Baseline Assessment in Support of Climate-resilient Food Security for Farming Households across the Federated States of Micronesia, Addendum:

D2 Indicator Calculations and Results

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Abbreviations

CDI= Crop Diversification Index
CSA= Climate Smart Agriculture
DDS= Dietary Diversity Score
FCS= Food Consumption Score
FCS-N= Food Consumption Score Nutritional Quality Analysis
FES= Food Expenditure Share
GCF= Green Climate Fund
HDDS= Household Dietary Diversity Score
HHs= Households
IDDS=Individual Dietary Diversity Score
LCSI= Livelihood Coping Strategies Index
MCT=Micronesia Conservation Trust
MoV=Means of Verification
N= Nutrition
RU= Rutgers, The State University of New Jersey

D2 entry – Number (#) of Beneficiaries

Expected Result	Indicator	Means of Verification (MoV)	Baseline
Increased climate resilient sustainable development	Total number of direct and indirect beneficiaries; number of beneficiaries relative to total population	**Household surveys workshop and training, minutes, inventory of Climate Smart Agriculture (CSA) packages**	**2,466 people** (1,233 men/1,233 women)

Calculations and results

The baseline number of people impacted was calculated by multiplying the total number of people surveyed times (X) the average household size (number of people per family):

members surveyed = 623

Average family size = 6.345

Total family members = 6.345 X 623 = 3,953

The gender ratio of the population was calculated from the gender of all household members:

	#	%
Female	1949	**56.67%**
Male	1490	**43.33%**
Total	**3439**	**100.00**

#Females in impacted population = 3953 x 56.67% = 2,240

#Males in impacted population = 3953 x 43.33% = 1,713

D2 entry – Loss of lives and economic assets

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.1 Change in expected loss of lives and economic assets (USD) due to the impact of extreme climate- related disasters in the geographic area of the GCF intervention	**Household surveys Effectiveness of Training through pre/post tests**	**$6 million USD** of major crops are estimated to be vulnerable to disaster loss

Calculations and results

Survey question: Have members of your family suffered loss of life due to climate change/extreme weather in the past year?

	Freq.	Percent
No	563	**93.21**
Yes	41	**6.79**
Total	**604**	**100.00**

If yes, how many?

	# Observations.	sum
No. of people	28	**74**

Average loss of life per household = 0.12

Survey question: ***What is your estimated economic loss due to climate change/extreme weather in the past year?***

	#Obs.	%	Average/household
Economic Loss Plants $	306	50.66%	**$444**
Economic Loss Livestock $	184	30.46%	**$213**
Economic Loss Aquatic Foods $	139	23.01%	**$156**

D2 entry – Number (#) of Beneficiaries

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)	Quantitative Surveys: Independent Household surveys	1,040 male 1,040 female

<see D2 entry #Beneficiaries above>

D2 entry - Livelihood Coping Strategies Index (LCSI)

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)	**Livelihood Coping Strategy Index (LCSl)**	To be determined during Year 1 implementation

Baseline value results

Average Livelihood Coping Strategy Index for the entire FSM is 5.50, indicating low "Stress" category

LCS Category	Score	Freq.	% Sample
None	0	383	**63.10**
Stress	1 – 14	134	**22.08**
Crisis	15 - 38	76	**12.52**
Emergency	39 - 73	14	**2.31**
Total		**607**	**100.00**

Livelihood Coping Strategies Index (LCSI) calculation[1]

We used LCS–FS: Livelihood Coping Strategies – Food Security.

This indicator is used to understand households' medium and longer-term coping capacity in response to lack of food or lack of money to buy food and their ability to overcome challenges in the future.

Calculating this index requires asking 10+ questions (strategies) from the WFP master list[2].

[1] https://www.indikit.net/indicator/5044-livelihood-coping-strategy-index#:~:text=The%20Livelihood%20Coping%20Strategy%20Index%20measures%20strategies%20a%20household%20employs,the%20Index%20indicates%20coping%20capacity

https://fscluster.org/handbook/Section_two_coping.html

[2] "Livelihood Coping Strategies Indicator for Food Security - List of strategies and their definitions" (https://docs.wfp.org/api/documents/WFP-0000147820/download/) contains 25 strategies for "Urban and Rural" settings, and an additional 6 that apply only to Rural settings

- 4+ Stress coping strategies
- 3+ Crisis coping strategies
- 3+ Emergency coping strategies

Each strategy is assigned a weight, and the "YES" answers are used to calculate the LCSI.

Livelihood Coping Strategies (LCS) – Food Security (FS): Survey questions asked

Q4	Question	Category	Weight
4.1	During the past 30 days, have you experienced any significant shocks or stresses that affected your household's livelihood?	NA	-
4.2	During the past 30 days, did anyone in your household have to sell household assets/goods (radio, furniture, television, jewelry, etc.) due to lack of food or money to buy food?	Stress	3
4.3	During the past 30 days, did anyone in your household have to prioritize the food consumption of active household members due to lack of food or money to buy food?	Stress	4
4.4	During the past 30 days, did anyone in your household have to borrow money to cover food needs due to lack of food or money to buy food?	Stress	2
4.5	During the past 30 days, did anyone in your household have to reduce or cease payments on essential utilities and bills due to lack of food or money to buy food?	Stress	4
4.6	During the past 30 days, did anyone in your household have to send family members to eat somewhere else due to lack of food or money to buy food?	Stress	1
4.7	During the past 30 days, did anyone in your household have to sell productive assets or means of transport (sewing machine, wheelbarrow, bicycle, car, etc.) due to lack of food or money to buy food?	Crisis	7
4.8	During the past 30 days, did anyone in your household have to barter/exchange clothing for food.	Crisis	5
4.9	During the past 30 days, did anyone in your household have to move within the FSM (e.g. moving from atoll to main island for example) due to lack of food or money to buy food?	Crisis	7
4.10	During the past 30 days, did any minor household members (under 15) migrate informally (sending a child off to live with relatives/family out of the FSM) due to lack of food or money to buy food?	Emergency	8
4.11	During the past 30 days, did anyone in your household have to decrease expenditures on fertilizer, pesticide, fodder, animal feed, veterinary care, etc. due to lack of food or money to buy food?	Crisis	5
4.12	During the past 30 days, did anyone in your household have to ask for assistance (i.e., ask friends/neighbors/strangers on the streets for money or food) due to lack of food or money to buy food?	NA	-

