TOWARDS CLIMATE CHANGE RESILIENCE II: TRADITIONAL KNOWLEDGE-BASED LOSS AND DAMAGE ASSESSMENT AND ADAPTATION IN UTWE BIOSPHERE RESERVE (KOSRAE, FEDERATED STATES OF MICRONESIA)

Inception Report

Introduction:

The project, "Towards Climate Change Resilience II: Traditional Knowledge-based Loss and Damage Assessment and Adaptation in the Utwe Biosphere Reserve" pilots a knowledge co-construction approach to community-based loss and damage assessment and climate change adaptation. The approach aims to ensure that the knowledge produced and acted upon throughout the project is grounded in an on-going and inclusive exchange between scientific knowledge holders and traditional knowledge holders. Foundational principles of the approach include, *inter alia*: building the project on TK; establishing dialogues to build trust; working with traditional knowledge holders to share their knowledge in a context that is appropriate and respectful; and making space for processes of community consultation and consent.

Despite years of adaptation projects across the world, too little is known about the effectiveness of adaptation interventions in the middle- and long-term. Moreover, communities in the Pacific and elsewhere sometimes report feeling marginalized and ignored in the design of projects. This is not the first attempt to implement adaptation interventions in Utwe Biosphere Reserve. And previous adaptation efforts have sometimes been insufficient or have not mitigated loss and damage at all. Indeed, Monnereau and Abraham[1] found that over 90% of the Kosrae households that had experienced loss and damage due to coastal erosion and flooding reported that their adaptation and coping measures had not been effective.

This project pilots a new approach to adaptation with the aim of finding more effective and appropriate adaptation interventions at the community level and beyond. It seeks to do this in two key ways: (1) working through a knowledge co-construction[2] approach with an emphasis on Kosraean traditional knowledge; and starting with a community-based loss and damage assessment to maximise community-based learning. One of the key features of the community loss and damage assessment is not just to review past impacts, but also to review the success of previous attempts to prevent recurrence of that loss and damage. In this way, the previous experiences of communities, as told by them, become central in evaluating adaptation effectiveness in the long term.

This methodology is not entirely new. Indeed, it builds upon lessons learned from a number of previous projects in Kosrae and elsewhere. However, by setting a scene where participants were empowered to think critically about the data and their own experiences and to identify adaptation actions to improve climate preparedness and resilience of the UBR community, it is hoped to also identify some key lessons that can improve effectiveness across the adaptation sector.

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[1] Monnereau, I. and S. Abraham (2013) "Loss and damage from coastal erosion in Kosrae, The Federated States of Micronesia`, *Loss and Damage in Vulnerable Countries Initiative, case study report*. Bonn: United Nations University Institute for Environment and Human Security

[2] For further discussion of what is meant by "knowledge co-construction" see *https://unfccc.int/resource/docs/2017/sbsta/eng/03.pdf*

The pilot is planned to run from May 2018 to August 2019 and consists of a relatively long inception phase (May-October 2018), allowing for reflection, joint learning, knowledge exchange and participatory planning. During the inception a rapid loss and damage assessment informed the identification of adaptation interventions and the development of a workplan.

The project implements ecosystem-based adaptation measures that respond specifically to the needs, priorities, capacities and knowledge gaps identified during the inception phase (November 2018-July 2019).

Community-based knowledge sharing, consultations, planning and monitoring and evaluation guide the project throughout. Traditional knowledge will be introduced early and often into the community-based decision-making process to creating spaces for community members to reflect upon, discuss and share the role of traditional knowledge in climate change adaptation and natural resource management.

As a pilot, monitoring and evaluation is an important part of the project and a participatory, community based monitoring and evaluation framework has been developed emphasising qualitative data and prioritising the perceptions, capacity-building and awareness of local stakeholders.

Utwe Biosphere Reserve, Kosrae, Federated States of Micronesia

Utwe Biosphere Reserve was established in 2005 on the southern end of Kosrae, FSM. The Biosphere Reserve has a total surface area of 17.7km^2 and is more or less contiguous with Utwe Municipality, which has a population of approximately 1000 people spread over three hamlets. The Biosphere Reserve incorporates a river basin that feeds into a harbour. The core zone consists of an extensive mangrove stand with islets, a coral reef and some tropical rainforest, rising steeply to the mountainous interior of the island. Some residents of Utwe Biosphere Reserve/Municipality earn their livelihoods through work with the government or NGOs. Others fish and farm for subsistence and small cash income.

Utwe Biosphere Reserve has featured small-scale tourism ventures, as well as markets, but these economic activities are currently in need of further investment and/or revitalisation.

Utwe Biosphere Reserve often works in close partnership with the Kosrae Conservation and Safety Organization, which is Kosrae's primary environmental NGO and the implementing partner for this project.

Inception phase

The project was launched in May 2018 and began with a six-month inception phase consisting of three steps: (1) community consultations; (2) inception workshop and loss and damage assessment; (3) validation and participatory planning.

