access programme to be developed within the GCF framework, and as such it can play a critical role in developing and supporting innovative pathways and mechanisms for engaging vulnerable communities and co-developing priority projects for climate change. Further, FSM's complex and dispersed structure will drive the programme and sub-grants to develop new innovative approaches for coordination and knowledge/innovation sharing.

[226] Ifalik CBA report.
[227] This estimate is based on the assumption that 2.5 municipalities will be targeted per grant, average losses will be evenly split across the 75 municipalities (USD 108k/year) and DRR activities will reduce losses by 20% (see the project Logical Framework for additional details).
[228] IPCC – Economics of Adaptation.
[229] WMO. Benefits of investments in climate services for agriculture and food security outweigh costs.

- **Best Available Technology** – The sub-grants will focus on leveraging best available technology and approaches for the disaster risk reduction, water security, and food security activities including, but not limited to cyclone proofing, rainwater catchment systems, endemic species and ecosystem services, MPAs, livestock and fisheries development, etc. Further, given the focused effort to tailor technologies and approaches to the priorities and needs of the LAs and communities that the programme is focused on, it is expected that additional innovation and contributions to the fields will be learned through the programme applications.
- **Potential to Catalyse Additional Financing** – The EDA model from this programme has the strong potential to catalyse additional financing for FSM and its LAs, particularly through its focus on capacity building for LAs to develop and implement projects, developing a fundable track record of project execution, and crucial capacity/experience showcasing effective project and financial management. All of this can help build donor/investor confidence, reduce investment risk, and ultimately unlock future projects and investment for FSM and the LAs.

14. Stakeholder Engagement Needs

The concept note has been co-developed by the NDA and SPC as the Accredited Entity, and shared and discussed with stakeholders from the FSM government, States governments, CSOs and municipalities during in-country consultations mid-October 2019, including a one-day national workshop gathering around 30 participants (see Annex 7 of the funding proposal). These initial consultations confirmed a strong interest, provided positive feedback, and demonstrated a high level of engagement and support. Additional stakeholder meetings have taken place during the development of the full proposal. These efforts were hampered by the COVID-19 pandemic, but the following entities were engaged in the feasibility study and funding proposal development:

- LAs in all the four States
- Select communities in the four States
- State authorities
- National Department of Finance (NDA)
- Micronesia Conservation Trust
- National Department of Resources and Development (Agriculture)
- State Resources & Development Agencies
- Pohnpei Weather Services
- Pohnpei State level Agriculture Services
- Pohnpei State level EPA (Environmental Protection)

Building from this, the programme will work to engage other stakeholders to secure buy-in and work to tailor and implement activities and outcomes. A summary of the different stakeholders and how they will be engaged is provided in Table 34 below, but a more detailed Stakeholder Engagement Plan is included as Annex 7 to the funding proposal.

Table 34: Initial Stakeholder Engagement Needs

Stakeholder Group	Description	Method of Engagement	Overview of engagement and key issues
Individual Households	Individual households in FSM. These are the primary beneficiaries targeted by the sub-grants.	Surveys; in home interviews; demonstrations; workshops/trainings;	Programme activities will need to be tailored to the needs and priorities of these households in order to ensure uptake and long-term sustainability of adaptation outcomes planned by the sub-grants.

		outreach material; sub-grant activities	**Key issues** • Identification of key climate adaptation priorities related to DRR, food security, and water security • Sustain interest and engagement in sub-grants and ensure benefits are realized for LAs.
Municipal governments	Municipalities (including council of chiefs and other equivalents for smaller municipalities) for each four States	Direct meetings; Capacity building and technical trainings; Project development support	The programme has met with a number of representatives from municipalities (limited by COVID-19) as part of programme development, but they will be a critical stakeholder for the development and implementation of priority projects. **Key Issues:** • Building awareness of local issues for climate action • Building capacity for identification and development of priority projects • Focused support for effective implementation of priority projects
State Government Institutions (Ministries and relevant Departments)	State-level policy makers responsible for State-level programming and policy. Includes for example State R&D offices.	Direct meetings; Capacity building and awareness building workshops; advocacy through policy recommendations and other communications from programme activities.	Various ministry representatives have been consulted as part of the programme development process laying the groundwork for further engagement during programme implementation. **Key Issues:** • Building awareness of climate change and the need to integrate it into support for LAs projects for the grant facility • Identify and leverage existing data streams to better support project interventions
National Government Institutions (Ministries and relevant Departments)	National agencies and policymakers responsible for coordinating national response and programmes for climate change that will support sub-grants. Includes for example the Department of Finance, National Department of Environment, Climate Change and Emergency Management, National Department of Resources and Development (which includes agriculture)	Direct meetings; advocacy through communications from programme activities.	Various ministry representatives have been consulted as part of the programme development process laying the groundwork for further engagement during programme implementation. **Key Issues:** • Ensure LAs have the right data and support to help develop and implement priority projects • Dissemination of lessons learned
National Department of Finance (NDA)	National Department of Finance is the National Designated Authority in FSM and responsible for coordinating all projects with the GCF	Direct meetings; project reporting and lessons learned	The NDA has been closely involved in the development of the EDA programme. As the official GCF focal point it will help coordinate programme activities including the development of the programme governance bodies and sub-grant review and implementation. **Key issues** • Development of programme governing bodies

			• Communication with GCF • Review and oversight of sub-grant development and implementation • Sharing of lessons learned
Civil Society Organizations and networks	Existing organizations both formal and informal supporting different aspects of community engagement, particularly those related to food security, water security, and DRR with a focus on youth development and persons with disability	Surveys; direct meetings; workshops and trainings; interviews, focus group discussions	For many communities these groups represent existing convening structures and sources of information and social cohesion. Further, many of these organizations have been involved in developing and implementing past initiatives for climate change. Accordingly, they will need to be engaged throughout the sub-grants to align ongoing activities and support full community engagement **Key issues** • Alignment of sub-grants with existing initiatives • Engagement of vulnerable households
Women's Organizations	Key social institutions for empowering women in FSM and providing opportunities for gender mainstreaming and social advancement with state women's associations, various faith based groups, disability groups, youth groups, informal clubs and others.	Community meetings; workshops; direct meetings; surveys	These institutions will be key partners in engaging households and designing gender-mainstreaming activities to support sub-grant development and implementation. **Key Issues** • Gender mainstreaming for sub-grants • Programme design • Community outreach and engagement
Other Donors	International/multi-lateral donors and other operators funding current and future projects in FSM. It will be critical to share lessons learned with these institutions to support development of future climate projects in FSM and beyond.	Direct meetings; workshops; lessons learned and best practices reporting.	Engagement with these groups will help to inform the design and implementation of programme activities and will ultimately be crucial for dissemination of programme success and lessons learned over time. **Key Issues** • Avoiding duplication and finding opportunities for collaboration and scaling up • Sharing lessons learned and best practices

15. Risk Analysis

An initial assessment of key programme risks and mitigation measures are included in Table 35 below.

Table 35: Initial Risk Assessment Table

Risk	Description	Impact/Probability	Mitigation Measures
Limited interest of engagement from Local Authorities	Limited interest of engagement from LAs leads to underdeveloped project pipeline and limited impact for the EDA Facility and EDA programme	Impact: High Probability: Low After Mitigation: Probability is negligible	LAs have been directly included in the development of the programme proposal to date, and through participatory governance, focused outreach, engagement, and delivered benefits through trainings and project development the programme will build

			key leadership and buy-in from LAs and communities
Geographic remoteness of certain Local Authorities	Some LAs are located in outer atolls that are very far from main islands/atolls. Transportation to these remote LAs is a significant challenge	Impact: High Probability: High After Mitigation: Impact reduced to low	Under the programme, LAs will be engaged in the development of sub-grants for their respective communities. This engagement will include communicating project needs based on the relative geographic isolation of their community. SPC has well established and efficient procurement protocols and teams that will adjust to transportation needs accordingly.
Local Authorities have insufficient capacity and resources to implement priority projects	LAs have insufficient capacity and resources to implement priority projects which results in stranded or underperforming projects and limited results for local communities	Impact: High Probability: Medium After Mitigation: Probability is negligible	Existing capacity for LAs is quite limited which is why the EDA programme deliberately builds multi-stage training for LAs on climate change, project development, and project management as well as sustained technical support, guidance, and oversight from project support bodies. In the event LAs need additional support beyond this in order to successfully implement a sub-grant, the LA will either (i) be paired with a State agency that will assist the LA in sub-grant development/implementation, or (ii) the ECU would serve as the financial and procurement provider and directly support project implementation in collaboration with the LA.
Local communities and individual households don't support or engage with local priority projects	Local communities and individual households don't support or engage with local priority projects stemming from misaligned project objectives and priorities and limited stakeholder engagement and co-development	Impact: High Probability: Low After Mitigation: Probability is negligible	The core principle of the EDA programme is co-development of adaptation projects tailored to local needs and priorities. As part of sub-grant development, the programme will be working through locally elected officials and leaders to engage with the target communities and identify priority project needs. Community engagement and buy-in is a primary focus of the sub-grant application and review processes, so extensive due diligence will be undertaken to hedge against this risk. Further, the programme will enlist formal/informal civil society organizations and other groups to help support programme outreach and development.
Localized data and information are insufficient to help support development of priority projects	Localized data and information are insufficient to help support development of priority projects leading to underdeveloped projects, sub-optimal design, siting, and implementation of sub-grant activities, and	Impact: Medium Probability: Medium After Mitigation: Probability and impact are low	The EDA programme works directly with national and State agencies to catalogue existing climate, vulnerability, and other data to help engage LAs to develop projects and importantly identify gaps that need to be sourced.

	ultimately limited climate adaptation outcomes		
Difficulty in sourcing of technology and other inputs for programme activities	Procurement for the EDA programme in FSM is complicated given the diverse, dispersed geographies of FSM as well as constrained supply chains from COVID-19 aftermath.	Impact: Medium Probability: Medium After Mitigation: Probability reduced to low	SPC has well established and efficient procurement protocols and teams that will handle all of the procurement for the priority projects at the local level.
COVID-19 constraints for engagement and operations	Depending on the timeline of the programme, stakeholder engagement could still be constrained by COVID-19 and the resulting shifts in staff and protocols.	Impact: Medium Probability: Medium After Mitigation: Impact reduced to low	The EDA programme has been adaptive and proactive in finding pathways to engage with needed stakeholders at the local level during the COVID-19 pandemic by leveraging highly effective national consultants and local networks. This foundation will help the programme to proactively plan for alternative pathways for stakeholder engagement.

16. Overall Programme Feasibility

As highlighted in the sections above, the GCF programme "**Climate change adaptation solutions for LAs in the Federated States of Micronesia"** includes a number of factors that help support the overall operational feasibility (in line with GCF criteria) in improving the climate resilience of local communities in FSM including:

- **Fit for Context and Need** – FSM's communities are extremely vulnerable to impacts from climate change particularly the impacts of increased sea level rise, increased variability of rainfall, increased severe weather events and king tides, and increased temperature on human and socioeconomic systems. Key areas like DRR, food security, and water security are all particularly vulnerable and remain established priorities within National Strategic Planning. At the same time, poverty in FSM is expansive with about 10% of people in FSM below the food poverty line and 41% below the total poverty line. In addition to this, FSM is an under-resourced country with 80% of State budgets dependent on the US COFA. As above, numerous past assessments have also highlighted the need/importance of building local capacity and budget to drive climate action, particularly in the absence of effective national coordination. The model of localized climate adaptation projects focusing on DRR, food security, and water security is an extremely good fit in this context given the expansive and diverse needs, climate vulnerabilities and the inability to effectively coordinate at the national level.

- **Climate Impact Aligned with GCF Investment Criteria** – The overall EDA programme and its sub-grants have substantial potential to deliver critically needed adaptation outcomes directly to local communities. As highlighted above the programme will work to provide improved adaptive capacity for 100% of FSM's population across three critical sectors DRR, food security, and water security and variety of GCF impact indicators (Table 30). The sub-grants will also include substantial economic, environmental, social, and gender-sensitive co-benefits (Table 32).

- **Technical Feasibility** – The actual sub-grant activities related to DRR, food security, and water security are not novel, but instead draw from successfully deployed projects and initiatives that have been extensively documented in other contexts across FSM and the Pacific (see projects and lessons learned discussion above). What is more novel is the EDA model itself. As highlighted previously direct grant programs have been utilized and for the most part effective in driving local projects. Specifically, mechanisms like the Adaptation Fund Practical Solutions for Reducing Community Vulnerability to Climate Change in the

Federated States of Micronesia[230], the GEF Small Grants Programme[231] and USAID PACAM[232] have been shown to be both effective and efficient at supporting certain one-off projects for community groups and delivering limited local climate change outcomes (including in DRR, ecosystem-based adaptation, food security, and water security) in FSM. The Adaptation Fund project in particular financed 10 projects based specifically on Local Early Action Plans for adaptation. All of those programmes highlighted the need to improve local ownership and engagement, and particularly engage local governments for long term sustainability. The present EDA programme therefore focuses on those gaps by centering capacity building efforts, project development and project implementation on LAs rather than CSOs. There are of course risks in this (see above) given the extremely limited baseline capacities of LAs, but the programme employs a very intentional approach to capacity building, audit, and local site visit, as well as focused technical assistance that helps to improve the technical viability of this operational model.

More broadly there are other strong examples from the development space highlighting the effectiveness of small grant programmes for LAs. One key programme is the Local Climate Adaptive Living (LoCAL) Facility of the UN Capital Development Fund. This project serves as a mechanism to integrate climate change adaption into local governments' planning and budgeting systems, increase awareness of and response to climate change at the local level, and increase the amount of finance available to local governments for climate change adaption. The LoCAL project works with LDCs and like the proposed EDA, applies principles of fiscal decentralization and effective local planning and public financial management for climate change. It combines performance-based climate resilience grants (PBCRGs), which ensure programming and verification of climate change expenditures at the local level, with technical and capacity-building support. As with the EDA programme, capacity-building activities are undertaken to assist the local governments and communities to address adaptation and resilience. The LoCAL project currently works in Bangladesh, Benin, Bhutan, Cambodia, Ghana, Gambia, Lao, Mali, Mozambique, Nepal Niger, Tanzania and Tuvalu. LoCAL has a well-proven mechanism in place for transferring of funding for local climate change adaptation, working with LAs and governments to enhance their capacities and capabilities to design and implement adaptation intervention. The LoCAL approach and project design have demonstrated the effectiveness and efficiency of working directly with LAs and established that the methodology outlined in this proposal extremely viable and proven and will work with the local communities in FSM.