4.13	During the past 30 days, did your household have to mortgage/sell the house where your household was permanently living in or land due to lack of food or money to buy food?	Emergency	10
4.14	During the past 30 days, did anyone in your household have to sell the last female (productive) animal due to lack of food or money to buy food?	Emergency	9
4.15	During the past 30 days, did anyone in your household have to gather wild foods that you normally don't consume due to lack of food or money to buy food?	Emergency	8
4.16	During the past 30 days, did your family accept new people into your household because they suffered from lack of food or lack of money to buy food?	NA	-

Livelihood Coping Strategies (LCS) – Food Security (FS): Calculation and Reporting

Multiply all the "yes" answers by the assigned "weight" (severity), sum the weights to get the total LCSI score for the given respondent. Score range is 0 – 73. Use the score to classify each household by their stress level:

LCS Category	Score	% sample
None	0	
Stress	1 – 14	
Crisis	15 - 38	
Emergency	39 - 73	

Report the percentage of households in each category, and the average value of the LCSI scores of all the respondents' households (i.e. sum up all the Index scores and divide them by the number of respondents).

D2 entry – Crop Diversification Index (CDI)

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)	**Increased Crop Diversification** **Quantitative assessment through farmer surveys**	To be determined during year 1 of implementation (activity 1.2.3)

Baseline value results:

Average Crop Diversity Index for the entire FSM is 6.70, indicating Moderate Crop Diversity

Categories	Thresholds	Freq.	Percent
Low crop diversity	3– 4	118	**19.19**
Moderate crop diversity	5 - 7	240	**39.02**
High crop diversity	8 - 9	257	**41.79**
Total		**615**	**100.00**

Crop Diversity Index (CDI) calculation

Survey questions

Q5.2	Food items	5.2.1.1-28 Do you grow and/or harvest this food? (0=no, 1=yes,)	Food group	Traditional food?
1	Swamp taro or hard taro		Staple	Yes
2	Land taro or soft taro		Staple	Yes
3	Breadfruit		Staple	Yes

4	Banana		Staple	Yes
5	Coconut		Staple	Yes
6	Copra (coconut product)		-	-
7	Yam		Staple	Yes
8	Mango		Fruit	Yes
9	Pineapple		Fruit	Yes
10	Limes/lemons		Fruit	Yes
11	Sweet Potatoes		Staple	Yes
12	Tapioca		Staple	Yes
13	Papaya		Fruit	Yes
14	Locally grown/collected Vegetables (if so, please list top: .....)		Vegetable	
15	Locally grown/collected Fruits (if so, please list top: .....)		Fruit	
16	Soursop		Fruit	Yes
17	Black Pepper		Condiment/spice	Yes
18	Hot peppers		Condiment/spice	Yes
19	Sakau (Kava)		Sakau	Yes
20	Sugar cane		Sugar	Yes
21	Betel Leaf		Condiment/spice	Yes
22	Durian (football plant)		Fruit	No
23	Cacao		Nut	Yes
24	Chestnut		Nut	Yes
25	Betelnut		Nut	Yes
26	Tangerine/Orange		Fruit	Yes
27	Medicinal crops (example: Noni)		Other	Yes
28	If others, list them here:			

For each household, total the following 3 scores:

1. Number of Different Crops Grown: Count the "yes" answers in Questions 5.2.1.1-28

- 0 - Omit this respondent from Crop Diversity Calculation
- 1 - 8 - Score: 1
- 9 - 14 - Score: 2
- 15 - 28 (or 15+) - Score: 3

2. Crop Variety: Count the different types of crops grown from the tables (E.g. Staples, fruit, condiments, etc.)

- 1 - 3 - Score: 1
- 4 - 5 - Score: 2
- 6 - 8 - Score: 3

3. Incorporation of Traditional Crops: Count the number of traditional crops grown from the tables:

- 0 - 8 - Score: 1
- 9 - 14 - Score: 2
- 15 – 23 (or 15+) - Score: 3

CDI - Reporting

Use the thresholds below to classify households into three groups - Low, Moderate and High Crop Diversity. Report the percentage of the sampled households that fall in each group.

Categories	Thresholds	% households
Low crop diversity	3 – 4	
Moderate crop diversity	5 - 7	
High crop diversity	8 - 9	

D2 entry – Harvest from demonstration gardens

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)	**Mass of food-crops harvested from demonstration gardens**	0

Baseline value results:

No food harvested from demonstration gardens yet:

Baseline value 0 as stated above

D2 entry – Number (#) Households using soil erosion practices

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)	**Number of HHs utilizing soil erosion practices promoted by project CSA packages developed in 2.1.1**	To be determined during year 1 of implementation (activities 1.2.1 and 1.2.2)

Calculations and results

Survey question: Q3.3.5 If yes, which behavioral changes (did you make)?