Step (1) consisted of community consultations, interviews, and dialogues between Kosrae Conservation and Safety Organization (KCSO), Utwe Biosphere Reserve board, and key stakeholders. Step (2) consisted of an inception workshop and rapid loss and damage assessment, as well as targeted capacity building and participatory identification of adaptation priorities. Step (3) consisted of validation of assessment results and workplan with Utwe

Biosphere Reserve communities and community organizations, as well as development of a monitoring and evaluation framework and carrying out a baseline awareness survey.

This report summarises the main outcomes of the inception process as well as sharing detailed outcomes and results in annexes 1-10. It also reflects on preliminary lessons learned related to the knowledge co-construction approach.

Step 1: UBR Community and stakeholder consultations

From June 19th – 26th, 2018, KCSO carried out a series of community consultations in Utwe. Community consultations (19-26 June) were held in three hamlets of Utwe Municipality (N-Wan, Centre Point and Gateway) and with Utwe senior citizens, Utwe Women's Organization and Utwe Youth Endeavor (Etawi Fusr) (approximately 150 people, 15% of Utwe total population) (see **Annex 1**). During the community consultations, the project was introduced, the free, prior, informed consent process was initiated and the most significant climate stressors and their coping and adaptation responses were discussed. Utwe stakeholders highlighted drought, inland flooding, coastal flooding, and coastal erosion as the main climate stressors of concern.

All consultation meetings were held in the Kosraean language and outputs were translated later by KCSO staff. The meeting began with a presentation that briefly described the project. General discussion was then held, which focused on which climate stressors most affected Utwe, namely drought, inland flooding, coastal flooding and coastal erosion. Further discussion considered how these stressors impacted different sectors and natural resources, including mangroves, agriculture, fisheries and water quality. For each of these sectors, the long-term success of coping and adaptation mechanisms that had previously been implemented in Utwe Municipality were considered. This information was summarized in tables, which provided a starting point for the loss and damage assessment that was undertaken during steps 2 and 3. The consultation meetings also provided an opportunity to select representatives of each of the hamlets and community organisations to attend the inception workshop.

Throughout late May and early June, initial discussions were held with other key partners in Kosrae to raise awareness about the project and ensure their participation and input. These partners included: the Kosrae Island Resource Management Agency (KIRMA) and its relevant units-- the Historic Preservation Office (HPO) and the Division of Environment; International Red Cross Kosrae Chapter; the Micronesia Conservation Trust (MCT), Office of Fisheries, the International Organization for Migration (IOM); and Kosrae's Ridge to Reef STAR project team.

Step II: Inception & Planning Workshop

The inception and planning workshop was held from July 10th -13th, 2018 at the Kosrae Red-cross office. The workshop was organized by KCSO with technical support from UNESCO Pacific Office, Micronesia Conservation Trust (MCT), the Historic Preservation Office of the Kosrae Island Resource Management Agency (KIRMA), and the Utwe Biosphere Reserve management board (**Annex 2**).

The inception workshop (10-13 July) was held in Tofol, Kosrae and was attended by over 40 participants (11 women) from the following organisations and institutions:

- Utwe Biosphere Reserve Management Board
- Utwe Senior Citizens

- Utwe Etawi Fusr (Youth Organization)
- Utwe Fisherman's Association
- Gateway Hamlet
- Center Point Hamlet
- N-Wan Hamlet
- Utwe Council
- Utwe Mayor
- Kosrae Island Resource Management Agency (Historic Preservation Office, Division of Forestry)
- Office of Fisheries
- Micronesia Conservation Trust
- Dr. Rob van Woesik and Dr. Chris Cacciapaglia, Department of Biological Sciences, Florida Institute of Technology
- KCSO
- UNESCO Office for the Pacific States

On average, there were about 7-8 women participants at the meeting each day, although the numbers differed slightly from day to day. Some participants from the Utwe community work for the government or the NGO sector. Others fish and farm to provide for their subsistence.

The objectives of the inception and planning workshop were to:

1. Review recommendations of previous projects, including "Towards Climate Change Resilience, Phase I", "Building the resilience of communities and their ecosystems in Micronesia and Melanesia", and "Limits to autonomous adaptation in response to coastal erosion in Kosrae, Micronesia";
2. Review and discuss outcomes of the community consultation meetings, including reviewing the initial loss and damage matrix;
3. Review and discuss traditional-knowledge related to climate, agriculture, marine resources and water. Agree appropriate methods for working with it;
4. Develop and agree a proposed methodology for loss and damage assessment in Utwe Biosphere Reserve;
5. Targeted capacity building for key elements of loss and damage assessment;
6. Identify a provisional list of adaptation priorities, based on consultations and past work;
7. Plan for L&D assessment and follow-on ecosystem-based adaptation.

The workshop opened with remarks from Executive Director Andy George of KCSO followed by by the Honorable Canston Segal, Mayor, Utwe Municipal Government. Dr. Serena Heckler (UNESCO), Mr. Andy George (KCSO), Mr. Bond Segal (KCSO), Ms. Ashley Meredith of the Historic Preservation Office (KIRMA) and Ms. Betty Sigrah (MCT) took turns to facilitate the sessions.

The workshop featured a community-based rapid loss and damage assessment and climate change adaptation planning. Facilitators shared various methods for loss and damage assessment and community-based adaptation that are being used around the world. In order to learn from these tools and evaluate their effectiveness, a hands-on training approach was used and the pros and cons of the methods reflected upon throughout the course of the workshop (see **Annex 3** for results and lessons learned).