Another example is the World Bank's Dedicated Grant Mechanism (DGM) through the Forest Investment Programme (FIP) of the Climate Investment Funds (CIF) which aims to enable the full and effective participation of Indigenous Peoples and Local Communities (IPLCs) in climate action at local, regional, and global scales. This project is executed through Conservation International and has 12 pilot countries projects/programmes; Burkina Faso, Democratic Republic of Congo, Mozambique, Cote'Ivoire, Republic of Congo, Indonesia, Nepal, Mexico, Brazil, Peru and Guatemala. At the country level, the funding is directed to indigenous peoples and local communities, which can apply for funding up to USD 500,000, for the implementation of climate related forestry projects. At the end of 2019 DGM has financed 400 subprojects reaching more than 200,000 beneficiaries.

The Global Environment Facility's Critical Ecosystem Partnership Fund (CEPF) is another example. The CEPF was formed in 2000 to champion biodiversity by delivering the financial resources of global donors to build the capacity of civil society groups in biodiversity hotspots. Since its inception in 2000, CEPF has awarded USD 242 million in grants to 2,408 civil society organizations. At the end of 2018, 1,250+ globally threatened species were benefiting from conservation action undertaken by CEPF grantees and more than 2,300 civil

[230] Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM.
[231] GEF Small Grants Programme – Micronesia OP 5 Strategy
[232] USAID PACAM Performance Evaluation Report (2017)

society organizations have received support with 69% of grantees reporting an increase in their organizational capacity, as measured by CEPF's civil society tracking tool.[233,234]

- **Economic and Financial Feasibility** – Given the uncertainty surrounding specific EDA activities it is difficult to fully assess the economic and financial feasibility metrics. DRR activities will provide earned value from the avoidance of potential disaster impacts (over USD 2 billion is currently exposed [235]) and the improvement of recovery timelines and procedures. Likewise, food/water security projects can create earned monetary value for communities through improved livelihoods, expanded markets, sustainable access to resources, resource pooling, etc. Other adaptation outcomes are much more difficult to monetize, but still provide earned value and return on concessionality in the form of improved adaptive capacity and absorptive capacity for local communities. Given that the activities have been shown to be effective in addressing certain adaptation outcomes in specific contexts from past projects in FSM and the Pacific, we expect that they can be deployed effectively in FSM communities, but specific returns on grant investment can't be determined ex-ante. The key point with regards to economic/financial feasibility of the proposed programme is the combination of critical climate vulnerability and lack of alternative options for finance. As above, FSM local, State and national financial and technical capacity is extremely constrained, particularly when considering the magnitude of potential climate change impacts. Specifically, a previous capacity assessment for FSM from USAID[236] highlighted that estimated costing for operationalizing climate change policies and action at the State and local level currently far outweighs department budgets and that there is a lack of capacity in national and State governments to effectively coordinate climate finance and adaptation priorities. Outside funding has been leveraged in this space, but the funding amount is still inadequate to meet adaptation needs and further more than 60% of the funds go "uncoordinated" by national decision makers which further creates a void for effective and coordinated financing for climate adaptation in FSM communities. All of this highlights the important need for GCF grant financing in order to unlock adaptation outcomes for FSM communities.

- **Environmental, Social, and Gender Feasibility –** While the EDA programme itself does not have existing E+S and gender studies it can cite for feasibility, the programme has developed extensive gender and E+S management plans and review/control for the sub-grant activities. In general, all of the sub-grant activities are expected to be limited both in scale and risk given the size of projects developed. As part of the granting mechanism, proposals for sub-grants will include an environmental and social safeguard screening to avoid, minimize and mitigate any harm to people and ecosystems and to incorporate environmental and social concerns as an intrinsic part of programme cycle management. Only proposals categorized as low or medium risks (Category C or B), in line with SPC's SER policy and the GCF's environmental and social safeguards, will be approved. For medium risk projects (category B), project proponents will be required to develop an environment and social impact assessment (ESIA) and an associated environmental and social management plan in line with FSM's ESIA requirements. For Gender, sub-grants will also conduct specific review in line with UN Women Gender Mainstreaming criteria, and the EDA programme as a whole will deliberately integrate gender equity and mainstreaming into the programme design and implementation through the detailed Gender Action Plan in Annex 8 of the funding proposal. All of this will be supported by dedicated capacity from SPC and the programme governing bodies. The combination of small-scale interventions, tight controls and trainings for LAs and sub-grants, as well as the overarching gender-inclusive and risk management approach suggests that the programme can be effectively implemented in a socially and environmentally responsible manner.

- **Exit Strategy and Sustainability** – The EDA model is well-positioned for sustainability and effective operation beyond the life of the GCF investment, as the components of the project have been planned to

[234] Critical Ecosystem Partnership Fund – 2018 Impact Report Highlights
[235] World Bank – FSM Country Risk Profile.
[236] FSM Climate Change and Disaster Risk Finance

ensure the long-term sustainability of the project outputs. First, the EDA programme proactively builds the capacity of LAs to effectively respond to climate change, and then supports them in implementing a priority adaptation project. The project is being implemented through LA structures and focuses on developing key knowledge and skills, ensuring that individuals and LAs will have the information and tools to develop and design effective adaptation interventions as well as the ability to design projects and programmes in line with donor requirements as appropriate. As the project is working directly with the LAs it will allow the project to be owned by the authorities and thus the outputs will be embedded into the regular day to day activities of the LAs. With successful implementation the LAs are not only building adaptive capacity, but also developing a fundable track record of project execution, and crucial capacity/experience showcasing effective project and financial management. All of this can help build donor/investor confidence, reduce investment risk, and ultimately unlock future projects and investment for FSM and the LAs. This approach to capacity building and development with LAs will ensure sustainability and continued growth, of improved human resource and technical capacities. It will also allow for enhanced institutional capacity building and allow the municipalities to be strengthened in ways which will allow them to be more effective in identifying and developing adaptation solutions. The sub-grant design and implementation process itself will also support long-term benefits mostly through improvements to disaster risk reduction, water, and food security. Each sub-grant will also include a proper exit strategy, to demonstrate the long-term sustainability of the proposed project intervention and how the project will provide long-term resilience in the specific LAs. All of this can help build donor/investor confidence, reduce investment risk, and ultimately unlock future projects and investment for FSM and the LAs. There is also strong potential to expand and replicate the model in other LAs in the Pacific and importantly expand the paradigm in FSM communities (i.e. launch additional rounds of the grant facility with different donors). Finally, activity 2.3.4 includes provisions for the development of a resource mobilization strategy to ensure recapitalization of the EDA facility. These structures and the other potential learnings identified in the investment performance section highlight clear potential long-term pathways for the programme.

Annex 1: Programme Results and Logical Framework

A Logical Framework was developed under this Feasibility Study but has been revised and integrated in section E of the Funding Proposal.

Annex 2: List of Climate Damaging Events by State

Table 36: List of climate damaging events in Kosrae[237]

Damaging event	Known impacts
Large swells from distant storms	
13–14 October 1961	Large waves inundated parts of Walung, causing damage to property at Insiaf and Leap. The waves caused a coconut tree to fall resulting in the deaths of two small children
December 1969	Affected the north coast of Kosrae
November 1979	A swell wave event damaged the old school buildings in Walung
8–9 December 2008	Flooding affecting northern coastline (Tafunsak, Walung and parts of the Lelu coastline)
January 2013	Affected east coast of Kosrae from Paal to Mosral in Malem
20 December 2013	Affected northern part of Walung
High tides combined with La Niña	
December 1999 to January 2000	Higher sea levels and inundation
November 2007 to February 2008	Higher sea levels and inundation
Typhoons	
1835 or 1837	No details of impacts available
15 March 1874	Severe storm or typhoon from the south sinks Bully Hayes ship
3-4 March 1891	Typhoon from the south. All but six houses left standing and virtually all breadfruit and coconut trees destroyed. This typhoon deposited a bank of coral rubble on to the reef flat along much of the eastern coastline which acted as a breakwater, sheltering the environment of wave energy and leading to the growth of mangroves around streams on the east coast.
1900?	Typhoon
19–23 April 1905	Most recent severe typhoon, lasting seven hours with much destruction of property and trees
19 May 1986	Typhoon Lola passed to the north west of Kosrae
5 January 1972	Typhoon Axel passed 75 km north of Kosrae. Maximum sustained winds of up to 80 knots were recorded resulting in severe crop losses, trees and vegetation damaged, and some wooden and tin-roofed structures destroyed.
17 December 2001	Tropical Storm 31W (Faxia) tracked west of Kosrae causing over washing on the east coast
Drought	
1997/1998	Associated with the El Niño event, this event affected all of the FSM including Kosrae (considered one of the “wet” States)
Flood	
7 April 2014	Inundate 218 houses in Tafunsak and 4 houses KCSO office in Tofol
23 July 2014	Inundate houses in Utwe
Landslide	
23 July 2014	Landslide at Utwe missing houses hence not causing significant damages

Table 37: List of climate damaging events in Chuuk[238]

Damaging Event	Known Impacts

[237] Federated States of Micronesia – Kosrae Joint State Action Plan for Disaster Risk Management and Climate Change.
[238] Federated States of Micronesia – Chuuk Joint State Action Plan for Disaster Risk Management and Climate Change.

Landslide	
Landslides from Tropical Storm Chataan (2002)	Of the 265 landslides attributed to the storm, at least 62 massive landslides occurred on 2 July, resulting in 43 deaths and hundreds of injuries on six islands in Chuuk.
Typhoons	
Typhoon Maysak (March – April 2015)	Made landfall at Chuuk lagoon on Sunday 29 Marchand Ulithi Atoll, Yap, on 1 April. Contaminated water sources, damaged crops and infrastructure, killed five people, around 7,000 people homeless in Chuuk and Yap States.
Super Typhoon Haiyan (November 2013)	Labelled the biggest storm ever recorded, beginning as a cluster of thunderstorms in Pacific waters of FSM. It traversed Chuuk but caused most damage in Yap and further Western Pacific Islands.
Tropical Storm Bopha (November 2012)	No major damage to Chuuk State reported
Typhoon Lupit (November 2003)	Damaged or destroyed about 200 homes in Chuuk State with high waves flooding roads and homes, while high winds damaged crops
Typhoon Pongsona (March 2003)	Brought tropical storm force winds to Chuuk. High waves from the storm washed over and covered some atolls. Destruction of houses and livestock on Hall Islands.
Tropical Storm Chataan (2002)	On 2 July 2002, Tropical Storm Chataan struck the islands of Chuuk with 20 inches (~500 mm) of rainfall received in 24-hour. 47 people were killed, 109 people were injured, and 39 people were hospitalised. Between 120 and 170 families (900-1,300 people) are estimated to have been directly affected.[239]
Supertyphoon Owen (November 1990)	Extensive damage to Hall Islands and Namonuito Atoll; nearly all houses and all food crops destroyed
Typhoon Nina (November 1987)	Killed 5 and seriously injured 38; 40,000 homeless; USD 30-40 million in damages; winds 75 mph with gusts to 95 mph
Tropical Storm Abby (December 1979)	70 mph winds on Chuuk
Typhoon Pamela (May 1976)	Heavy damage to Satawan including a church steeple; 11” rain on Chuuk; 10 killed due to mudslides; massive damage to crops
Typhoon Amy (May 1971)	Wind 75 mph gusting to 110 mph; 1 death and many injuries; completely destroyed Namonuito Atoll; USD 4.5 million in damages plus USD 1 million in crop damage
High Tide Events	
Abnormally high tide (December 2008)	It is likely that the Chuuk and Yap outer islands experienced saltwater submergence nothing was reported by State authorities
Typhoon Pongsona (March 2003)	High waves from the storm washed over and covered some atolls
Drought	
Drought – El Niño (January 2016 – ongoing)	Lower than normal rainfall during 2016. Below normal rainfall is expected across the region until later in the year
Drought - El Niño (March - November 2007)	No information is available for this event (US government provided emergency assistance to Chuuk State government – July 2007).
Drought - El Niño (1997-1998)	El Niño weather phenomenon was causing record low rainfalls in many areas of the Pacific including Chuuk State. Severe impact on State’s water supply system, crops and food security.

[239] Micronesia - Tropical Storm Chataan; OCHA Situation Report (July 2002). Provided by DECEM.

Drought – El Niño (1983)	Acute water shortage, destruction of crops, contamination of water, forest fire – throughout FSM.

Table 38: List of climate damaging events in Yap[240]

Damaging event	Known impacts
Typhoons	
Typhoon Mitag (2002)	Tidal surge inundated up to 1640 ft inland that destroyed nearly all food crops in low-lying areas and brought many low-lying areas including the main town under water for several hours. Approximately 150-200 people lost their homes. Coastline was extensively damaged.
Typhoon Lupit (2003)	Storm surge went as far as 3900 ft inland and resulted in contamination of potable water sources, destruction of food crops in low-lying areas, damage to public utilities and commercial properties.
Typhoon Sudal (2004)	Storm surge damaged and destroyed most homes in low-lying coastal areas, the State hospital sustained structural damage including severed pipelines and damage to the refrigeration system.
Typhoon Bopha (Nov 2013)	Across FSM, most of the impacts from the typhoon were fairly limited with only three islands of Chuuk State (Kutu, Lukunor and Ta) reporting damage to property and livelihoods. Some impacts were felt in Yap although these were minor.
Typhoon Haiyan (Nov 2013)	Typhoon Haiyan was upgraded to 'super typhoon' status as it passed over the islands of Yap in November 2013. The islands of Ngulu in Yap State was completely inundated by approximately 0.5 m of water and sustained damage, while on Yap island, the villages of Epibnaw, Weloy, Fanif and Colonia reported minor damage, although most fruit-bearing trees were destroyed. Inundation was mainly on the eastern side of the island, including the main bridge and a hotel in Colonia. Power and telecommunications services were restored and there was no significant damage reported from Woleai and Eauripik.
Typhoon Hagupit (Dec 2014)	Outlying islands including Ngulu Atoll, Eauripik Atoll, Woleai Atoll and Ifalik Atolls sustained significant damage from Typhoon Hagupit. Wind and inundation damage were experienced, affecting food crops, infrastructure, communications and coastal areas particularly on atolls closer to the centre of the storm.
Drought	
1997/1998	Major drought disaster declaration in 1998, associated with El Niño event which caused a reduction in rainfall and highly compromised water supply for Colonia on Yap main island and for outlying islands.
July 2007	Emergency drought declarations in 2007 also associated with El Niño.

Table 39: List of climate damaging events in Pohnpei[241]

Damaging Event	Known Impacts
Landslides	
Landslide (1997)	Landslide occurred Palikir, on the main island. People died during this event, but there is no memory of how many people died.
Typhoons	

[240]Federated States of Micronesia – Yap Joint State Action Plan for Disaster Risk Management and Climate Change.
[241] Federated States of Micronesia – Pohnpei Joint State Action Plan for Disaster Risk Management and Climate Change.