1= Changed crop types

2= Changed crop varieties

3= Built a water harvesting scheme (collecting water)

4= Implemented soil conservation techniques (to prevent erosion or soil contamination)

5=

…

14= Other

Count how many people answered #4

	Resp	No	Yes	Total
YAP	Freq	23	12	**35**
	%	65.71	34.29	**100**
Pohnpei	Freq	32	23	**56**
	%	58.93	41.07	**100**
Kosrae	Freq	20	30	**50**
	%	40	60	**100**
Chuuk	Freq	22	20	**42**
	%	52.38	47.62	**100**
All	Freq	97	**85**	**183**
	%	**53.01**	**46.45**	**100**

Average #households utilizing soil erosion = 85 / 623 = 13.6%

D2 entry – Soil Erosion

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)	**Soil erosion level increase after CSA packages deployed**	Baseline: measurement of rate of erosion prior to CSA package

Calculations and results

The baseline is obtained using the Revised Universal Soil Loss Equation (RUSLE) based on five contributing factors:

0 Rainfall Erosivity (R) – MJ mm ha-1 h-1 y-1

1 Soil Erodibility Factor (K) – Mg ha h MJ-1 ha-1 mm-1

2 Slope Length and Steepness Factor (LS) – dimensionless

3 Cover Management Factor (C) – dimensionless

4 Conservation Practice Factor (P) – dimensionless

Average annual soil loss (*A*) due to water erosion can be calculated as: A = *R K LS C P*

See Appendix I for a detailed explanation as to the estimated rate and risk of erosion for each of the four main island states of the FSM.

Island	Mean Erosion	Median Erosion	Mean Erosion (Slope < 50%)	Median Erosion (Slope < 50%)
Pohnpei	41.8	16.5	33.4	**13.3**
Chuuk	422.0	66.5	373.3	**70.9**
Kosrae	252.4	40.4	210.0	**22.1**
Yap	155.0	36.2	151.1	**32.2**
Mean	**217.8**	**39.9**	**192.0**	**34.6**

Mean Soil Erosion for the entire FSM is 34.6 tons per hectare per year

D2 entry – Crop yields

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A1.0 Increased resilience and enhanced livelihoods of the most vulnerable people, communities and regions	A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)	Farmer direct beneficiaries experience an increase in **Crop yields**	To be determined during year 1 of implementation (activity 1.2.3)

Calculations and results

Survey questions - for EACH crop:

5.2.1.1-28: Do you grow and/or harvest this food? (0=no, 1=yes,)

5.2.3.1-28 Over the course of a year, how much do you harvest for each crop? (0=crop not ready for harvest;1=small quantity (<50 lbs); 2=medium quantity (50-100 lbs); 3=large quantity (>100 lbs)

Assume the following average numbers:

- 1=25 lbs
- 2=75 lbs
- 3=125 lbs

Calculate net crop yield per crop, then average crop yield for the total surveyed population (divide net crop yield by 623) Finally aggregate these average crop yields to produce net average crop yield per family.

Baseline value

Average net crop yield per household = 652 lbs/year

D2 entry – Food Consumption Score (FCS), by sex of household head

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A2.0 Increased resilience of health and well-being, and food and water security	A2.2 Number of food secure households (in areas/periods at risk of climate change impacts)	**Food Consumption Score (FCS) disaggregated by sex of household head**	To be determined during Year implementation

Baseline results net

Average Food Consumption Score for the entire FSM is 60, indicating Acceptable Food Consumption

FCS Male headed households = 56.62

FCS Female headed households = 58.58

Categories	Thresholds	Freq.	% Households
Poor food consumption	0-20	22	**3.81**
Borderline food consumption	21-35	50	**8.65**
Acceptable food consumption	36+	506	**87.54**
Total		**578**	**100.00**

Disaggregate by gender of Head of Household

Decision maker	Mean	Freq.
Myself		
Female	60.38	**73**
Male	55.05	**155**
My spouse		
Female	59.83	**76 (males)**
Male	53.32	**25 (females)**
Unknown		
Female	61.13	**119**
Male	64.11	**118**

Total respondents 329

Female Headed Households = 98/329 = 30%

Male Headed Households = 231/329 = 70%

FCS Male headed households = (55.05 x 155 + 59.83 x 76) / (155+76) = (8533.06 + 4547.00)/231 = 56.62

FCS Female headed households = (60.38 x 73 + 53.32 x 25) / (73+25) = (4408.03 + 1333.00) / 98 = 58.58

Calculating Food Consumption Score Nutritional Quality Analysis (FCS-N) -Nutrition[3]

The Food Consumption Score (FCS) is a composite score based on households':

- **Dietary Diversity**: number of individual foods consumed over a reference period.
- **Food frequency**: number of days (in the past 7 days) that a specific food item has been consumed.
- **Nutritional importance**: food groups are weighted to reflect their nutritional importance.