Data collected from the community consultations, historical timeline, traditional lunar calendar, MCT's Local Early Action Plan (LEAP) toolkit were then used to develop a draft climate story for Utwe Biosphere Reserve, highlighting the important role that natural resources and ecosystem services play in mitigating or exacerbating the impacts of climate stressors. This all came together by filling out a loss and damage matrix for drought, which enabled the participants to document detailed qualitative data on drought, its impacts, and adaptation actions in the Utwe Biosphere Reserve community over the last 20 years. The process of collecting the data and recounting their experiences of drought helped the UBR community identify and reflect upon the limits of adaptation and how they can improve adaptation in the future.

The main findings and lessons learned from the use of the tools are summarized here (see Annex 3 for more detailed reflection on the tools):

- *Historical Timeline: Participants identified the principle stressors that they have contended with over the last 150 years. It enabled them to reflect upon how economic and political events, such as the construction of a bridge or the establishment of the Utwe Biosphere Reserve, have correlated with climate stressors. It was noted that: typhoons are very rare, but have a severe impact; drought has a recurring impact; loss and damage due to inland floods has been exacerbated by the construction of the concrete Finkol bridge in 1984.*

- *Traditional Seasonal Calendar: Participants agreed to analyse the traditional Kosraean lunar calendar, rather than a seasonal calendar, to organize discussion of their traditional knowledge, if it is still relevant and used. The lunar calendar integrates a great deal of traditional environmental information, including when in the month to carry out fishing, farming, and tree harvesting among other livelihood activities. This provided important guidance on sustainable harvesting methods, for instance during rains, which tend to occur during certain days of the month, soil is more likely to slide into waterways and end up as sedimentation on the reef. The calendar can provide guidance as to when in the month it is drier, soil is more stable and so harvesting trees can be soil erosion. It was also discussed how this calendar can be used as a guide for sustainable natural resource management.*

- *MCT Local Early Action Planning (LEAP) Toolkit: This tool was used by the workshop to allow participants to discuss and identify natural and social resources in the UBR that are of high importance to the people of Utwe. Priority natural resources were: coastal areas, upland forest, rivers and streams, mangrove forest. Coastal areas, rivers and mangroves were identified as declining in status with poor or non-existent management effectiveness. On the other hand social resources are in good condition, suggesting that improving management of natural assets could be a priority for Utwe.*

- *Loss & Damage Matrix: Data acquired from previous discussions and assessments during the workshop were used to construct the loss & damage matrix. Drought was chosen by participants as a severe climate event that has impacted different sectors in the UBR community. At a subsequent meeting, participants completed a similar matrix for flooding. The matrix is a simple table with columns showing: the impacted sectors; the types and level of impacts; coping/adaptation interventions; impact after interventions; explanation for ongoing impacts after interventions; and what further interventions participants would recommend to prevent future impacts. The loss and damage matrix enabled participants to identify factors that impact on reducing loss and damage and led to the development of a list of priority coping/adaptation measures for the UBR community.*

Presentations

Although the workshop focused primarily on group work and joint decision-making, a few presentations provided information and data that helped the participants make informed decisions.

On Day 1, Dr. Serena Heckler of UNESCO introduced previous studies on climate change loss and damage in the Pacific. She presented on the project "*Towards Climate Change Resilience: Minimising loss and damage in Pacific SIDS communities"* which was jointly implemented by UNESCO and the University of the South Pacific's Pacific Centre for Environment and Sustainable Development. Findings, lessons learned and methodologies from that study were used to the develop the approach and focus in Utwe.

Dr. Heckler also shared the report from the 2012 study "*Loss and damage from coastal erosion in Kosrae*", carried out by Iris Monnereau and Simpson Abraham.[3] This study, part of a series of country studies by the United Nations University, was a precursor to UNESCO's "*Towards Climate Change Resilience*" phase I and II projects. Most participants at the workshop were not fully aware of this past study but agreed that coastal erosion is an important climate change-related impact with which they are struggling.

Also on Day 1, Mr. Bond Segal (KCSO) presented the results of the community consultations.
Pictured: Sweetyona Tulensru (left) and Aaron Waguk (right)

This provided a useful opportunity for participants to discuss the main points and think about how their neighbours and family members had been impacted by previous climate stressors. Mr. Segal's presentation also provided the basis for the loss and damage matrix carried out on Day 4.

On Day 2, Ms. Ashley Meredith, the FSM National Cultural Anthropologist based in the Historic Preservation Office of KIRMA, facilitated discussions on traditional knowledge, including the consideration of the traditional Lunar Calendar. Her expertise on local knowledge protocol and priorities for working with traditional knowledge provided a significant insight into the depth and relevance of traditional knowledge for the challenges facing Utwe stakeholders on contemporary Kosrae.