Typhoon Dolphin (2015)	On May 10, 2015, Tropical Storm Dolphin passed North East of Pohnpei with winds at approximately 80mph causing an Emergency Declaration issued after damage to electrical, roads, uprooting of trees and crops and damaging more than 246 homes. 1 fatality was recorded and estimate damage
Typhoon Pongsona (2002)	On 5 December 2002, Pongsona passed to the north of Oroluk Atoll in northern Pohnpei State. However, this event did not cause significant damage (either from wind, rainfall or storm surge).
Typhoon Lola (May 1986)	The most recent damaging typhoon affecting Pohnpei (occurred in a El Niño year – see Figure 8). Major disaster declared after damage to electrical infrastructure, uprooting of trees and crops and damage to homes. No fatalities were recorded; however, damage was estimated at USD 11.6 million.
Typhoon Ophelia (January 1958)	Damage to crops and homes in Pohnpei, and reportedly Ophelia tore off the roof of the United States Weather Bureau office.
Typhoon Lola (1957)	Damage to crops and homes, with maximum wind force hitting Pohnpei exceeding 105 mph.
Typhoon (1905)	Kolonia and northern Pohnpei were devastated by a typhoon in 1905, with damage reported to have flattened the island of Pohnpei.
High Tide Events	
2007 (Pohnpei)	No information was available for this event.
Drought	
El Niño, 2015, 2016	On February 20, 2016, Emergency Declaration was issued due to severe drought damaging crops and water on Pohnpei and the outer islands estimated to be USD 11.4 million. More than 40 wildfires were reported.
El Niño, 1997-1998	Sea level dropped by 1 foot below its long-term average and rainfall between Dec ’97 and Feb ’98 was 16% of long-term average. Water restrictions were imposed in Kolonia, with some residents only able to access water 2 hours per day.
El Niño, 1983	No information was available for this event.

Annex 3: Past and Ongoing Projects

Table 40: Previous and ongoing adaptation projects and initiatives in FSM

Project / Programme title	Description	Additionality / complementarity with EDA Programme
'Practical Solutions for Reducing Community Vulnerability to Climate Change in the Federated States of Micronesia' – Adaptation Fund	This is a nationwide Adaptation Fund project that has an overall project goal to build/increase the ecological, social and economic resilience of communities by reducing vulnerability to stressors from climate change.[242] The project focuses on protecting marine ecosystems in FSM and increasing their resilience to climate change. Expected outcomes of this project include: • Natural assets or ecosystems under protected area management are adequately protected/rehabilitated through effective legislative, institutional and financial arrangements and support. • Natural assets or ecosystems under protected area management are adequately protected/rehabilitated through effective State-level enforcement of MPA and nearshore fisheries legislation regulations. • Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level. • Improved Knowledge Management for Protected Areas and Ecosystem based adaptation Solutions The project also leveraged an EDA Facility to provide support for 10 communities to implement priority actions identified in their Local Early Action Plans for climate adaptation - demonstrating that the small grants mode of delivery works well in FSM.	The present programme proposal will work to leverage the past experience with small grants, particularly utilizing them to support specific local priorities for adaptation as well as the increased capacity of communities that have participated in this project in regard to water conservation and coastal protection. Opportunities to be leveraged for the proposed EDA Programme: • Increased understanding of climate change risks/adaptation at the local level. • Improved protection of fishing grounds (food security).
Pacific-American Climate Fund – USAID	The PACAM regional programme provides grant support to NGOs operating in Pacific island communities in adapting to climate change.[243] The programme includes focus on capacity building through various means (technical training, workshops, purchasing equipment through grants, etc.) and projects are both regional and country/community specific. Relevant recent projects that have been implemented in FSM include 'Climate Change Adaptation through Family Gardens, Food, and Health' and 'Improving Community Climate Resilience in Micronesia'. The family gardens project aims at strengthening the capacity of households and school communities to grow food in FSM. The climate resilience project is a regional project that targets remote outer islands and strengthening community resilience to climate change risks and hazards.	The present programme proposal will work to leverage the community knowledge of implementing home gardens and other household level food security projects through the family gardens project and increased capacity for climate change adaptation planning on outer islands through the climate resilience project. The proposed EDA is synergistic with the USAID initiative as it will seek to increase community capacity to implement coastal management projects.
'Climate Resilient Food Security for Farming Households across FSM' – Micronesia Conservation Trust (MCT) Green Climate Fund (GCF)	This additional GCF project is focused on providing a system-wide solution to increasing the resilience of FSM's most vulnerable communities to food insecurity in the face of climate change. Goals of the project include strengthening the enabling environment with the agriculture sector at both the national and State-levels, providing an evidence-base for specific interventions, developing new opportunities for market access and development and targeting climate smart agricultural techniques and opportunities to be used at the	Potential areas for leverage with the present programme include utilizing updated data, mapping, and climate information from the food security project to provide better targeted interventions across all three climate impact areas. The vulnerability assessments conducted as part of Component 1 of the MCT project will inform and guide the elaboration of sub-projects by LAs by

[242] Adaptation Fund – Practical Solutions for Reducing Community Vulnerability to Climate Change in FSM.
[243] USAID – Pacific-American Climate Fund.

	household level. Because of the similar target outcomes regarding food security, there has been communication with this proposed programme during the development stages to ensure these projects are designed harmoniously.	supporting the prioritization and decision-making processes. Additionally, as the MCT project does not target outer atoll communities, the proposed EDA Programme will aim to provide sub-grants for climate-resilient agriculture and water security interventions to enhance the resilience of households in more remote communities, in addition to fostering activities undertaken under the MCT project. To ensure there is no duplication of efforts between the MCT project and the proposed Programme, the ECU will assess, using the sub-project screening form, the potential synergies and opportunities to be leveraged.
Small Grants Programme – Global Environment Facility (GEF)	The GEF SGP provides financial and technical support to communities in developing countries for small projects that conserve and restore the environment and enhance community well-being and livelihoods. The programme provides grants up to USD 50,000 to beneficiaries for project implementation.[244] Various SGP projects have been implemented in FSM and the region, including a climate food security project in the community of Enimwahn and a coastal and land ecosystem rehabilitation project in the community of Satawan.	The present programme proposal will work to leverage the increased capacity to implement various types of adaptation projects throughout FSM that has been increased through the SGP.
ADB/GCF Pacific Islands Renewable Energy Investment Program	The Pacific Islands Renewable Energy Investment Program (the program) will support a paradigm shift from diesel power generation to renewable energy in seven Pacific SIDS and place the SIDS on a sustainable, climate resilient development pathway. Participating SIDS include Cook Islands, Tonga, Republic of Marshall Islands, Federated States of Micronesia, Papua New Guinea, Nauru and Samoa. In terms of adaptation, the project will focus in particular in floating solar panels on water reservoir to minimize evaporation and secure water supply (in Yap State), but also incorporate climate proofing into technical design of infrastructure.	The project is in the early stages of implementation, but it can inform the present programme on implementation of a GCF project in FSM and highlight specific challenges for project development in the individual FSM States. Further, to the extent that the States and Local Authorities have developed prior capacity with distributed renewable systems, particularly solar, the programme can leverage that capacity to support the design, operations, and maintenance of the PV systems envisioned to support adaptation solutions in the EDA sub-projects.
FAO El Niño drought: Food insecurity monitoring, preparedness and support in Micronesia and Melanesia	The project worked to mitigate risks to the food security and nutrition of vulnerable households created by El Niño-induced effects, particularly droughts. Specifically, the project: • Developed and designed a food availability monitoring system for data collection and analysis. • Trained government officials in Solomon Islands, Palau, the Marshall Islands and Micronesia (Federated States of) on the use of tablets populated with the Kobo Toolbox software for data collection, analysis and reporting. • Guided and assisted government departments to prepare implementation plans for data collection and monitoring capability for household food security and nutrition. Liaised with ministries of agriculture and village leaders/local representatives to ensure regular collection and triangulation of data	The project also trained government officials and guided and assisted government departments to prepare implementation plans for data collection and monitoring capability for household food security and nutrition. This capacity will be helpful in guiding the development and implementation of food security sub-projects.

[244] GEF SGP.

Annex 4: LA Capacity Assessment

The project used the below capacity assessment tool to assess the initial capacity and priorities of the LAs in FSM.

Institutional Capacity Rapid Assessment for LAs in FSM

I. Background

Contact Information	
Name of municipality/State agency	
Municipal Chief / Head of State agency	
Point of Contact	
Email address	
Phone number	

Staffing		
	# Female	# Male
Full-Time Staff		
Part-time Staff		
Other personnel (i.e. volunteers, interns, consultants etc):		
Total:		

Budget						
	<10K	10K – 50K	51K-100K	101K – 250K	251K – 500K	>500K
Total annual core budget						
Additional annual funding by other sources (i.e. UNDP, USAID, USFS, etc.):						

II. Capacity Assessment[245]

Institutional capacity assessment scoring system (scale between 1 and 5)

1 – Extremely low capacity to none available; **2 –** Low capacity; **3** – Moderate capacity; **4** – High capacity; **5** – Full capacity for any potential sub-grant

Capacity category	**Score**					**Notes/comments**
	1	**2**	**3**	**4**	**5**	
Organizational Capacity						

[245] Rapid Assessment Adapted from: UNDP Capacity Assessment Methodology User's Guide (2008); Institutional capacity assessment approach for national adaptation planning in the agriculture sectors, FAO (2018)

To what extent does LA have accounting, procurement, and other financial management systems in place?

To what extent does the LA have systems in place to prevent financial mismanagement and fraud?

Does the LA have a coherent organizational structure and well defined roles for staff ?

Ability to Manage Projects

Does the LA have the internal organizational capacity to implement and manage potential sub-grants?

Does the LA have the capacity to monitor and evaluate sub-grants?

To what extent does the LA have experience managing donor funded projects?

Knowledge of Climate Change Threats

To what extent can the LA access, manage and provide information on climate vulnerability, hazards and impacts to support decision making on adaptation?

To what extent is staff knowledgeable, adequately qualified, and competent in prioritizing climate change adaptation and disaster risk reduction responses?

To what extent does the LA staff include sector specialization (i.e. forest, marine, environmental specialists, etc.)?

Project Identification, Design, and Implementation

Does the LA have the capacity to design and manage systematic gathering and analysis of information regarding stakeholders 'needs'?

Does the LA have the capacity to design and organize the collection and analysis of gender-disaggregated data?

Does the LA have the capacity to ensure multi-stakeholder participation?

Does the LA have the capacity to identify and manage environmental and social risks?

III. Climate assessment and priority projects.

Institutional capacity assessment scoring system (scale between 1 and 5)

1 – Not a threat; **2 –** Minimal threat; **3** – Moderate Threat; **4** – Large threat; **5** – Extreme threat

Threat category	**Score**					**Notes/comments**
	1	**2**	**3**	**4**	**5**	

Climate change/Extreme Weather Events/Human Activities

Tropical storm/typhoon

Sea level rise

Coastal/Beach erosion

Increased sea surface temperature, coral bleaching

Saltwater intrusion into gardens/fields/taro patches/water wells

Drought

Lack of sustainable water source/infrastructure

Landslides from heavy rainfalls

Flood from heavy rainfalls

Availability/access to clean freshwater

Decreasing fish habitat and fish stocks

Deforestations

Wildfire

Any other threats identified:

1. What do you think your municipal government can do to address these threats?
   _____
   _____
   _____
   _____

2. What type of community climate change projects would you like to see implemented in your municipality/community?
   _____
   _____
   _____
   _____

IV. Municipalities policy and resource management plan

1. Does the municipality have any specific gender policies that are followed?
   ___ No
   ___ Yes; Please provide a copy?

2. Does your municipality have a Local Early Action Plan (LEAP) or Natural Resource Management Plan?
   ____ No
   ____ Yes; Please provide a copy

Annex 5: Project Prototype Examples

The below section provides a diagrammatic overview of some potential EDA sub-grant activities for the three thematic areas: DRR, food security and water security, as well as links to technical guidance documents that will be utilized by the specific technical support capacity provided to LAs.

DRR and Coastal protection

Rock Revetment

Rock revetments are conventional land protection structures that have been used extensively throughout the Pacific. A rock revetment is formed using a geotextile filter fabric placed on a formed backshore slope, overlain by a cushioning layer of small rock, and protected from wave energy by suitably large rock armour. The high porosity provided by the voids between the rock, together with the slope, provide a form of wave energy dissipation, reducing the reflected wave and wave overtopping

Rock armour slopes typically range from 1.5 (Horizontal (H)):1(Vertical (V)) to 3(H):1(V), with lower slopes requiring more construction material but enabling the use of smaller rock and resulting in less overtopping. The revetment should be extended sufficiently deep that the toe is not undermined by scour or erosion, and sufficiently high to reduce overtopping to tolerable volumes. Rock density makes a large difference in required size, with lighter rocks such as limestone (coral) requiring much larger sizes for similar wave height.

Figure 31: (Annex) Rock revetment at South Tarawa, Kiribati

Typically armour rock and underlayer should be sized to withstand design wave height (see Table 41). Geotextile should be used to limit loss of fine soil particle through the structure and should be wrapped into or beneath armour layers. The toe of the revetment should be designed to withstand scour by excavating and/or placing additional toe armour. Crest elevation should be set to limit overtopping to tolerable level for use and backshore material. The crest should be backed by impermeable wall, if below backshore level, by armour rock 3xD50 wide or by crown wall if crest is higher than backshore level desired. The structure should be protected from flanking by extending alongshore beyond areas of active erosion, by tying into adjacent non erodible structures or by landward return at moderate angle beyond likely extent of future erosion.