FCS-N – Survey Questions (sample)

	Foods	Number of days eaten in the past 7 days (0 – 7) If 0 days, do not specify the main source.	How was this food acquired? Write the main source of food for the past 7 days Use codes below
6.1	Grains, roots and tubers, such as: Taro, breadfruit, Rice, pasta, bread, corn, potato, yam, cassava/tapioca, white/light sweet potato, banana (starchy banana or plantain), and other starch rich foods	|_ |	|_ |
6.2	Pulses/legumes/nuts, such as: beans, cowpeas, peanuts, lentils, nuts, soybeans, tofu	|_ |	|_ |

Calculate a consumption score for each household

Food Groups (definitive)	Weight	Frequency of consumption	Frequency x weight
Meat, Fish & Eggs	4		
Milk	4		
Pulses	3		

[3] https://resources.vam.wfp.org/data-analysis/quantitative/food-security/food-consumption-score
https://docs.wfp.org/api/documents/WFP-0000146648/download/

https://www.wfp.org/publications/food-consumption-score-nutritional-quality-analysis-fcs-n-technical-guidance-note

Staples	2		
Vegetables	1		
Fruits	1		
Oil	0.5		
Sugar	0.5		
Condiments	0		
		TOTAL	<Household FCS>

FCS-N - Reporting

Use the thresholds below to classify households into three groups: Poor, Borderline or Acceptable food consumption. Report the percentage of the sampled households that fall in each group.

Categories	Thresholds	% households
Poor food consumption	0-20	
Borderline food consumption	21-35	
Acceptable food consumption	36+	

FCS-N – Reporting – disaggregating by gender of Head of Household

Correlate the gender of respondent to their answer for who makes decisions regarding land to determine 'head of household' – either answer 1 or 2 to question 8.2.

Survey questions

2.1a: Gender of respondent

8.2: In your household, who makes a majority of the decisions regarding where to farm, what types of food to farm, where to wild forage, and what types of foods to wild forage?

- myself
- my spouse

D2 entry - Food Expenditure Share (FES)

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A2.0 Increased resilience of health and well-being, and food and water security	A2.2 Number of food secure households (in areas/periods at risk of climate change impacts)	**Food Expenditure Share (FES)**	32-76% of HH expenditures

Baseline results

Average Food Expenditure Share for the entire FSM is 71, indicating Moderately Food Insecure

Category	Value	FES Value	Freq.	% Sample
Food Secure	1	0-49%	67	**11.24**
Marginally Food Secure	2	50% - 64%	101	**16.95**
Moderately Food Insecure	3	65% - 74%	144	**24.16**
Severely Food Insecure	4	75% - 100%	284	**47.65**
Total			**596**	**100.00**

Food Expenditure Share (FES) calculation[4]

FES is used to measure households' economic vulnerability: the higher the share of households' consumption expenditures on food - out of the total consumption expenditure - the more vulnerable the households are to food insecurity.

For computing the FES, it is required to collect consumption expenditure data through the standard expenditure module. This is composed of three sub-modules:

[4] https://resources.vam.wfp.org/data-analysis/quantitative/food-security/food-expenditure-share

The questionnaire is available at: https://docs.wfp.org/api/documents/WFP-0000134275/download/ (We need to administer the first 3 modules, not the 2supplementary modules.)

Instructions for calculating the FES from the results of the survey questions are on pages 23/24 of the CARI document from INDIKIT:

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiI7r33n7WBAxXjFlkFHTmIAKEQFnoECCAQAQ&url=https%3A%2F%2Fwww.indikit.net%2Fdocument%2F421-consolidated-approach-to-reporting-indicators-of-food-security-cari&usg=AOvVaw2A4p2IffMIihSsntN4rCSg&opi=89978449

- Food submodule (seven-day recall)
- Non-food submodule (30-day recall)
- Non-food submodule (six-month recall)

Food Expenditure Share (FES) – Food Submodule (7 day)

Survey questions (sample)

5.1	Item name	Example	5.1.(1-14).1 Did your household purchase any [item] for household consumption in the last 7 days, using cash or on credit?	5.1.(1-14).2 Considering both purchases made in cash and on credit, how much did your household spend on [item] in the last 7 days? US $	5.1.(1-14).3 In the last 7 days, did your household consume any [item] that came from in-kind gifts or in-kind assistance?	5.1.(1-14).4 What would be the value of the consumed [item] that came from in-kind gifts or assistance if you were to buy that at the market? US $	5.1.(1-14).5 In the last 7 days, did your household consume any [item] that you produced, gathered/hunted/fished, or received in exchange of labor?	5.1.(1-14).6 What would be the value of the consumed [item] that you produced, gathered/hunted/fished, or received in exchange of labor if you were to buy that at the market? US $
1	Cereals	maize, rice, sorghum, wheat, etc. in the form of raw cereals, flour, bread, pasta and	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next item	_____

		similar products						
2	Tubers	Potatoes, sweet potatoes, cassava, plantains, yams	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next item	_____

Food Expenditure Share (FES) – Non-Food Submodule (30 day) Survey questions (sample)

5.2	Item name	Example	5.2.(1-10).1	5.2.(1-10).2	5.2.(1-10).3	5.2.(1-10).4
			In the last 30 days, did your household purchase any [item], using cash or credit?	Considering both purchases made in cash and on credit, how much did your household spend on[item] in the last 30 days? US $	In the last 30 days, did your household use any [item] that came from in-kind gifts or in-kind assistance?	What would be the value of [item] that came from in-kind gifts or in-kind assistance if you were to pay for it? US $
	Personal care					
1	Hygiene items and services	Soap, toothbrush, toothpaste, toilet paper, razors, detergents, insecticides, cosmetics; hairdressers/barber, beauty salon	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next question	_____

	Transport					
2	Transport-related goods and services	Public transportation (bus, rail, boat etc.), taxi, rental of vehicles, maintenance of vehicles used for transportation (including lubricant, tires, spare parts, repairs fees etc.) DO NOT INCLUDE PURCHASE OF VEHICLES; EXCLUDE FUEL	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next question	_____

FES – Non-Food Submodule (6 months) Survey questions (sample)

5.3	Item name	Example	5.3.(1-8).1 In the last 6 months, did your household purchase any or pay for [item], using cash or credit?	5.3.(1-8).2 Considering both purchases made in cash and on credit, how much did your household spend on [item] in the last 6 months? US $	5.3.(1-8).3 In the last 6 months, did your household use or benefit from any [item] that came from in-kind gifts or in-kind assistance?	5.3.(1-8).4 What would be the value of [item] that came from in-kind gifts or in-kind assistance if you were to pay for it? US $
	Health					
1	Health services	Outpatient and hospital services, doctor fees, traditional healing	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next item	_____
2	Medicines & Health products	Medicines, other medical products and equipment like glasses,	1=Yes -> 0=No -> next question	_____	1=Yes -> 0=No -> next item	_____

		syringes, crutches etc.				