Ms. Meredith shared details on a Youth Ethnographic Field School hosted by Kosrae HPO (funded by the US National Park Service), which took place in early July 2018 (immediately before the *Towards Climate Change Resilience* workshop). Youth and elders came together to discuss ethnozoology in Kosraean culture. In the first week, the youth participants learned about oral history data collection from Kosrae HPO Staff (including Ms. Ashley Meredith and Dr. David Fazzino who are cultural anthropologists to the office) and practiced collecting data from their parents and grandparents. In the second week, elders visited Kosrae HPO. During this time, the youth elicited oral histories on ethnozoology in Kosraeans culture. It was through this field school a comparative analysis took place between three generations of Kosraeans and showed some of the impacts of climate change in terms of animals seen when elders were youth and by the youth today. Such experiences offer valuable insights into how traditional knowledge might contribute to appropriate climate change adaptation.

[3] Monnereau and Abraham (2013)

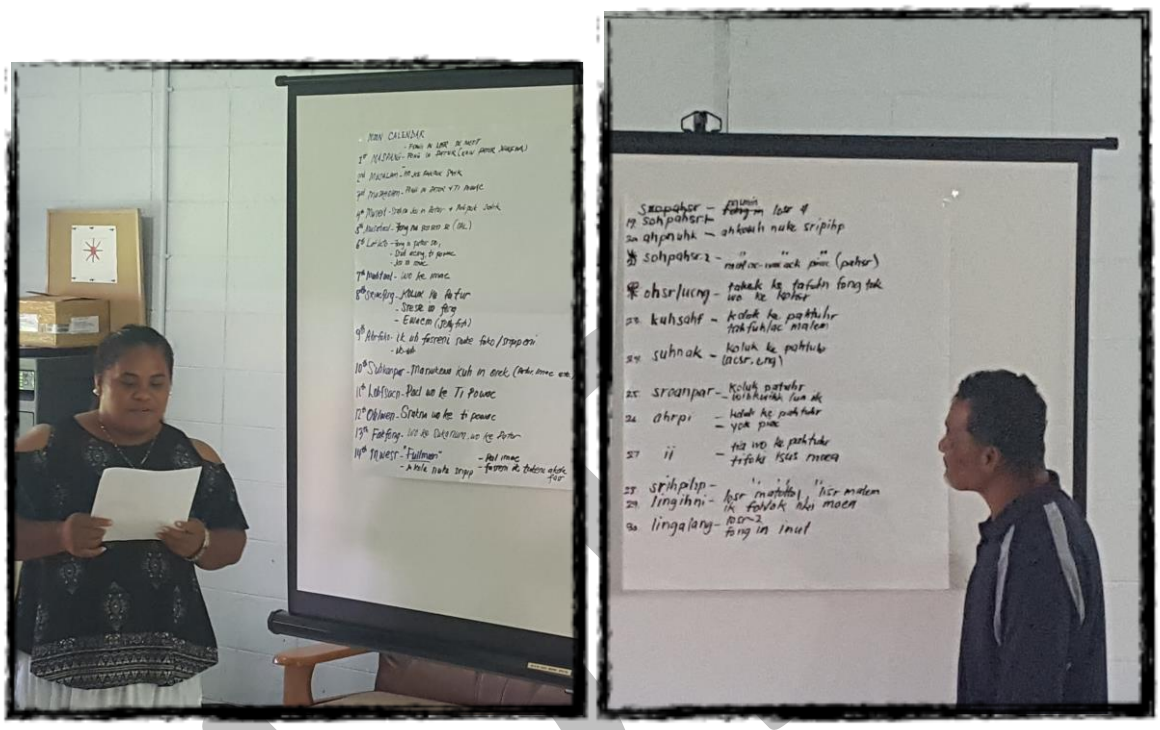
The exercise carried out during the workshop consisted of reviewing a traditional Kosraean lunar calendar that had been recorded in [ ] by early travelers (Figure 1) and highlighting whether the current names had changed, if they still guide livelihood activities and if they are relevant to management of resources and conservation (Figures 2 and 3).

Figure 1: The traditional Kosraean lunar calendar as recorded in 18XX. (Source: Island of Angels by Elden M. Buck. **Publisher:** Watermark Publishing; 1st edition (November 1, 2005). 592 pages.)

Day of Moon Phase	Kosraean Name	Meaning
1st	Maspang	new moon
2nd	Musalum	new moon
3rd	Musaan	new moon
4th	Museit	good fishing
5th	Musaoal	poor fishing
6th	Lotloto	poor fishing
7th	Mutaoal	good for turtle catching
8th	Sriafong	phosphorescence, poor fishing
9th	Arfoko	fish gathering by species
10th	Sukanpur	good for gathering house timber
11th	Lofsan	good for crab catching
12th	Olwen	good for crab catching
13th	Fakfong	good fishing
14th	Mesr	planting day
15th	Eel	planting day
16th	Lulti	good fishing
17th	Kawulah Sie	good fishing
18th	Kuwulah Luo	good fishing
19th	Sopasr	fish producing eggs
20th	Apnuk	fishing in separate schools
21st	Sopasr	fish full of eggs
22nd	Osrlun	all fish now in species groups
23rd	Kusaf	fish in species groups
24th	Sunak	fish hiding
25th	Sroanpur	fishing hiding beneath hanging branches
26th	Arpi	fish releasing eggs
27th	Lil	fish returning to the sea
28th	Srupup	regrouping of species
29th	Lunguni	dark of the moon
30th	Lungalan	dark of the moon

For participants, this early session provided an important opportunity to reflect upon, share and discuss their own knowledge and observations of the environment and its changes. This provided a rare opportunity for Utwe stakeholders to discuss traditional knowledge in a formal/planning context and to consider how transmission can be strengthened and integrated into policy. It also set the scene for bringing traditional knowledge into all subsequent discussions throughout the workshop. Many participants said they had not thought much about the lunar calendar since they were young children in school; however, some specialists, especially people who fish as part of their subsistence way of life, said they were still guided by the lunar calendar.