Table 41: (Annex) Design Considerations for Rock Revetment

Wave Height	Armour Layer			Underlayer			Toe Depth	Crest Width	Crest Freeboard	Minimal Return
			t_a (m)			t_a	h_e (m)	c_w (m)	h_c (m)	

H_s (m)	W_{50} (kg)	D_{50} (m)		W_{50} (kg)	D_{50} (m)	(m)	Reef	Sand		Ocean	Lagoon	Ls (m)
0.7	220	0.52	0.8	15	0.2	0.3	0.3	0.5	1.2	1.2	0.7	2
1.0	650	0.75	1.15	45	0.3	0.45	0.4	0.7	1.7	1.6	1.2	3
1.5	2200	1.1	1.7	150	0.45	0.7	0.6	1.1	2.6	2.3	1.4	5
2.0	5200	1.5	2.3	350	0.6	0.9	0.8	1.4	3.5	2.9	1.8	7

In terms of materials, 90% of the rock should have a density of at least 2,600 kg/m3 or as designed. The grading should be 0.5xW50 <W50 <2W50. The maximum rock dimension should not exceed 3x the minimum rock dimension. The rock should be free from visually observable cracks, veins, fissures, laminations, unit contacts, cleavage planes, or other such flaws that could result in breakage during loading, unloading, or placing. The rock generally should be visually clean and free from impurities such as clays and soils

The geotextile filter fabric should be a nonwoven, needle-punched, continuous filament polyester or polypropylene geotextile. An example of the geotextile to be used is Texcel® 900R or equivalent, approved by a supervising engineer. The fabric should be stored out of direct sunlight and not in contact with the ground. Fabric which is torn or punctured should not be used. Below is an example design of a rock revetment (Figure 32 and Figure 33).

Rock revetments have been demonstrated to reduce costal erosion and protect against coastal inundation[246]. They also have lower space requirement than other coastal defences, resulting in potential cost savings compared to other coastal defence infrastructure. The increased security provided by such infrastructure also maintains economic value of the adjacent coastal areas[247], and with proper maintenance can be extremely long-lived[248]. Rock revetments also allow for less technologically advanced designs to be implemented using local knowledge and craftsmanship, with comparatively lower investment costs, and can be used in conjunction with other coastal protection technologies such as beach nourishment and ecosystem-based adaptation[249]. Rock revetments were used with success on Tongatapu (Tonga), a limestone island with similar characteristics to many islands in FSM. Here, rock revetments protected local communities from storm surges through reduced inundation and coastal erosion[250].

[246] Linham & Nicholls. 2010. Technologies for Climate Change Adaptation: Coastal Erosion and Flooding.
[247] Nicholls et al. 2007. The management of coastal flooding and erosion. In: Thorne et al. (eds.). Future Flood and Coastal Erosion Risks.
[248] Dean & Dalrymple. 2002. Coastal Processes with Engineering Applications.
[249] Mauritius & UNEP RISOE Centre. 2012. Technology Needs Assessment for Climate Change Adaptation and Mitigation.
[250] GCCA+ SUPA. 2020. Report: Community-based impact assessment in Eastern Tongatapu.

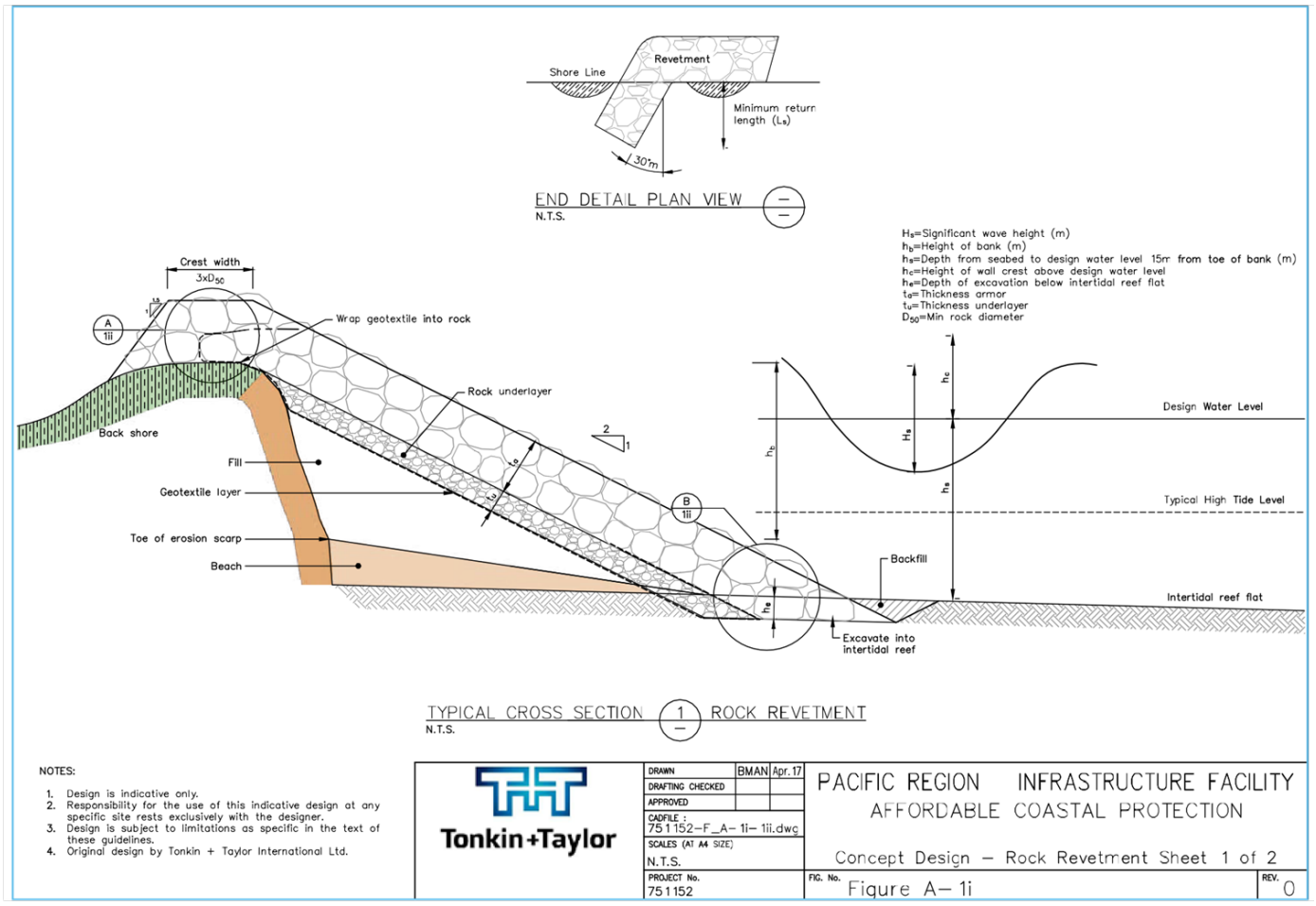
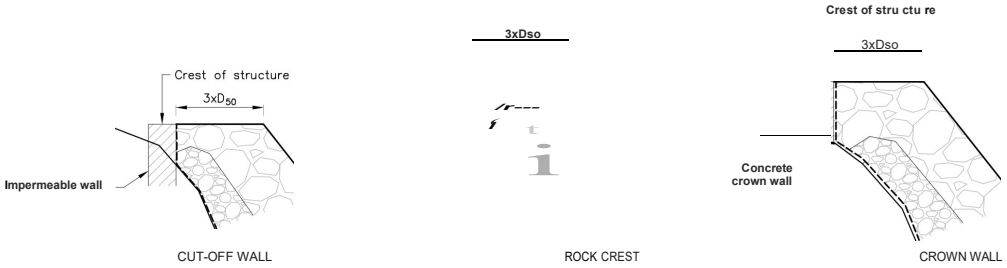


Figure 32: (Annex) Rock Revetment Example Design



TYPICAL DETAILS A CREST DETAILS
N.T.S. 1i

TYPICAL DETAILS B TOE DETAILS
N.T.S. 1i

1. Design is indicative only.
2. Responsibility for the use of this indicative design at any specific site rests exclusively with the designer.
3. Design is subject to limitations as specific in the text of these guidelines.
4. Original design by Tonkin + Taylar International Ltd.

Tonkin+Taylor

Tonkin & Taylor International LTD.

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SCALES (AT A4 SIZE)

PACIFIC REGION INFRASTRUCTURE FACILITY
AFFORDABLE COASTAL PROTECTION

Concept Design - Rock Revetment Sheet 2 of 2

Figure 33: (Annex) Rock Revetment Example Design cont.

Offshore Structures

Offshore structures protect the shoreline by reducing the wave energy arriving at the shore and rotating incoming wave crests. On a sandy coast, this can reduce longshore drift gradients and encourage sand deposition in the lee of the structure. Offshore structures may be emergent, partially emergent or submerged. Submerged and semi-submerged structures act by breaking or refracting the waves rather than absorbing or reflecting them to dissipate energy. While less visually intrusive, they are less effective than emergent structures, particularly during high water level and wave conditions that can result in beach erosion. Structures may be constructed from rock, pre-cast concrete armour units or geosynthetic containers and must be stable under wave attack while also reducing transmitted wave energy to a desirable level.

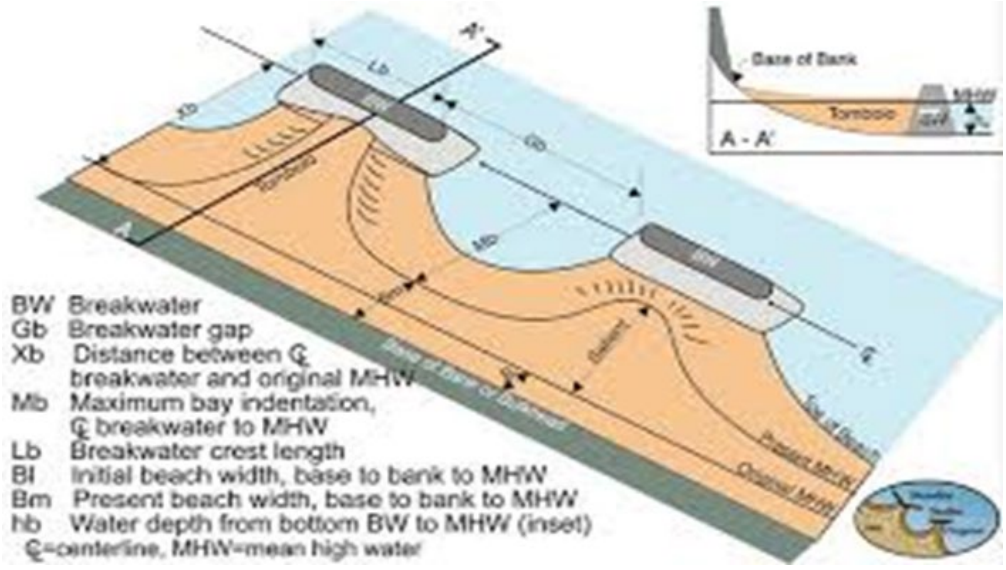


Figure 34: (Annex) Example Breakwater Design Parameters

Detached offshore breakwaters were used with success on Tongatapu (Tonga), a limestone island with similar characteristics to many islands in FSM. Here, detached breakwaters were successful in providing a similar level of protection to rock revetments, but at a much reduced cost[251]. Prior to project implementation (2014), over-topping of the beach during extreme high tide and storm surge events occurred 2–3 times per year, resulting in debris landing on the adjacent road and normal high tides reaching the road foundation. By 2021, the detached offshore breakwaters had resulted in a 10–30 m buffer of land and beach in front of the road, with over-topping no longer occurring. In addition, co-benefits such as enhanced amenity, aesthetics and beach access for local communities were realised. Such offshore breakwaters have also been found to present opportunities for positive ecosystem benefits in the Pacific. Submerged breakwaters function as fish habitats by adding three-dimensional complexities and thus increasing local fish density and biomass, while also providing substrates and associated conditions for recruitment, growth, and survival of coral comparable to those on adjacent reefs[252]. For the detached offshore breakwaters used in Tonga, adjacent communities did not report any impacts on their abilities to catch fish or gather seafood in response to assessment questionnaires specifically requesting information on such impacts[253].

[251] GCCA+ SUPA. 2020. Report: Community-based impact assessment in Eastern Tongatapu.
[252] Stender et al. 2021. Evaluating the feasibility and advantage of a multi-purpose submerged breakwater for harbor protection and benthic habitat enhancement at Kahului Commercial Harbor, Hawai'i: case study. SN Applied Sciences 3: 167.
[253] GCCA+ SUPA. 2020. Report: Community-based impact assessment in Eastern Tongatapu.

Ecosystem Based Adaptation – Mangrove Replanting

Ecosystem-based approaches (EbA) aim to protect the shoreline from wave-induced erosion by maintaining healthy ecosystems. This may include the following:

i. Establishment of offshore vegetation, such as mangroves, to dissipate wave energy before it reaches the shoreline and traps fine sediment, while maintaining habitats for juvenile fish and marine species;

ii. Establishment of backshore vegetation to reduce wave run-up extent and damage potential, trap wind-blown sand, and improve ecological connectivity between land and sea; and

iii. Improvement of coral reef health to ensure coral production is maintained

Protection and restoration of natural defences such as mangrove ecosystems can play a vital role in coastal protection and DRR. There are two main EbA functions that are relevant to coastal vegetation: reducing coastal erosion from storm surge/cyclones and protection of coastal inhabitants from loss of livelihoods and life – the 'bio shield' function

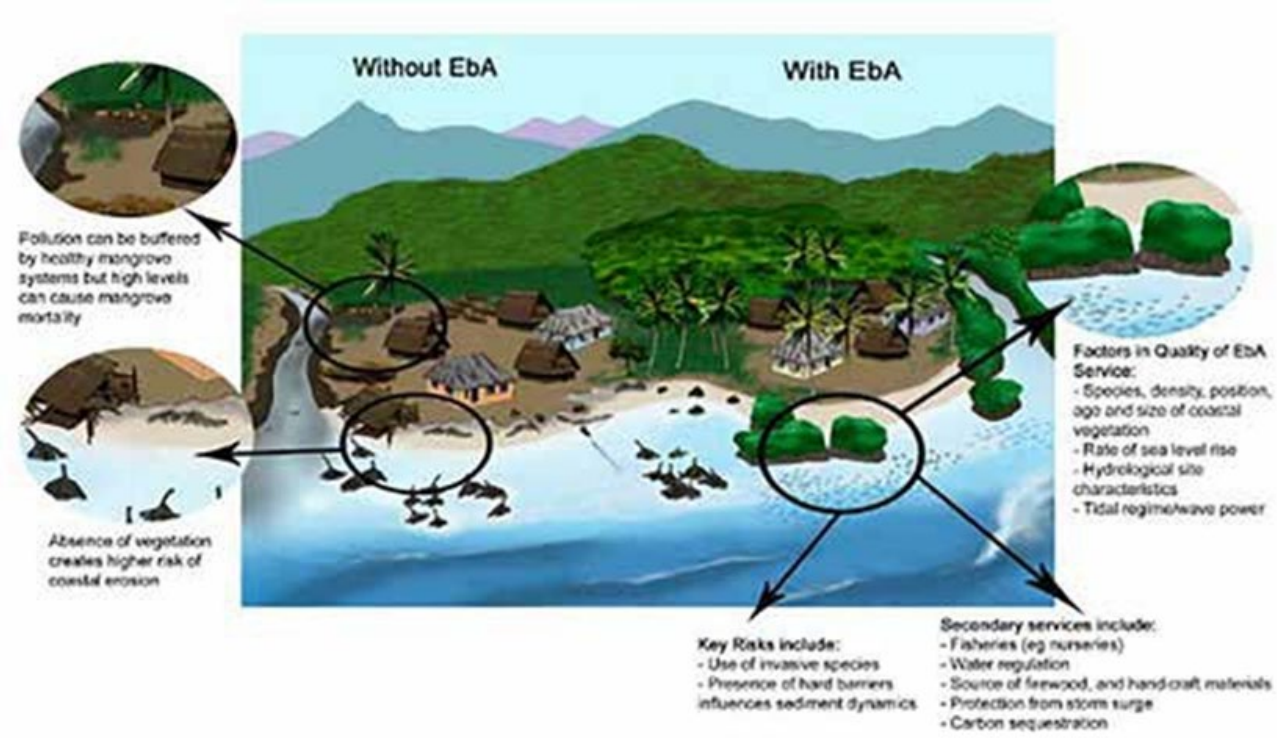


Figure 35: (Annex) Concept sketches of the use of EbA to reduce the effects of coastal erosion and flooding

In addition to provisioning services, mangrove ecosystems also provide protection against storm surges, typhoons, and other natural disasters and contribute to adaptation by mitigating against beach erosion and buffering wind and waves during storms. Mangroves can reduce wave impact or erosion by trapping sand. Mangrove planting as a coastal protection mechanism has occurred throughout the Pacific. It has been observed that replanting of mangroves in Fiji and Kiribati has been less successful in areas without soft sedimentary mud, and that juvenile mangroves should be planted in low wave energy zones. However, mangrove rehabilitation in FSM has been demonstrated to have more differential responses to sediment accretion, indicating more potential for

rehabilitation[254]. Coastal wetlands are effective at reducing erosion in low energy environment, but less so in high energy environments. Vetiver grass can be used as bank protection on shorelines exposed to wind waves, though care needs to be taken during the planting process.