FES – Calculation

For each household:

- Sum together the total food expenditures (cash and credit), and the total value of non-purchased food items which were consumed in past 7 days. This is the household's total 'food basket value' for the past 7 days. Multiply by 30/7; you now have the variable 'food monthly'.
- Sum together short-term (30 day) non-food expenses; you now have the variable 'nonfood1_monthly'.
- Sum together longer-term (6 months) non-food expenses; divide this by 6. You now have the variable 'nonfood2_monthly'.
- Calculate $food\ expenditure\ share$ = ($food\_monthly$) / ($food\_monthly$ + $nonfood1\_monthly$ + $nonfood2\_monthly$)

FES – Reporting

Convert the FES to a 4-point scale. Report the percentage of the sampled households that fall in each category.

Category	Value	FES Value	% sample
Food Secure	1	0-49%	
Marginally Food Secure	2	50% - 64%	
Moderately Food Insecure	3	65% - 74%	
Severely Food Insecure	4	75% - 100%	

D2 entry - Increase in Individual Dietary Diversity Score (IDDS)

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A2.0 Increased resilience of health and well-being, and food and water security	A2.2 Number of food secure households (in areas/periods at risk of climate change impacts)	**Increase in Individual Dietary Diversity Score (IDDS)**	To be determined during year 1 of implementation

Baseline result

Mean IDDS = 4.65 / 9 (# Observations = 603)

D2 entry - Household Dietary Diversity Score (HDDS)

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A2.0 Increased resilience of health and well-being, and food and water security	A2.2 Number of food secure households (in areas/periods at risk of climate change impacts)	**Increase Household Dietary Diversity Score (HDDS)**	To be determined during year 1 of implementation

Baseline result

Mean HDDS = 8.15 / 12 (#Observations = 606)

D2 entry – Dietary Diversity Score (DDS) - Household Dietary Diversity Score (HDDS)

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A2.0 Increased resilience of health and well-being, and food and water security	A2.2 Number of food secure households (in areas/periods at risk of climate change impacts)	**Dietary Diversity Score**	To be determined during year 1 of implementation

<= HDDS as detailed above>

Baseline result

Mean DDS (HDDS) = 8.15 / 12 (#Observations = 606)

Calculating Household Dietary Diversity Score (HDDS) and Individual Dietary Diversity Score (IDDS)[5]

HDDS assesses a household's economic access to food (i.e. its ability to produce, purchase or otherwise secure food for consumption by all household members). It does not provide data on the nutritional quality of a person's diet.

IDDS assesses the number of (pre-determined) food groups that were eaten by a specific target group the previous day or night. It is an indicator of a diet's micronutrient adequacy, an important dimension of its quality. It does not measure the intake of kilocalories.

HDDS and IDDS Survey questions (sample)

#	Food Groups	Examples	7.(1-18).1 Household level responses: did anyone in your household consume this food? Does NOT include food consumed outside of the household.	7.(1-18).2 Individual level responses: did YOU consume this food? This DOES include food consumed outside of the household.
7.1	CEREALS	Any breadfruit, bread, rice noodles, biscuits, or any other foods	CIRCLE ONE 0= No	CIRCLE ONE 0= No

[5] https://www.indikit.net/indicator/13-individual-dietary-diversity-score-idds
https://www.indikit.net/indicator/19-household-dietary-diversity-score
Guidelines for Measuring Household and Individual Dietary Diversity (.pdf)

		made from millet, rice, or wheat, starchy banana (plantain)	1= Yes	1= Yes
7.2	WHITE ROOTS AND TUBERS	Any taro, white potatoes, white yam, white cassava, manioc, or other foods made from roots	CIRCLE ONE 0= No 1= Yes	CIRCLE ONE 0= No 1= Yes

IDDS Calculation

Aggregate the food groups from the questionnaire as shown, score each respondent with a "1" for each group consumed and total the score:

0 – 9 for each individual

Question number(s)	Food group
1,2	Starchy staples
4	Dark green leafy vegetables
3,6	Other vitamin A rich fruits and vegetables
5,7	Other fruits and vegetables
8	Organ meat
9,11	Meat and fish
10	Eggs
12	Legumes, nuts and seeds
13	Milk and milk products

HDDS Calculation

Aggregate the food groups from the questionnaire as shown, score each household with a "1" for each group consumed and total the score:

0 – 12 for each household

Question number(s)	Food group
1	Cereals
2	White tubers and roots
3,4,5	Vegetables
6,7	Fruits
8,9	Meat

10	Eggs
11	Fish and other seafood
12	Legumes, nuts and seeds
13	Milk and milk products
14	Oils and fats
15	Sweets
16	Spices, condiments and beverages

HDDS and IDDS Reporting

Report the mean IDDS (out of a max of 9)