Figure 2: Sweetyona Tulensru (left) and Aaron Waguk (right) present the results of their group discussions on the traditional Kosraean calendar



HPO is working to research the lunar calendar as a tool for natural resource management and climate change observation. One such example comes from Kosrae State's law 11-156, which was recently passed, for the management of the Mahkontowe Conservation Area, which utilizes the moon calendar as part of its regulations as enforced by KIRMA. On-going HPO intensive ethnographic survey projects on ethnozoology, navigation practices, and subsistence practices could also provide insights into Kosraean economic development in light of adaptation to climate change.

Kosrae HPO encouraged joint work with its office to ensure that adaptation efforts build upon and support traditional knowledge. Specific ideas for further assessment include using the lunar calendar as a framework for assessing how climate change is affecting Utwe Biosphere Reserve, including:

- identifying key changes observed over the decades (for instance a two-day shift in the lunar calendar and changing tides) and doing more in-depth interviews with farmers, fishers or other knowledge holders to confirm;

- participant observation to tease out how the reported changes impact daily lives and subsistence in Utwe;
- Daily journals to pinpoint shifts in seasonality, for instance with breadfruit, and to identify how that has changed and how it is impacting peoples' lives

Kosrae HPO indicated that elders will be able to share much more than was shared in the workshop, and that they would be able to provide much more insight if interviewed on site.

On Day 3, Dr. Rob van Woesik and Dr. Chris Cacciapaglia (Department of Biological Sciences, Florida Institute of Technology) was invited to share preliminary findings from his survey of coral reef health in Kosrae, including Utwe. He highlighted that Utwe reef is a breeding ground for fish and a coral refuge. He explained that in Kosrae, the coral reefs were capable of growing fast enough to keep pace with climate change-related sea level rise, hence providing some protection from coastal erosion and flooding. However, he warned that the reefs must be protected to ensure healthy regrowth and resiliency. His survey provided evidence of good recovery after the severe coral bleaching incident in 2015-16, with coral larvae possibly drifting from as far away as Indonesia.

Dr. van Woesik identified three main risks to the recovery of these young corals: (1) sedimentation on the reefs that is impeding regrowth and may kill some of the immature corals; (2) a crown of thorns population explosion; (3) climate change. He recommended that the community take necessary measures to protect the fragile reef recovery from the first two of these threats. His survey showed that the reefs off the northwestern to southwestern coasts of Kosrae were highly infested with COTs, warranting immediate eradication and management actions by the government and all relevant stakeholders.

After Dr. van Woesik's presentation, there was a discussion about means of controlling sedimentation on the reef, including by reducing runoff of agricultural inputs. Means and methods of COT eradication were also discussed and Mr. Maxson Nithan (State Forester, Division of Forestry, KIRMA) shared that one farmer has been experimenting with using COT as green fertilizer on some of their high value crops, namely fruit trees. In the past, Kosrae farmers have used sea cucumbers as green fertilizer, but the falling sea cucumber population has led to a decrease in this practice.

Adapting COTs to this use was proposed as one way of reducing agricultural inputs, saving farmers money and reducing a source of river and reef pollution, as well as providing a use for harvested COTs. Dr. van Woesik recounted that farmers in Japan use sea urchins as green fertilizer for their crops. Utwe farmers agreed that this experiment was worth expanding and initial plans were discussed to carry out trial to determine if this intervention was feasible.

Other points of interest and discussion

Several key themes came up throughout the workshop discussions, including:

- changes being observed in terrestrial and marine ecosystems
- the importance of traditional knowledge
- lessons learned from previous development projects
- a strong commitment on the part of stakeholders to the Biosphere Reserve and sustainable management as a way of improving Utwe's climate and disaster resilience

Utwe farmers and fishers mentioned many changes they have observed in ecosystem functioning during recent decades. These changes include:

- shifting production cycles for certain crops, most noticeably breadfruits;
- an increase over time of certain invasive and pest species, such as white fly, African snail, frogs, toads, mosquitos and monitor lizards;
- a decline of certain wild native and crop species, including citrus trees, coastal medicinal plants, white-eye and Micronesia pigeons, certain freshwater food fish, the bump-headed parrotfish, some rare night fish, some types of corals, the mangrove crab, mudfish and other mangrove species;
- the local population of the Kosrae flying fox (*Pteropus ualanus*, identified as "vulnerable" on the IUCN red list) has expanded over the years and these bats are feeding on local crops including breadfruits and mangos. Ironically, bats are also an important pollinator and disseminator of forest and crop species.