Mangroves have been demonstrated to provide considerable DRR and associated co-benefits across the world (see the comprehensive review by McIvor et al., 2016)[255]. This includes reducing risk from climate change-related coastal hazards such as waves, storm surges and cyclones by decreasing flood depths and wave heights, thereby minimising damage to economic assets protected by mangrove forests[256,257]. A study of mangroves in FSM showed consistent sediment accretion in Kosrae and Pohnpei, indicating that similar benefits can be expected to result from mangrove restoration in FSM[258]. Degradation of mangrove habitats in FSM are leaving shorelines more vulnerable to storm surges, with significant impacts on ecosystem services – including disruption of fish spawning sites and coral reef degradation – as well as direct risks to communities vulnerable to storm and tidal surges[259].

Figure 36: (Annex) Mangrove planting for coastal protection in Tuvalu

FOOD SECURITY

[254] Krauss et al. 2010. Surface Elevation Change and Susceptibility of Different Mangrove Zones to Sea Level Rise on Pacific High Islands of Micronesia. Ecosystems 13(1): 129–143.
[255] McIvor et al. 2016. Coastal Defense Services Provided by Mangroves. In: World Bank. Guidelines for Measuring and Valuing the Coastal Protection Services of Mangroves and Coral Reefs.
[256] Mazda et al. 2006. Wave Reduction in a Mangrove Forest Dominated by Sonneratia Sp. Wetlands Ecology and Management 14(4): 365–378.
[257] Quartel et al. 2007. Wave Attenuation in Coastal Mangroves in the Red River Delta, Vietnam. Journal of Asian Earth Sciences 29(4) 576–584.
[258] Krauss et al. 2010. Surface Elevation Change and Susceptibility of Different Mangrove Zones to Sea Level Rise on Pacific High Islands of Micronesia. Ecosystems 13(1): 129–143.
[259] Ramsay et al. 2014. Kosrae Shoreline Management Plan; Repositioning for Resilience. Kosrae.

Alternative Farming Systems

The ITTA-ALLEY agro-forest garden system is a multi-layered system containing diverse food plants such as fruit and nut trees, vegetables and root crops. It aims to conserve and restore the land and its biodiversity thus protecting them from further degradation. The garden system was designed in the Solomon Islands and is based on ecological and biological principles, often using patterns that occur in nature to maximize effect and minimize work

The ecological processes of plants, animals, their nutrient cycles, climatic factors and weather cycles are all part of the system. Elements in a system are viewed in relationship to other elements, where the outputs of one element become the inputs of another. Within the system, work is minimized, “wastes” become resources, productivity and yields increase, environments are restored and costs are lowered.

The system is appropriate for physical conditions which have been susceptible to climate change. In Ontong Java in the Solomon Islands, agricultural land is limited and moderately sustainable and potential in relation to food production. In addition, it is susceptible to climate change especially sea level rise. The idea behind the farming system is that it is permanent, self-mulching, self-sustaining and self-regenerating, and that it can provide a good source of food to the community. The system is a multi- layered system of fruit and nut trees, vegetables and root crops. Figure 37 below shows an example of a plot utilizing the ITTA-ALLEY agro-forest garden system, in Ontong Java and Table 42 identifies the types of crops which are cultivated

At maturity, the two subcomponents (ITTA and ALLEY) operate simultaneously to create a single holistic system functioning in a manner that resembles both forest shade gardening and sunlight gardening.

The crops environmental and agronomic requirements dictate their placement in their positions in the two components in the farm. Their placement enables the system to fully utilize all available ground and air space, sunlight and canopy shade and ground water and soil nutrients.

Placement of leguminous tree species in selected positions throughout the farm enhances crop synergism providing nitrogen to associate non-leguminous crop species because of their ability to fix nitrogen. Preferable fast-growing leguminous species are established in hedgerows spaced 6 m apart in the alley component. The trees are periodically pruned and managed during the cropping phase to prevent shading of the companion crops. The pruning of foliage and young stems are incorporated into the soil as green manure or used as mulch. Some portion of the tree foliage can be harvested and fed to livestock, particularly small ruminants.

Alley farming parallels bush-fallow systems in the sense that tree foliage is used to maintain and improve soil fertility. However, land-use efficiency is higher in the ALLEY because cropping and fallow are carried out on the same plot of land, at the same time. The whole ITTA-ALLEY farm system operates holistically and consequently achieves sustainable nutrient cycle.

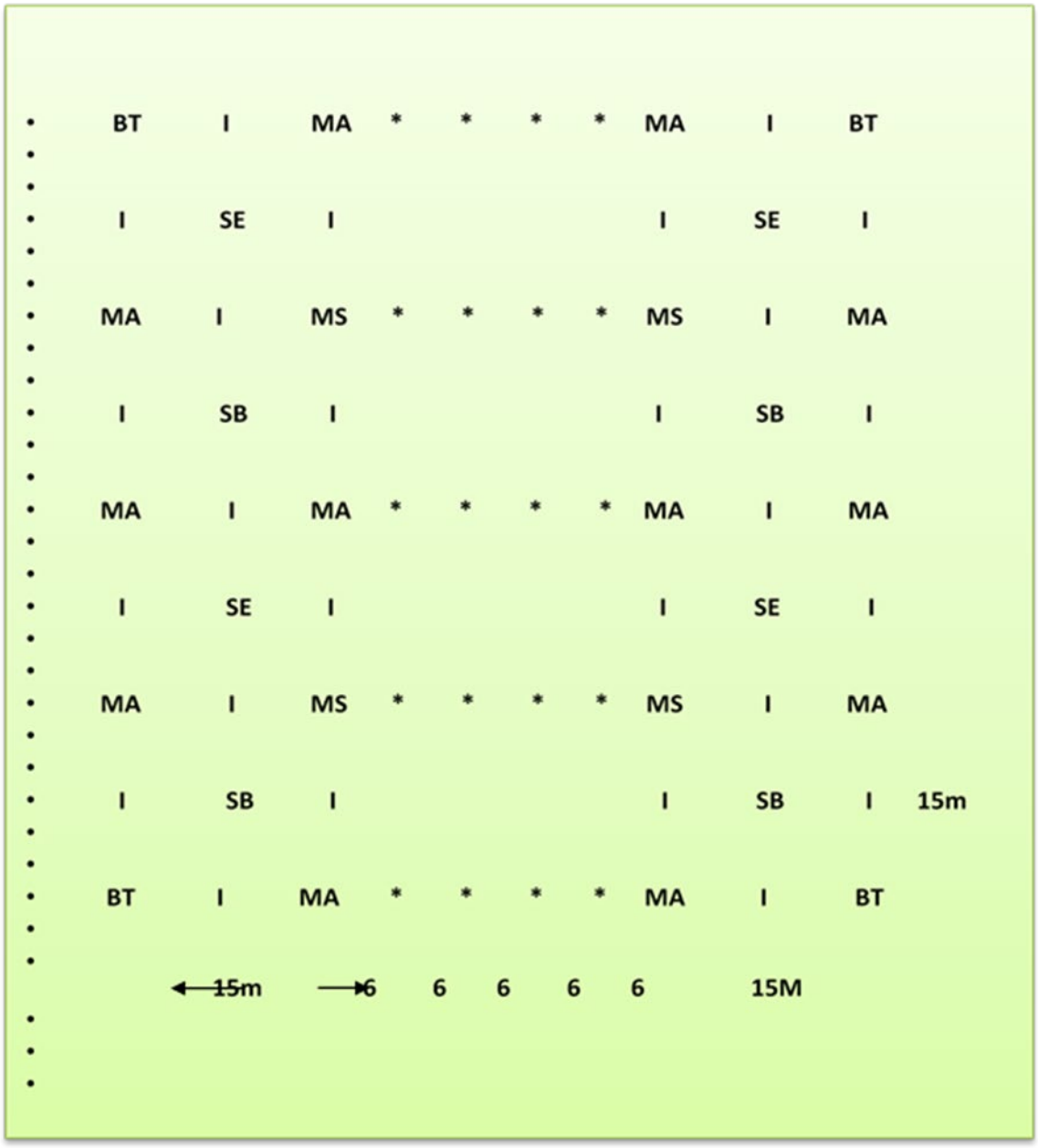


Figure 37: (Annex) Plot Design of ITTA-ALLEY

Table 42: (Annex) Crops selected for use in ITTA-ALLEY Farming System

Common Name	Botanical Name	Symbol
Alite	Terminalia catapa	BT
Polynesian Chestnut	Inocarpus fagiferus	BI
Breadfruit	Artocarpus altilis	MA
Funny face	Spondius cyathera	MS
Local avocado	Burkella obovata	SB
Malay apple	Eugenia malascensis	SE
Cut nut (round)	Barringtonia procera	IBE
Kingtree	Gnetum gnemon	IG

Swamp taro	Cyrtosperma chamissonis	
Giant Taro(Stem taro)	Alocasia	
Kongkong Taro	Xanthosoma	
Sweet taro (Santa Cruz Taro)	Colocasia esculentum	
Elephant Yam	Amophophallus campanulatus	
Pacific Yam	Dioscoria numularia	
Banana	Musa sp (some varieties)	B
Pawpaw	Carica papaya	
Pumpkin	Cucurbita pepo	
Coconut	Cocos nucifera	
Cassava (some varieties)	Manihot esculenta	C
Kumara (some varieties)	Ipomoea batatas	K
Lusina	Leucaena leucocephala	*

Agricultural Irrigation Systems

Drip irrigation is a method which allows water to drip slowly near the roots of plants utilizing a network of valves and pumps. Drip irrigation has proved to be valuable approach to addressing climate change concerns as is it relates to agriculture. Micro-irrigation is a method with lower pressure and flow than a traditional sprinkler system. Low volume irrigation is used in agriculture for row crops, orchards, and vineyards. It is also used in horticulture in wholesale nurseries, in landscaping for civic, commercial, and private landscapes and gardens, and in the science and practice of restoration ecology and environmental remediation.

Micro irrigation is quite appropriate for many small island developing states as less water is required, and reduced pumping means reduced cost of energy. Micro irrigation has been used in many small island states as an effective measure to address water shortages due to climate change.

Micro-irrigation has been successful in many small island states. In Cape Verde's Santiago Island (home to 50% of Cape Verde's population and most important agricultural centre), the Longueira and Covoada communities are highly dependent on livestock and rain-fed small scale agricultural farming. Increased incidences of droughts and variable rainfall have led to unreliable water access from springs and severely eroded agricultural lands.

The communities were able to farm even during droughts by installing micro-irrigation systems, constructing a 50 m^3 water tank in Longueira, rehabilitating a community well in Covoada and using drought-tolerant species with high market value to restore their agricultural lands. Increased water availability and agricultural reliability have resulted in increases in average monthly incomes ranging from 258–1,115%. While the male farmers' monthly incomes increased from USD 89 to USD 319 (+258%), the average income of the women farmers soared from USD 26 to USD 315 (+1,115%).[260]

Micro irrigation systems range from those simple in design (Figure 38) to those which are more complex in design (Figure 39 and Figure 40).