Report the mean HDDS (out of a max of 12)

D2 entry - % Households survival deficit

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A2.0 Increased resilience of health and well-being, and food and water security	A2.2 Number of food secure households (in areas/periods at risk of climate change impacts)	**Percentage of HHs survival deficit**	To be determined during year 1 of implementation

Baseline results

Average HHs Survival Deficit for the entire FSM is 6.26, indicating Occasional Hunger

Categories	Thresholds	Freq.	% households
No hunger	1-4	301	**48.71**
Occasional hunger	5 - 12	305	**49.35**
Moderate hunger	13- 14	7	**1.13**
Severe hunger	15 - 16	5	**0.81**
Total		**618**	**100.00**

Percentage of Households Survival Deficit

The survival deficit measures the total food and cash income required to cover the food and non-food items necessary for survival in the short term. It includes (1) 100% of minimum food energy needs; (2) the costs associated with food preparation and consumption; and (3) where applicable, the cost of water for human consumption.

It is a complex index measured as part of the HEA (Household Economy Approach)[6]; we use a proxy that measures frequency of hunger.

Calculating Percentage of Households Survival Deficit

Survey questions

9.2.4	(I/we) skipped meals because there wasn't enough money for food.	CIRCLE ONE 1= Never 2= Rarely (Only 1 or 2 months)

[6] https://fscluster.org/handbook/Section_two_survival.html

		3= Sometimes (Some months, but not every month) 4= Often (Almost every month or more)
9.2.5	(I/we) ate less than preferred because there wasn't enough money for food.	CIRCLE ONE 1= Never 2= Rarely (Only 1 or 2 months) 3= Sometimes (Some months, but not every month) 4= Often (Almost every month or more)
9.2.6	(I/we) were hungry because there wasn't enough money for food.	CIRCLE ONE 1= Never 2= Rarely (Only 1 or 2 months) 3= Sometimes (Some months, but not every month) 4= Often (Almost every month or more)
9.2.7	(I/we) went a whole day without eating.	CIRCLE ONE 1= Never 2= Rarely (Only 1 or 2 months) 3= Sometimes (Some months, but not every month) 4= Often (Almost every month or more)

Percentage of Households Survival Deficit – Reporting

For each respondent, aggregate the responses to the 4 questions:

Score range: 4 – 16

Use the thresholds below to classify households by their Hunger frequency. Report the percentage of the sampled households/individuals that fall in each group.

Categories	Thresholds	% households
No hunger	4	
Occasional hunger	5 - 12	
Moderate hunger	13 - 14	
Severe hunger	15 - 16	

D2 entry – Locally processed foods

Expected Result	Indicator	Means of Verification (MoV)	Baseline
A2.0 Increased resilience of health and well-being, and food and water security	A2.2 Number of food secure households (in areas/periods at risk of climate change impacts)	Increase in availability of **locally processed foods**	To be determined during year 1 of implementation

Calculation and results

Survey question: ***Are you able to purchase or procure locally processed and packaged foods that you want? (e.g taro and breadfruit from your area that has been made into chips and/or other foods).***

Note: Cooked and prepared foods sold on the streets or in formal and informal markets are not considered here as processed foods or value-added foods. (e.g baked chicken, sandwiches, deserts, soups)

Baseline results

Particulars	Frequency	Percent
No	387	**64.72%**
Yes	211	**35.28%**
Total	**598**	**100.00%**

Availability of locally processed food:

For the entire FSM = 35%

Yap = 17.5%, Pohnpei = 44%, Chuuk = 9%, and Kosrae = 68%

Calculations for the D2 Indicators Relating to Micronesia Soil Erosion Rate and Risk

Led by James Shope, Department of Environmental Sciences and NJ Agricultural Experiment Station, Rutgers University, we calculated the estimated soil erosion risk in the main islands of each FSM state. We thank Roger Garner (USAID) for providing us with soil surveys for Pohnpei and Chuuk and his helpful discussions on programs involving soil conservation and management, We also are very grateful and thank the strong support and assistance of Amy Koch, Assistant Director for Soil Science, USDA NRCS - Pacific Islands Area stationed in Hawaii.

The potential annual risk of soil erosion due to water runoff was assessed using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE equation is based on five contributing factors:

1. Rainfall Erosivity (*R*) – MJ mm ha^{-1} h^{-1} y^{-1}
2. Soil Erodibility Factor (*K*) – Mg ha h MJ^{-1} ha^{-1} mm^{-1}
3. Slope Length and Steepness Factor (*LS*) – dimensionless
4. Cover Management Factor (*C*) – dimensionless
5. Conservation Practice Factor (*P*) – dimensionless

Average annual soil loss (*A*) due to water erosion can be calculated as:

$A = R\,K\,LS\,C\,P$

Individual Factor Calculations

For the purposes of this brief report, individual equations/calculation processes for each factor will not be listed, but the relevant literature containing the equations will be referenced.

R

R was calculated from more than 10 years of daily rainfall data (in mm) from the U.S. National Weather Service stations listed in Table 1 for years where more than 95% of daily rainfall amounts were logged.