Throughout the workshop, Utwe stakeholders expressed a strong commitment to the Biosphere Reserve and to sustainably managing the reef, forest and watershed. They also shared their observations of how previous development interventions had impacted those natural resources. For instance, they provided detailed feedback on how the design of the current Finkol Bridge created a bottleneck and worsened flooding incidents. They pointed out that the previous wooden bridge had been less of a barrier to flooding and made recommendations about the redesign of the bridge.

Participants were keen to eradicate crown of thorns and protect Utwe harbour as a breeding ground for fish for the whole of Kosrae Island. Participants also discussed issues surrounding illegal harvesting of mangroves. It was recognised that mangrove is illegally harvested for firewood and construction in the core zone of the Biosphere Reserve and while some support a full ban on mangrove harvesting, others use the resource in their business or homes and argued for sustainable management. There was some discussion of traditional harvesting techniques that are less harmful to mangroves and therefore could be part of a management plan. This controversial discussion was not concluded during the workshop.

Outcomes

As the result of workshop discussions and preliminary results of the tools applied, a climate story for Utwe Biosphere Reserve was developed and presented back to the workshop to help identify the most effective and viable community-level activities. This draft story is shared in **Table 1**. Further discussions and reflections led to the development of a priority list of actions for Ecosystem-based adaptation (**Annex 4**). Some issues and unknowns worthy of further intervention and discussion, but that require the support of partners and technical experts were identified for future consideration and discussion (**Annex 5**). Subsequently, ways of addressing these issues within the scope of the project were identified for some of the issues, while others may not be within the scope of this project to address.

Traditional knowledge was introduced and discussed early in the meeting thereby providing a platform for traditional and local knowledge holders to think through the issues being discussed from their own knowledge perspectives. This set the scene for knowledge exchange and co-construction. The most productive discussions focussed on sharing ideas and thoughts between scientists and local knowledge holders, for instance a discussion between Dr. van Woesik, fishers and Biosphere Reserve managers about how to care for the reef to ensure its recovery from the coral bleaching incident in 2015-16. For further examples of the ways in which exchanges between traditional knowledge holders and scientific knowledge holders contributed to the decision-making, see **Annex 6**.

Table 1: Draft Utwe Biosphere Reserve climate story/theory of change as developed during inception workshop

Main stressors impacting Utwe	**Sea level rise**	**Inland flooding**	**Drought**
What's happening?	Coastal flooding Coastal erosion Damage to homes, businesses, infrastructure, graves, cultural heritage	Damage to crops Damage to homes, businesses, infrastructure, cultural heritage, forest, reefs and fishing grounds (sedimentation). Disease outbreaks	Water and Disease o Loss of in
What natural resources protect Utwe from this?	Coral reef Mangrove	Healthy watershed Mangroves Clean water	Healthy w Mangrove Clean wat

What is the state of these resources?	--Coral reef badly affected by bleaching in 2015-16. Now regenerating well, but this should be protected. It is threatened by invasive species, sedimentation, and overuse. --Mangrove is protected in Utwe, but illegal harvesting continues for firewood and construction. Also threatened by wild fires during dry periods. Mangrove species, such as crabs are declining. The mangroves are declining and the level of management effectiveness is judged to be poor.	--Upland forest is well protected and in good condition, partly because it is inaccessible, but is also protected by law. Rivers, streams and waterfalls are only in fair condition and are declining with poor management effectiveness. --Dams and springs are improving. It is worth doing more analysis to better understand water quality and water security. If water sedimentation is affecting reefs, where is the sedimentation coming from and is it polluted? --Mangrove is protected in Utwe, but illegal harvesting continues for firewood and construction. Also threatened by wild fires during dry periods. Mangrove species, such as crabs are declining. The mangroves are declining and the level of management effectiveness is judged to be poor.	--Upland good co inaccessib Rivers, st fair condit managem --Dams a worth do understan security. affecting sedimenta polluted? --Mangrov illegal ha and const fires dur species, s mangrove managem be poor.
What can Utwe do to maintain these resources?	Ensure reef resilience (regrowth) by: • Control invasive species (e.g. COT) • Reduce sedimentation • Reduce unsustainable harvesting practices (mangroves, coral, marine, fishing)	Reduce unsustainable tree/mangrove harvesting (sustainable harvesting methods?) • Mangrove restoration • Fire management in mangroves Reduce water pollution: • Agricultural inputs (more sustainable fertilizer and pesticides) • Pig waste • Sanitation/sewage treatment • Analyse sediment in Utwe harbour • Mangrove restoration	Diversify a sources to water Mangrove managem

Potential Activities	*Maintain/improve reef resilience*: Giant clam farming (livelihood diversification and sustainable reef management); crown of thorns management; improve quality of sedimentation and runoff (watershed management) *Maintain/restore mangroves*: Awareness raising, mangrove restoration, fire control, sustainable management of mangroves	*Watershed management:* Decreasing agricultural inputs/improving green farming practices (green fertilizers, organic/traditional pesticides); maintain forested watersheds; maintain mangroves *Disaster risk management:* WASH training and awareness raising; rebuilding bridges, improved run off control; water quality management—waste and sanitation.	*Improve w* Identify secondary *Watershe* Decreasin green f forested w *Disaster r* WASH tra water qua sanitation

Step III: Validation and joint planning

As a result of the decisions made at the inception meeting, a work plan was developed by KCSO in consultation with UNESCO for the implementation of the priority adaptation actions (**Annex 7**).