[260] Community-Based Adaptation in Small Island Developing State, and Mekong-Asia-Pacific Regions

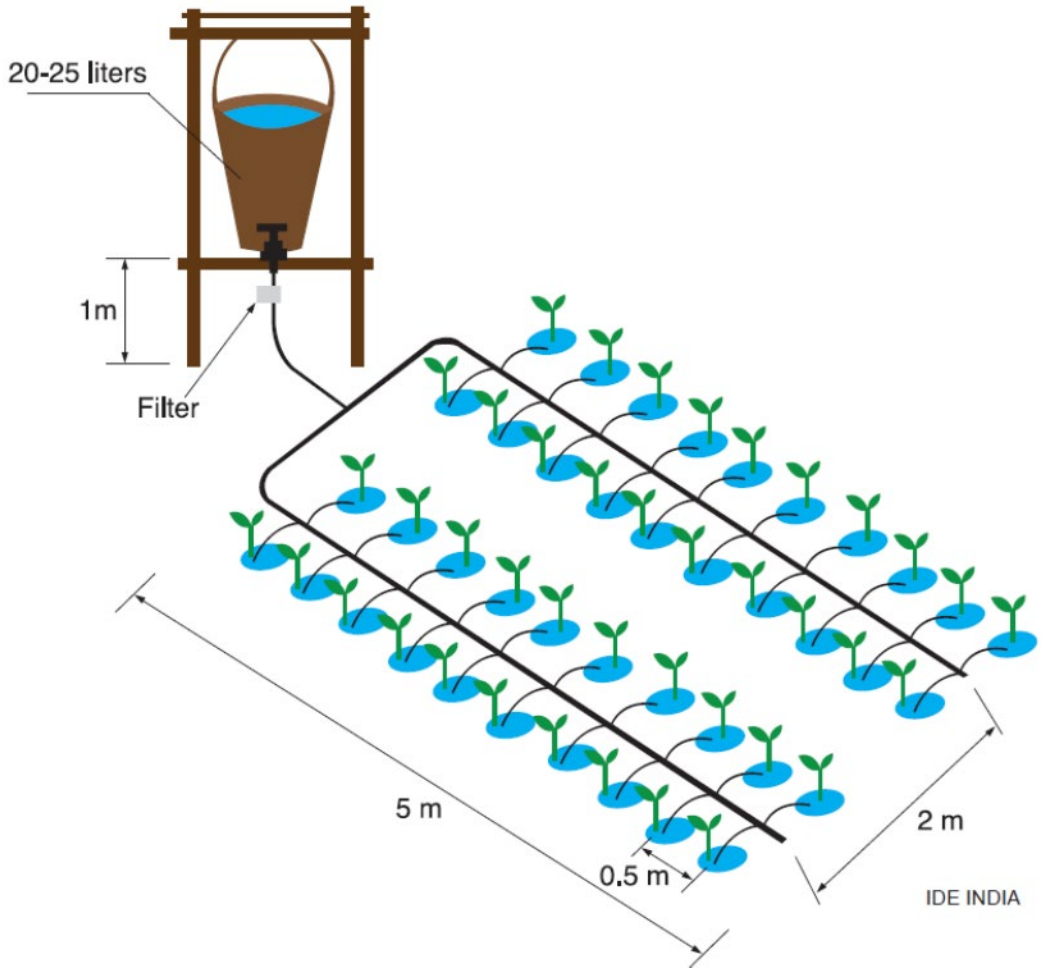


Figure 38: (Annex) Simple Drip Irrigation System

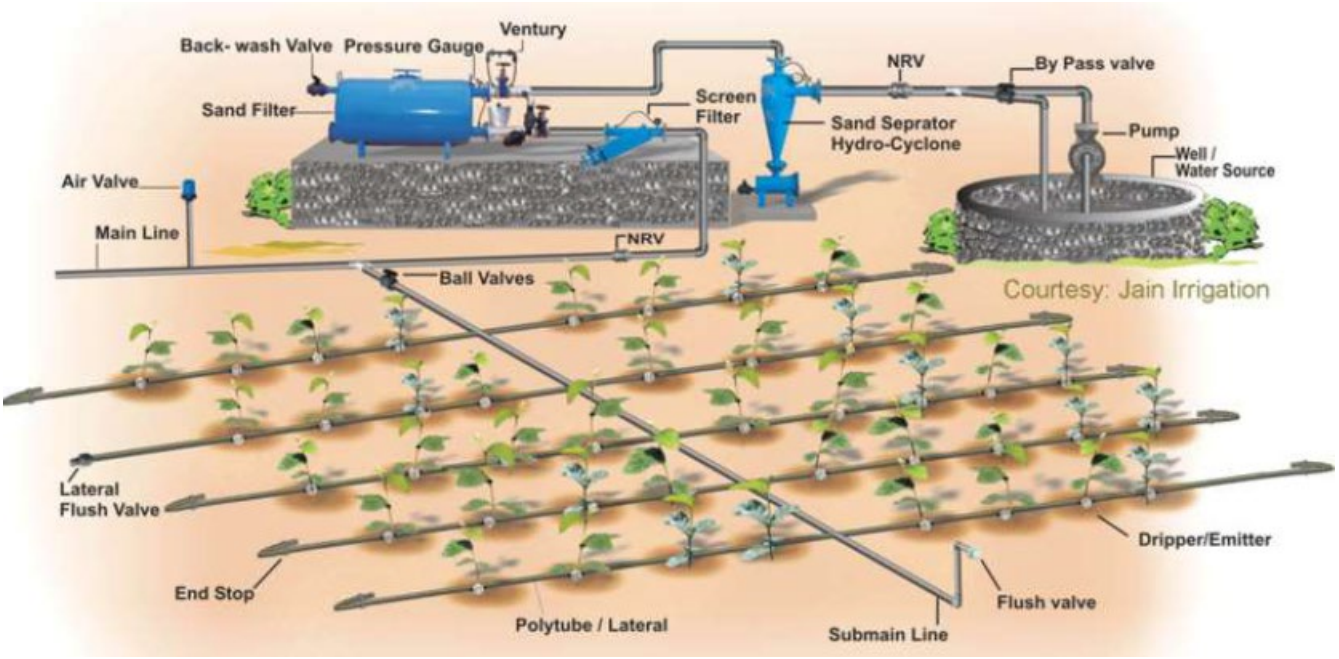


Figure 39: (Annex) Micro-Irrigation System - Example 1

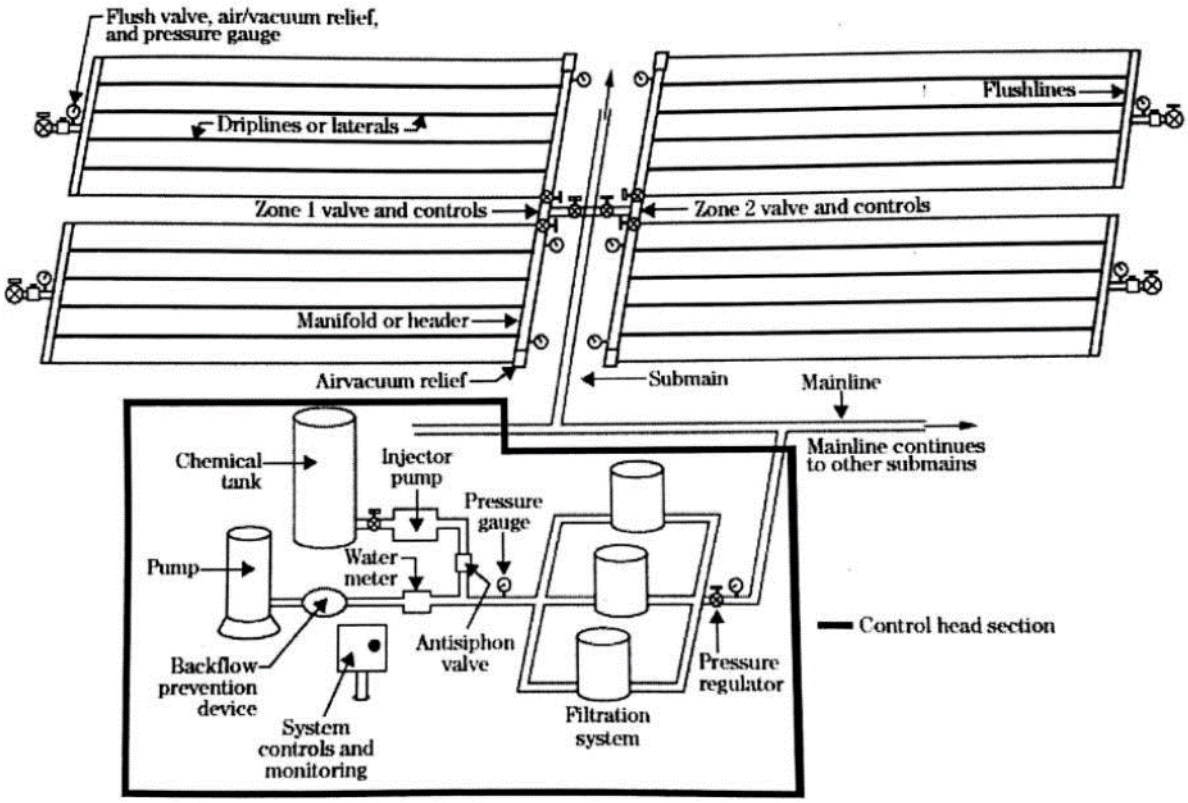


Figure 40: Micro-Irrigation System - Example 2

Livestock production and management systems

An adaptation such as the modification of production and management systems involves diversification of livestock animals and crops, integration of livestock systems with forestry and crop production, and changing the timing and locations of farm operations[261] (IFAD, 2010).
Diversification of livestock and crop varieties can increase drought and heat wave tolerance and may increase livestock production when animals are exposed to temperature and precipitation stresses. In addition, this diversity of crops and livestock animals is effective in fighting against climate change-related diseases and pest outbreaks.
Agroforestry (establishing trees alongside crops and pastures in a mix) as a land management approach can help maintain the balance between agricultural production, environmental protection and carbon sequestration to offset emissions from the sector. Agroforestry may increase productivity and improve quality of air, soil, and water, biodiversity, pests and diseases, and improves nutrient cycling.

Surveillance and information systems to support coastal fisheries adaptation

The development of a national surveillance, prediction and information system dedicated to climate variability and change impacts on the coastal and marine environment helps to inform adaptive fisheries and aquaculture management. It examines the status of coastal and inshore fisk stocks, strengthens control mechanism of the fish sites and resources and fishing activities. Early warning systems, climate-induced disaster risk reduction and preparedness plans also allow for adaptive management of the coastal fisheries sector.

WATER SECURITY

Solar Water Pumping

Depending on the ultimate site selections and end use applications/needs for the sub-grants there can be a number of different solar PV water pump technologies deployed. The World Bank, SIDS Partnership, Pacific Power Association (PPA) and the Sustainable Energy Industry Association of the Pacific Islands (SEIAPI) published a specific best practice guidance document for designing, selecting, and installing solar water pumping systems in Pacific Island contexts including FSM.[262] While the specific selection and design considerations will be tailored to the sub-grant sites, general technology considerations and specifications from the guidance document are summarized below.

[261] IFAD (International Fund for Agricultural Development), Livestock and climate change (2010)
[262] World Bank Group, "Solar Water Pumping Systems: System Design, Selection, and Installation Guidelines" (2019)

Both AC/DC solar water pumps will be considered by the project (see basic system configurations in Figure 41).

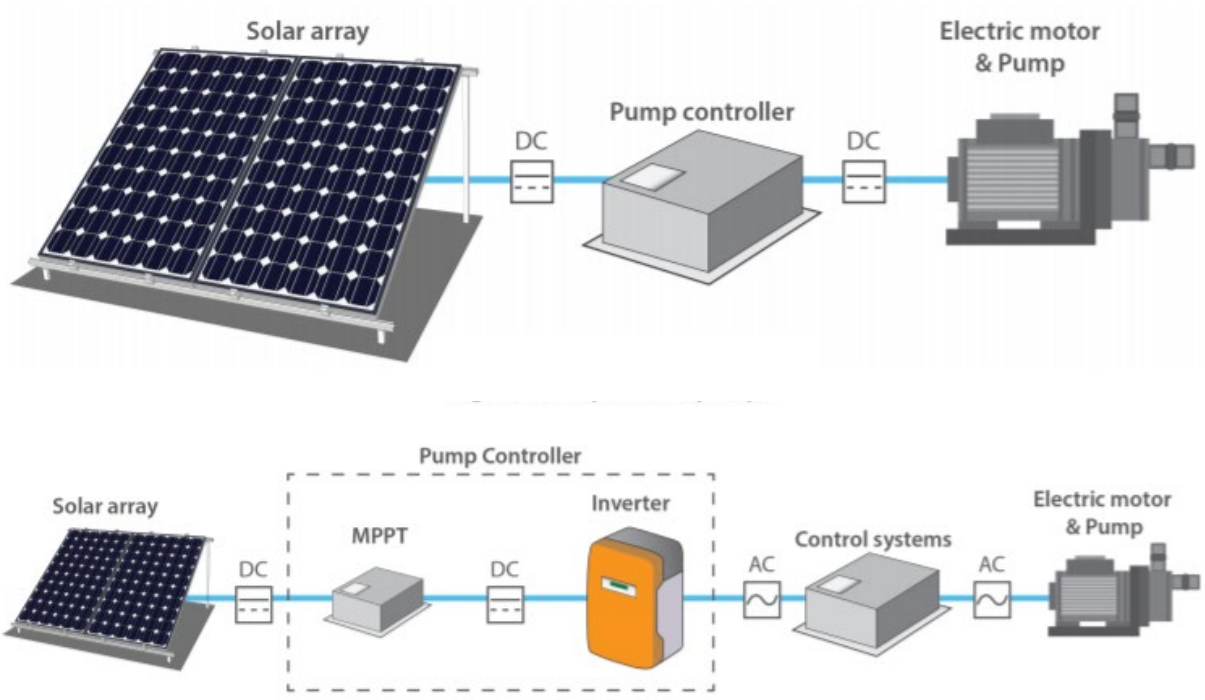


Figure 41** (Annex): **Basic DC (top) and AC (bottom) Solar Water Pump Configurations

In general, there are three main types of solar water pumping systems: borehole/well (submersible) pumps, surface pumps, and floating pumps. Floating pumps are unlikely to be applicable given context applications in FSM and the Pacific, so sub-grants will include only borehole/well (submersible) pumps and surface pumps.

Borehole systems will be the target for some communities where groundwater resources are needed. In these systems the solar water pumps are inside boreholes or wells and are available for 100 mm (4 inch) and 150 mm (6 inch) boreholes, both of which will be effective for the small-scale applications in the target LAs. The solar array is typically located near the top of the borehole/well and the water is generally pumped to a storage tank. The pump intake should be a minimum of 1 m (39 inches) above the bottom of the borehole or well and the top of the pump shall be below the drawdown level by at least 1 m (39 inches). These will need detailed site assessments both for technical engineering design on characteristics like drill depth, head, flow, piping, etc., but also for E+S considerations to ensure that the systems are designed and operated in a way that will support long-term viability of the solutions while minimizing risks to communities and the environment. An overview of the borehole pump setup can be seen in Figure 42.