Table 1. Weather station locations and estimated rainfall erosivity

Station	Latitude	Longitude	Rainfall Erosivity (MJ mm ha^{-1} h^{-1} y^{-1})
Pohnpei			
Pohnpei	6.9667	158.2167	16196
Chuuk			
Chuuk	7.45	151.8333	12215

Kosrae			
Kosrae	5.3544	162.9533	17649
Tofol	5.3264	163.005	19506
Utwa	5.2739	162.9742	16107
Yap			
Dugor	9.5367	138.1211	13365
Gilman	9.45	138.0667	11361
North_Fanif	9.5667	138.1167	11667
Rumung	9.6333	138.1667	9583
Tamil	9.55	138.15	11511
Yap	9.4833	138.0833	11650

Due to a dearth of measurement locations on Pohnpei and Chuuk, only one point was used to represent the rainfall characteristics across the whole island, despite there likely being geographic variability in rainfall amount and intensity around the island. *R* was calculated following the 5-variable methodology of Yu and Rosewell (1996) as presented by Lu and Yu (2002) and Angulo-Martínez and Beguería (2009). This approach uses daily measurements of rainfall totals to approximate storm erosion index values, which integrates storm kinetic energy and the maximum 30-minute rainfall intensity. For Kosrae and Yap, *R* was calculated at the locations listed in Table 1 and interpolated between points of the islands by an inverse weight distance interpolation.

K

K is the erodibility of the soil and relates to the soil physical characteristics such as texture, structure, porosity, and organic matter content (to name a few). *K* values were taken from the USDA Soil Survey Geographic Database program (Soil Survey Staff, Natural Resources Conservation Service). No modifications were made to these data other than to convert the shapefiles to raster data for computation.

LS

LS is the combined effect of slope length (*L*) and steepness (*S*). *L* was calculated following the methodology of Desmet and Govers (1996) as presented by Panagos et al., (2015) and Elnashar et al. (2021). *S* was calculated following Renard et al. (1997) for simplicity as presented by Panagos et al., (2015). The LS values were automatically calculated by the SAGA (System for Automated Geoscientific Analyses) software's hydrology module (Conrad et al., 2015). The values were derived through GIS analysis from a 10-m resolution digital elevation models of each island (Example Pohnpei: https://catalog.data.gov/dataset/usgs-10-m-digital-elevation-model-dem-fsm-pohnpei). Note that the LS factor calculated in SAGA is only advisable for use on slopes less than 50% grade. For this report, both whole island erosion estimates and estimates for just those lands less than 50% grade are provided using this LS value.

C

The cover management factor, *C*, is related to the vegetation cover of the soil. Vegetation cover dissipates raindrop energy, reducing the erosive ability of the rain in an area. *C* is extremely variable, depending on the type of growth, stage of development of that vegetation, and the density of the cover per unit area. Currently, there are no readily accessible *C* factor values for Pohnpei. Instead, a vegetation/land cover map was utilized to approximate *C* values based on published literature. The most recent vegetation land cover data were obtained from the U.S. Forest Service (https://www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046690) for 2020-2021. The land cover types and *C* values utilized within the erosion analysis are presented below:

Table 2. Land cover types and associated *C*-factor values.

Land Cover	C-factor	Source
Agroforest	0.0881	Panagos et al. (2015)
Barren	1	Sampath et al. (2023)
Beach	1	Wischmeier & Smith 1978
Cropland	0.34	Ebabu et al. (2022)
Forest	0.004	Ebabu et al. (2022)
Grassland or Savanna	0.09	Ebabu et al. (2022)
Mangrove Forest	0.004	Chatterjee et al. (2014)
Marsh	0	Wischmeier & Smith 1978
other vegetated	0.0775	Ebabu et al. (2022)
Palm Forest	0.004	Assume forest category from Ebabu et al. (2022)
Secondary Vegetation	0.5	da Cunha et al. (2016)
Swamp Forest	0.004	Ebabu et al. (2022)
Upland Forest	0.004	Ebabu et al. (2022)
Urban Buildup	0	Kadaverugu et al. (2022)
Urban Cultivated	0.05	Assuming discontinuous urban fabric from Wischmeier & Smith 1978
Vegetated non-forest	0.05	Based on non-forest vegetation classes from Wischmeier & Smith 1978
Water	0	Kadaverugu et al. (2022)

P

The support practice factor (*P*) incorporates the efforts and agricultural practices that help reduce the rate of runoff and soil erosion. For the island of Pohnpei, these values are unknown to the author as cropping practices for Pohnpei are not represented in the literature and the associated P-factors in Pohnpei have not been empirically measured at this time. Additionally, these values will likely differ between field agriculture (which is more represented within the literature) vs agroforestry. Lacking this information, a *P* factor of 1 was used across the island, which has been used for non-agricultural land use types without specific erosion mitigation practices (Girma and Gebre, 2020). A *P* factor of 1 should be viewed as a very conservative estimate (i.e., producing a larger amount of erosion) when incorporated into the RUSLE equation.

Results

Table 3. Mean and median erosion estimates in tons hectare^{-1} year^{-1}. Note both estimates for the whole island and just those lands with slopes less than 50% grade are provided.

Island	Mean Erosion	Median Erosion	Mean Erosion (Slope < 50%)	Median Erosion (Slope < 50%)
Pohnpei	41.8	16.5	33.4	13.3
Chuuk	422.0	66.5	373.3	70.9
Kosrae	252.4	40.4	210.0	22.1
Yap	155.0	36.2	151.1	32.2
Mean	217.8	39.9	192.0	34.6

The mean soil erosion risk across each island is typically high, with Pohnpei being the lowest at 41.8 tons hectare^{-1} year^{-1} and the highest being Chuuk at 422 tons hectare^{-1} year^{-1}. These values are variable across each island, with some of the greatest erosion values being along steep slopes, rivers, and regions with limited tree cover (Figure 1). Similar estimates are generated for the islands on slopes less than 50% grade. In this case, it is likely that erroneously high erosion estimates generated through this technique along the islands are disproportionately affecting the mean. The median estimates are much more in line with other humid tropical region estimates, though often being somewhat higher (Millward and Mersey, 1999; Labrière et al., 2015). Overall, these higher values compared to other humid tropical regions likely indicate the limitations of the RUSLE approach with limited ground-truthing. Similarly, there is a level of uncertainty with the calculation of each contributing variable to the RUSLE equation that would need to be constrained by field measurements. In particular, the *R* and *C* factors would need to be locally calibrated from higher temporal resolution data for R and on-site measurements of *C* across the Micronesian islands.