On 21 September 2018, 21 September 2018 to complete the loss and damage assessment before finalizing work plans. This included completing a loss and damage matrix on flooding (Annex 8).

On 31 October 2018, 25 community members gathered at the Utwe Municipal Government (UMB) office on participate in a Validation Meeting, which was facilitated by KCSO staff. By reviewing the work plan one output at a time, community members were able to discuss in detail how to implement the project. Most validation meeting participants agreed with the project activities and draft workplan. However, some changes were made as a result of feedback and discussion during the validation meeting. These changes are highlighted in red text in the work-plan (**Annex 7**). At the end of the meeting, participants were also asked to indicate their consent by checking the last box of the sign-in sheet. In general, participants were fully engaged with and enthusiastic about the proposed activities and workplan. However, a few issues were raised for further consideration:

- It was proposed to involve Utwe BR Management Group in the purchasing of materials
- There was a request to know the budget for each activity
- They requested further information about crown-of-thorns and how to use it as a fertilizer
- UBR Chair requested technical assistance from key stakeholders (KIRMA, MCT, Community Groups) to review the workplan.

The meeting also provided an opportunity to begin planning the first activities. In particular, community volunteers were chosen to assist with the Crown-of-thorns eradication. Moreover, community members pointed out a few freshwater springs to be mapped and considered for improvement (Yasrasr, Finsrem, Yenni, Yelum, Fonloesr).

Planning for implementation is on-going with key stakeholders, including Red Cross-Kosrae Office, KIRMA, Micronesia Conservation Trust, Kosrae Department of Education, Kosrae Historic Preservation Office, National Aquaculture Center.

Monitoring and evaluation

A monitoring and evaluation plan has been developed based on the Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation (PMERL) approach developed by CARE[4] (**Annex 9**)

A baseline awareness survey was held between 26 October and 10 November 2018. Focus groups were held with Utwe youth group, Utwe elder's group, Utwe women's association, and Utwe Elementary School pupils. The qualitative awareness survey is designed to monitor the following outcomes and outputs (**Annex 10**):

[4] See, for instance CARE (2014) Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation: A revised manual for local practitioners. Accessed 4 September 2018 (*https://careclimatechange.org/wp-content/uploads/2014/12/2014_PMERL.pdf*)

- ***Outcome 2****: Clear understanding of the importance of reef and mangrove resilience and how natural resources management can mitigate the impacts of coastal flooding is expressed by UBR stakeholders*
- *Output 2.3: Increase in community support for sustainable mangrove management*
- **Outcome 3**: *Clear understanding of the importance of how natural resources management can improve water security is expressed by UBR stakeholders*
- *Output 3.3: Women expressing increased awareness of how to manage water-related health and sanitation in emergency situations*
- *Outcome 4: Increased community awareness on traditional knowledge, traditional resource management strategies, climate resilience and water security*
- *Output 4.2: Knowledge level on traditional knowledge, traditional resource management strategies, climate resilience and water security for students*

As expected, awareness on reef, mangrove and climate change is already high amongst all focus groups in Utwe, at least in part because the community has been implementing climate change adaptation and environmental conservation projects for many years. However, there were a few areas where participants expressed low awareness on certain issues. For instance, and as expected, while elders have used traditional knowledge to predict weather, rainfall, drought, tides, youth and elementary school children have less experience and awareness of traditional knowledge.

The importance of watersheds for mitigating floods and drought did not emerge in any of the focus groups. Moreover, awareness of the impacts of the planned project on lessening loss and damage was not high, although data from youth on this issue is currently lacking.

Conclusion

Planning and adaptation to climate change impacts such as sea level rise, higher air and ocean temperatures are more important now than ever for all Pacific island communities. The data collected during the inception phase made it clear that, for Utwe, as for communities across the Pacific climate change adaptation is not to address future impacts. Rather, it is planning for immediate actions to address impacts that are affecting the community now. As can be seen from the experiences related by community members, fishers, farmers, families, elders and youth from Utwe, the impacts of climate change have far-reaching implications for their incomes, homes, health and well-being.

As a pilot project, it is important to capture the impacts of methodology as well as the activities. Early feedback from partners at KCSO and stakeholders suggests that the local partner is more involved in planning, monitoring, evaluation and reporting than in other projects that they implement. While the transparency and consultative approach is appreciated, it is putting further burden on a small and very busy NGO. For the project to succeed, a balance must be struck between capacity-building, joint planning and not overburdening local stakeholders and participants with planning and reporting. It is also important to highlight that the project must be seen as part of the long-term relationship that the NGO has with local stakeholders and the community. Therefore, it is important to not design an entirely new methodology, but rather to adapt to local expectations, knowledge, ways of working, relationships and constraints. To further strengthen the social and technical capital of the local partners and relevant institutions, the project must remain sufficiently flexible to become part of that process. This may require shifts in work plan or timeline or other adaptations to ensure that the project contributes to the local development landscape as a whole.