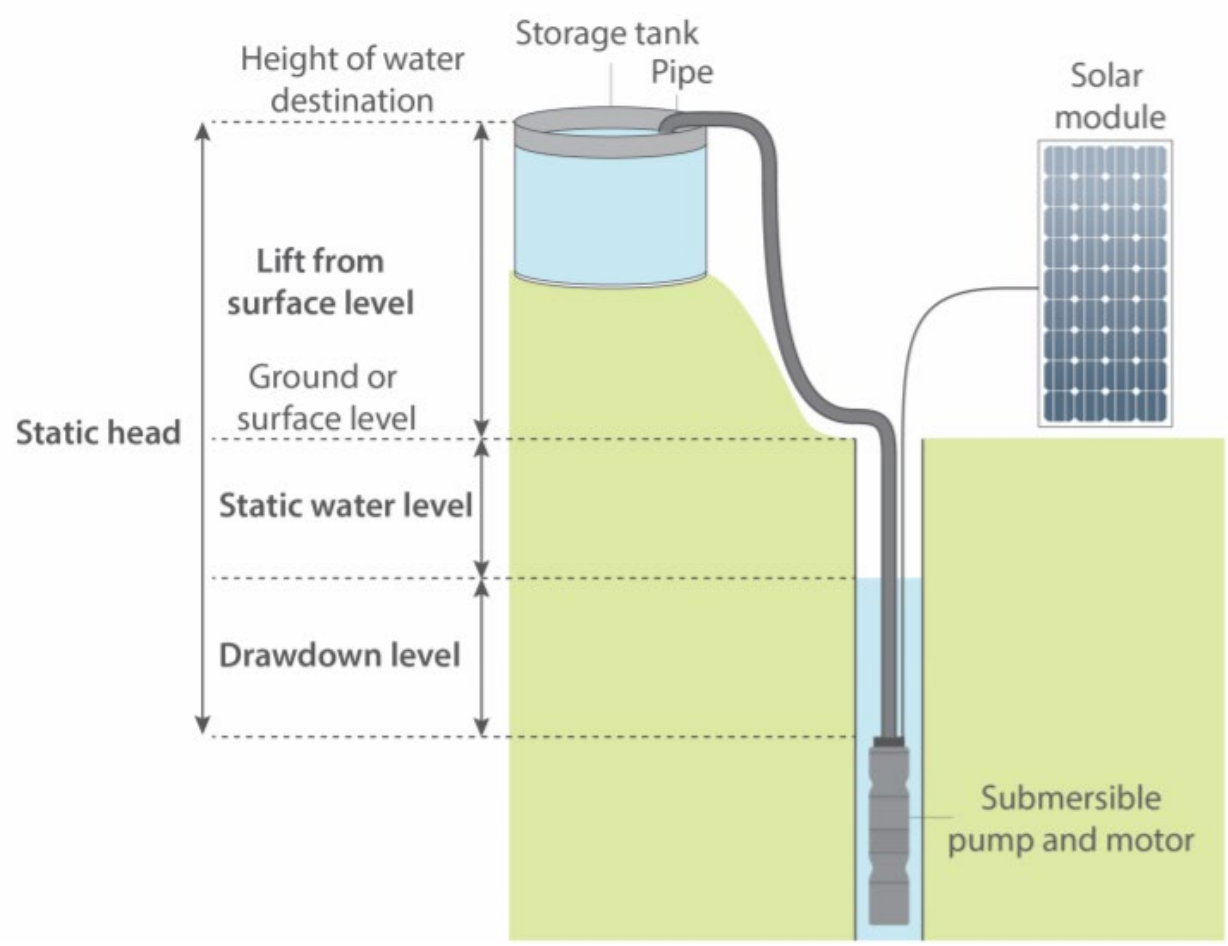


Figure 42** (Annex)**: Borehole PV Pump System

Surface pump systems are typically used in shallow wells or boreholes and other surface water sources. The solar water pump is located above the water level and a suction pipe is used for drawing the water from the water source. Surface pumps have a specified maximum suction head. This is typically no greater than 8 m (26 feet) but often only from 6.5 m (21 feet) to 7.5 m (24 feet). In FSM, these pumps can be installed beside rivers and streams, though flooding may present a serious risk. An overview of the system can be seen in Figure 43.

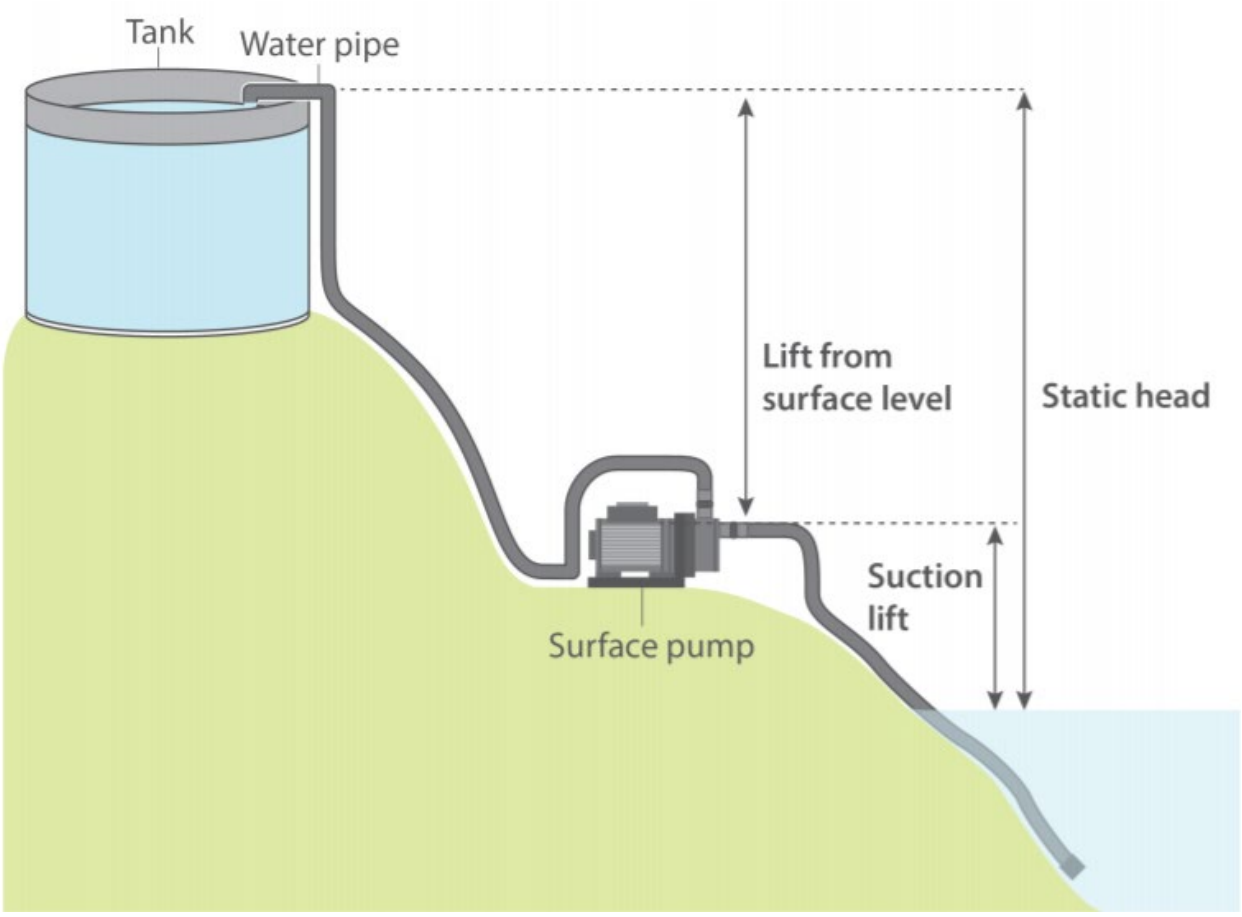


*Figure 43 (Annex): **Surface Water PV Pump System***

There will be two main types of pumps deployed for the PV water pump systems. The first type are roto-dynamic pumps (most commonly centrifugal pumps. These types of pumps transfer the energy of the pump to the water by a rotating component of the pump (i.e. an impeller, propeller or rotor). Sub-categories of roto pumps considered for the EDA programme can be seen in Figure 44.

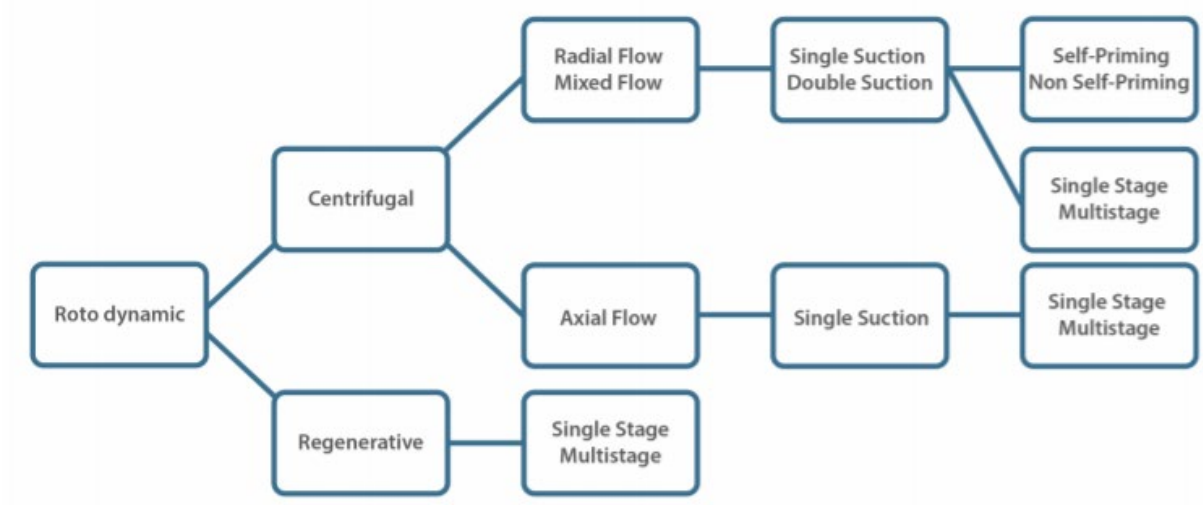


Figure 44 (Annex): Classifications of Roto-Dynamic Pumps

The second type of pumps are positive displacement pumps. Positive displacement pumps draw water into a chamber and then expel it through pressure actuated valves. Sub-categories of positive displacement pumps are shown in Figure 45.

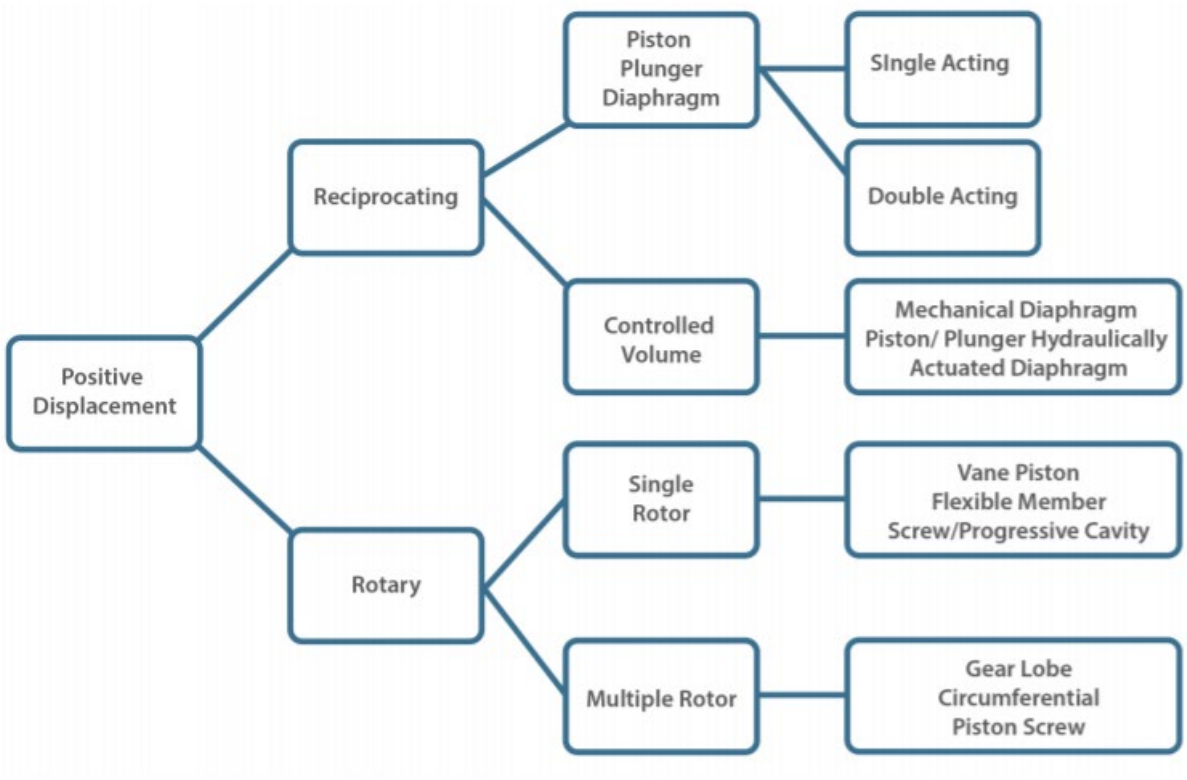


Figure 45 (Annex): Classifications of Positive-Displacement Pumps

As stated previously specific pumping designs and technology selections will be made based on the specific context and needs of the sub-grant sites. Per the guidance document a general process for designing and selecting solar water pumping systems is as follows:

1. Conduct a site visit to:
    a. Determine the water source and, based on the characteristics of the water source and the water's end usage, select the appropriate solar water pumping system to be installed.
    b. Determine the daily or weekly water requirement and verify that the water resource availability over the long term can meet the requirements.
    c. Determine where the solar array will be located.
    d. Determine where the water pump will be located.
    e. Determine the length of cables required between the solar array, pump controller and water pump.
    f. Determine where and how the water will be stored.
    g. Measure the static head for the site.
    h. Measure the total distance from the water source to the final location of the water.
    i. Determine and measure any land irregularities (hills, ditches, etc.) that the piping system must traverse.
2. Determine the solar irradiation for the selected site on an annual and a monthly basis.

3. Select the size and type of the water pipe to be used to transfer the water from the source to its storage tank or its final destination if there is no storage tank.
4. Make an estimate of the expected dynamic head and select a possible solar water pumping system using either manufacturers' tables or an appropriate computer programme, accounting for available solar irradiation. This will then provide information on the maximum flow rate.
5. Use the estimated maximum flow rate and calculate the frictional losses (flow friction head) and determine the dynamic head.
6. Choose a type of pump consistent with the quality of the water being pumped and the overall characteristics of the site (especially the particulate content of the water such as mud or coral sand).
7. With the final calculated dynamic head finalise the selection of the solar water pumping system from either manufacturer's tables or a computer programme.

The EDA programme will deploy specific technical assistance and expertise to support solar water pumping projects. This support will leverage solar CASS software or equivalent and the specific methodology and detailed example calculations from the guidance document including for the solar irradiation, solar array orientation, the selection and rating of pipes, friction within pipes, flow rates, size of water pipes, dynamic head, velocity head, suction head, installation and securing of systems, etc.