For practical usage and reporting, this report suggests using the median erosion estimates in Table 3 as being more representative of the islands overall. A second suggestion would be to use the values estimates for just the slopes less than 50% grade as the maximum suggested slope for the above method as cited by Panagos et al. (2015) is about 50%. If a mean value as opposed to median value is desired, this report recommends reporting the mean for the slopes less than 50% from Table 3.

Future assessments of soil erosion in Micronesia need to consider the unique conditions of each island. Given the tropical setting, potential for intense rainfall, and sleep slopes on many of these islands, it is important to effectively calibrate any erosion modeling for soil loss to these conditions. Assumptions for the slope steepness factor, for example, may want to be reassessed using models calibrated for alpine environments despite the climate setting being very different. Finally, note that the erosion values are extremely variable between islands primarily due to land cover classification and topography. Certain land cover classes such as forestry and agroforestry have very different literature C values but may be similar in practice in Micronesia. Subsequent analyses would need to try to bridge the differing land cover classifications utilized on each island for more consistent erosion values.

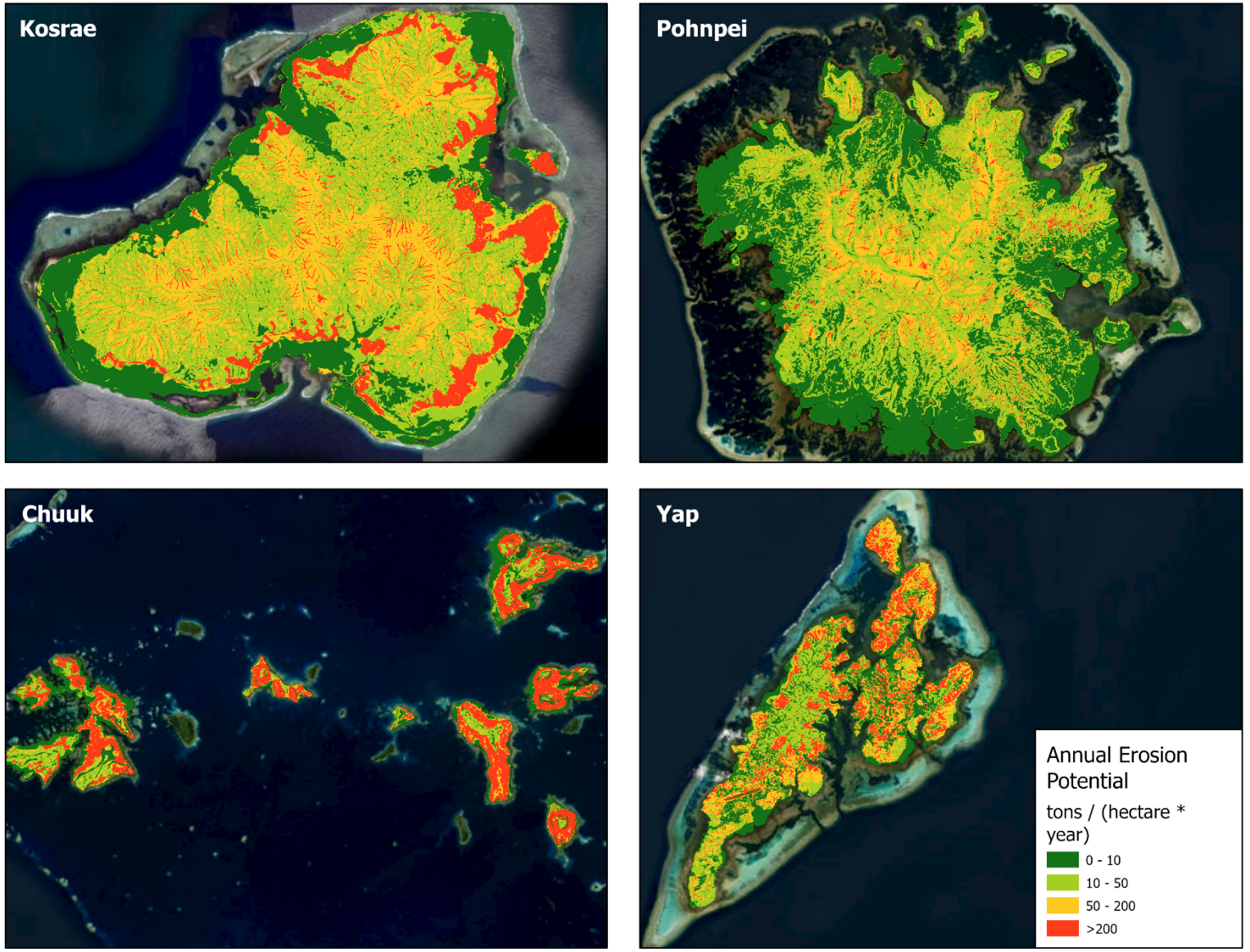

Figure 1. Spatial distribution of rainfall-driven erosion risk across the main islands of the Federated States of Micronesia.

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