Rainwater Harvesting

The South Pacific Applied Geoscience Commission (SOPAC) and the Secretariat of the Pacific Community (SPC) commissioned a guidelines document for rainwater harvesting in the Pacific in 2004[263] which was expanded on by a later document focusing on rainwater harvesting in the Caribbean from UNEP and the Caribbean Environmental Health Institute[264]. Both of these documents provide practical step by step methodologies for designing and sizing rainwater harvesting systems in island communities and will serve as guidance for rainwater harvesting sub-grants in the EDA programme.

Rainwater catchment systems consists of four major components:

1. **Catchment area:** Commonly a roof surface or pavement. Concrete and other impervious pavements may be used for multiple-user community systems.
2. **Conveyance system:** Network of guttering and pipes to transfer the rainwater from the catchment to the storage tank. This consists of connections to one or more down-pipes connected to the roof gutters.
3. **Storage device:** A tank situated above, underneath or partially below the ground.
4. **Distribution system:** In the most basic case, this can be simply a container to extract the water from the storage tank or a pipe functioning solely as an outlet. For a household, this will be the piping network that supplies the building with the harvested water. For a community RWH system, this could be a single outlet pipe or a network of pipes serving multiple users. A pump may be used to transmit the water throughout the distribution system (see Figure 46).

[263] SOPAC/SPC, "Harvesting the Heavens: Guidelines for Rainwater Harvesting in Pacific Island Countries" (2004)
[264] UNEP/CEHI, "Handbook for Rainwater Harvesting for the Caribbean" (2009)

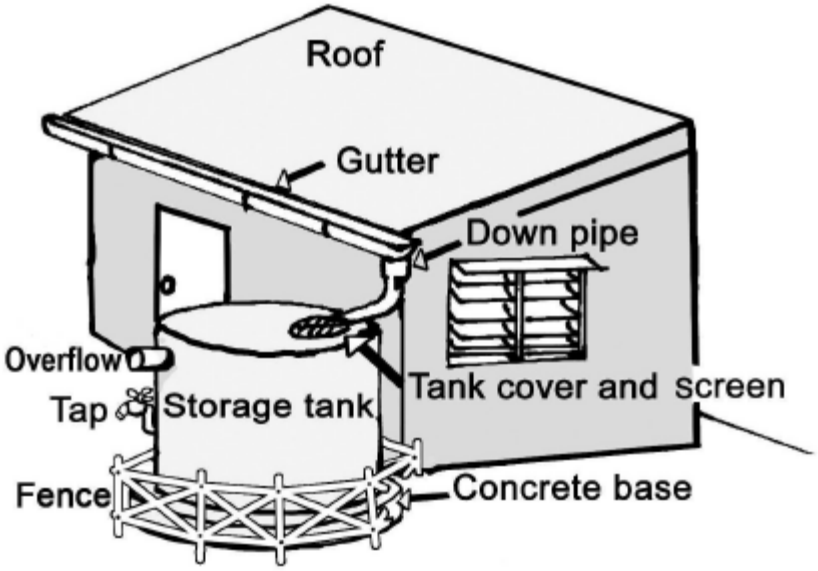


Figure 46** (Annex): **General Diagram for Rainwater Harvesting

Roofs in the Pacific are generally corrugated galvanized steel sheets, but the specific material will affect the sizing of systems through the materials' specific runoff coefficients. For steel sheets, the runoff coefficient is 0.8 – 0.85.

The delivery systems can be a range of different methods depending on the context. Gutters and downpipes can be utilized for community structures and individual households. A general sizing guide is included in Table 43.

Table 43** (Annex): **Sizing Guide for Gutters and Downspouts

Roof area (m2)	Gutter width (mm)	Minimum diameter of downpipe (mm)
17	60	40
25	70	50
34	80	50
46	90	63
66	100	63
128	125	75
208	150	90

Filtration screens can be added to improve the quality of stored water and prevent debris from entering the storage tanks. Flushing devices can also be used to remove contaminants and make the water better to drink. The Pacific Guidance suggests two different methods for flushing devices in rainwater harvesting systems in the Pacific: a manual method and a semi-automatic method. In the manual method the downpipe system is manually moved away from the tank inlet to be flushed. The semi-automatic method utilizes a separate vertical pipe serves as a "T" junction in the downpipe (see Figure 47).

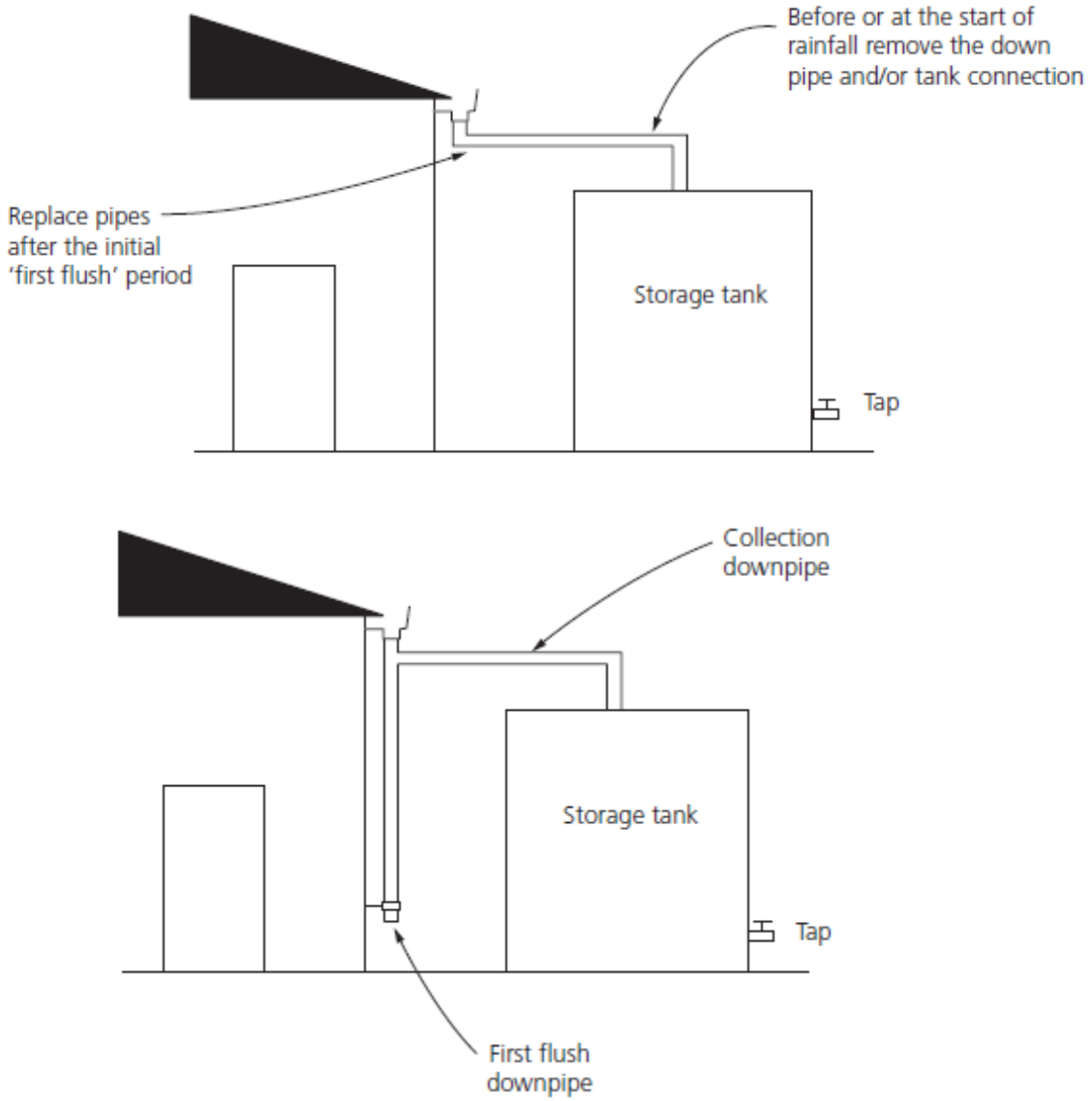
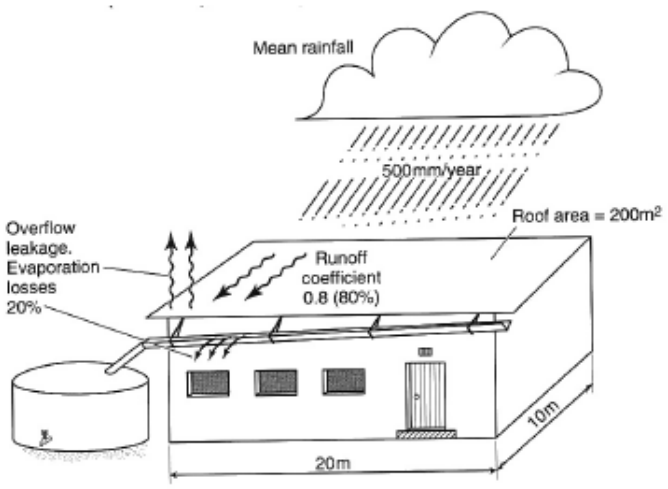


Figure 47 (Annex) a) Manual Flush method b) Semi-automatic method

Storage tanks are generally the most difficult part of the catchment systems and need to be tailored extensively to local context and needs. Both underground and above ground tanks will be considered, but below-ground will obviously come with additional E+S and cost considerations. There are a variety of tank types (ferrocement, concrete, galvanized steel, polymer-coated steel, HDPE, fiberglass, brick and blockwork, wood, etc.) that will be considered per the Pacific Guidance document. Generally, systems are around 1,200 gallons, but should be sized for 20% overcapacity.

The maximum yield of rainwater runoff from any system is dependent upon two variables: the rainfall amount and the size of the catchment area. In practice, the total yield will also be determined by the collection efficiency (runoff coefficient) and storage capacity of the system.



$S = R \times A \times Cr$

Where: S = mean rainwater supply in litres (l)

R = mean annual rainfall in millimetres (mm)

A = catchment area in square meters (m^2)

Cr = runoff coefficient (volume of runoff/volume of rainwater)

Figure 48** (Annex): **Runoff Sizing for Rainwater Catchment Systems

Sizing of tanks and pipes will be based on household and community water needs which will be determined from detailed surveys of target households. Rainfall availability will be determined using State rainfall availability broken out weekly or daily where possible. From there, simple table calculations for water deficit beginning with the wettest month will be used to help guide system sizing. The storage volume required is found by examining column F in the table. If no water is allowed to overflow the tank, the storage volume required will be equal to the highest value in column F. The absolute minimum storage volume is found by taking this highest value and subtracting the amount left in storage at the end of the year. The actual tank capacity will need to be greater than the minimum storage volume calculated in order to allow for the 'dead storage' space below the outlet and air space above the overflow to the tank. Fully worked examples can be seen in the guidance document. In some cases, rainwater harvesting systems will also employ pumping systems as outlined in the PV water pump systems.

Table 44 (Annex): Simple Water Deficit Table Structure

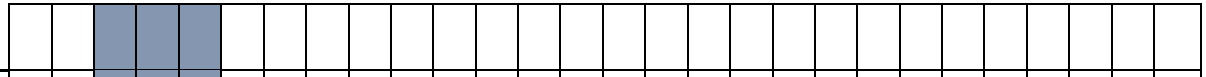
A) Month	B) Volume of Rainwater Captured	C) Cumulative Volume Captured	D) Volume demanded	E) Cumulative Demand	F) Total Amount Stored	G) Deficit/Surplus for Month
March	Mean Annual Rainfall * Capture Area * Roof Coefficient	B+ lag(C)	Daily usage per person * Number of people * 30.4 days	D+lag(E)	(C-E)	(B-D)

Specific sizing and technical design considerations will be tailored depending on the individual sub-grants, but in general the technical support provided to projects will follow the calculation methods laid out in the guidelines for storage tank sizing, supply/demand, and reliability. Finally, the decision matrix and social surveys developed in the guidance document will help to guide development of similar documents for individual sub-grants. The guidance document also provides detailed best practices for operations and maintenance of systems that will be used to guide training of LA participants.

There are two additional GCF projects for rainwater harvesting in the Maldives and the Marshall Islands which will also be used to help guide technical design of rainwater harvesting systems. Both of these projects leveraged detailed community focused water demand assessments as well as specific engineering site assessments for the design of technical rainwater harvesting systems.

Annex 6: Timetable of Project Implementation

	Year 1				Year 2				Year 3				Year 4				Year 5				Year 6				Year 7			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	Q
Component 1: Local authorities empowered to deliver climate change adaptation services to their populations																												
Output 1.1 Build technical expertise to identify and prioritize adaptation solutions																												
Activity 1.1.1 Develop climate adaptation decision support framework training curriculum including interactive case studies targeting government officials																												
Activity 1.1.2. Climate adaptation decision support training for local authorities																												
Activity 1.1.3 Develop train-the-trainer's module and conduct training for national consultants and/or local NGOs in each State to become Facilitating Agents																												
Activity 1.1.4 Facilitating Agents to support LAs prioritize adaptation actions for Grant Facility																												
Output 1.2 Technical support on project preparation																												
Activity 1.2.2 Project Preparation Trainings and Mentoring																												
Output 1.3 Knowledge sharing mechanisms to develop and foster a network of local government authorities																												
Activity 1.3.1 Develop a knowledge platform and ensure the programme is connected to regional platforms across the Pacific																												
Activity 1.3.2 Learning exchanges and site visits																												
Activity 1.3.3 Climate change adaptation local authorities conference																												
Component 2: Priority project implementation-EDA Facility for strengthening local community resilience																												
Output 2.1 Establishment of Resilient Communities Grant Facility (RCGF)																												

Activity 2.1.1 Governance structure for RCGF established and formalized	
Activity 2.1.2 EDA Facility guidelines and procedures developed and finalized	
Output 2.2 Grant award selection	
Activity 2.2.1-Initial call for expressions of interest (EOI)	
Activity 2.2.2-Screening of Expressions of Interest (EOI)	
Activity 2.2.3-Organizational audit of sub-national entities undertaken	
Activity 2.2.4 Invitations to submit full proposal	
Activity 2.2.5-Sub-projects preparation support provided	
Activity 2.2.6-Sub-projects screening and selection	
Activity 2.2.7 - Awarding of grants in the three thematic areas, of food security, climate-induced disaster risk reduction and coastal protection, and water security	
Output 2.3 Sub-grant award implementation	
Activity 2.3.1-Training to improve sub-national entity service delivery of adaptation interventions	
Activity 2.3.2-Grant agreements entered implemented, monitored and reviewed	
Activity 2.3.3-Sub-projects evaluated and lessons gathered	
Activity 2.3.4-Resource mobilization strategy	
Reporting	
Annual Performance Review	
Inception Report	
Mid Term Review	
Terminal Evaluation	

	Indicates duration of the activity