It is noted that participatory monitoring and evaluation, especially the qualitative indicators, is new and challenging to many local development actors, especially given the tight budget and timeline.

KCSO reported that the use of traditional knowledge is new and is appreciated by all stakeholders, but is also challenging as it requires capacity-building by staff to take on new ways of working with community members, as well as to draw on different kinds of information. However, the loss and damage matrix tool is a useful means of capturing and framing community level experiences of climate stressors and helping communities to learn from previous experiences. KCSO has included the methodology in a project in another Kosrae community.

In November 2018, implementation of the action plan began and data are being collected on the effectiveness of the interventions. However, regardless of the impact of the individual interventions, a major impact of the project is the involvement of Utwe community members in critically evaluating, planning and implementing or advocating for adaptation in their own community. By emphasizing community-based, traditional knowledge-based scoping, planning, implementation and monitoring and evaluation, it is hoped that the lessons learned will continue to impact Utwe's community-based adaptation far beyond the closing date of this pilot project.

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Monnereau, I. and S. Abraham (2013) "Loss and damage from coastal erosion in Kosrae, The Federated States of Micronesia", *Loss and Damage in Vulnerable Countries Initiative, case study report*. Bonn: United Nations University Institute for Environment and Human Security

United National Framework Convention on Climate Change (2013) *Best practices and available tools for the use of indigenous and traditional knowledge and practices for adaptation, and the application of gender-sensitive approaches and tools for understanding and assessing impacts, vulnerability and adaptation to climate change*. FCCC/TP/2013/11 (available at: https://unfccc.int/resource/docs/2017/sbsta/eng/03.pdf)

Annex 1: Community consultation list of participants

Utwe UNESCO UBR Participation List (Utwe Community Consultations)					
Utwe Women Org.	**Utwe Senior Citizens**	**Etawi Fusr Utwe (Youth)**	**N-one**	**Centerpoint**	**Gateway**
Lorna Alik	Dersina Keller	Henricky Obet	Lipan Kephas	Verlinton Tilfas	Reed Tilfas
Elsina Danny	Benista Benjamin	Yaichy Atchiro	RobertYos Foster	Ruth Tatchuo	Wilton Wag
Angelina Taulung	Juslene Benjamin	Alik Livaie	Nona Romus	Vernet Waguk	Carson Nena
Madlina Atchiro	Christina Madison	Leiana Livaie	Lorlinda Segal	Paul Waguk	Edwina Tilfa
Srue Reed	Rev. Madison Nena	Kenye D. Abraham	Molly Edmond	Madlina Calton	Sepe Man
Megelina Joab	Juslina Benjamin	Dwight R. Abraham	Sepe Emius	Lucy Salik	Jasmine Ben
Marcilyn John	Emius Nena	Tolennoa Edmond	Emius Nena	SepeRose Taulung	Magrida Har
Marciana Heuver	Erwina Obeth	Jaydee Joseph	Meryulyn Livaie	KellyAnn Nena	Sally-Ann Be
Martha Canston	Magrina Tulenkun	Blair L. Livaie	Jerry Diaka	Kenye R	Kenye Dwigl
Nona Romus	Renster Andrew	Edward Jack	Emef-Ann Nena	Lorna Larry	Shrue Reed
Notwe Kun	Sepe Emius	Jester Paulino	Sharolyn Robert	Shrue P Waguk	Merbila Wag

Suzie Henry	Kersin Ansin	Chester Tatchuo	Arthy Joseph	Larry Alik	Naiomey Ric
Emmanlyn Atchiro	Melisa Kersin	Mimi Ackley	Joarson Joshua	Reedson Edmond	Elizaphine S
Regina Sapuro	Aaron Wakuk	Mary Waguk	Henry Benjamin	Brandon Waguk	Sepe J Livaie
Alice Wilton	Margy Orlando	Mondalee Ludwig	TJ Joseph	Emma Melander	Diasyme Ho
Mary-Anna Anderson	Flora Bino	Brandon Tatchuo	Marlyn Ernist	Mondalee Ludwig	Erwina Elanj
Mary Wilton	Saimon Alik	Kim Asher	Kotaro Joshua	Rovey Benjamin	Anita Kalis
Lucy Taulung	Lena Tulenkun	Nena Tilfas	Sepe Lipan	Lolyn Verlinton	Harland Tilfa
Petrina Kun	Sepe Rentul	Alice Waguk	Ranky Benjamin	Susin Kilafwa	Irene Maxon
Irene Maxon	Rosina Joseph	RosieAnn Waguk		Verlinton Jr. Tilfas	Mary Norlin
Lynn Rebauw	Lipia Kilafwa	Arlyn Edwin		Jefferlyn P Nena	Alice Wilton
Sepe Alik	Rebecca H	Carolee Tulenkun		Hoya Alik	Shrue Nena
Sayomina Mckenzie	Sepe Benjamin	Kidson Jonithan		Vincent Verlinton	Rissey Emiot
Ruth Tatchuo	Sepe Honosr	Krystal Yamado		Yamado Melander	Jason Livaie

Rebecca H	Betsy Milson	Lelean Tulensa		Krystle Yam	
Mirah Alik	Magdalina Renster	Linus Obet			
Lorlina Bj	Rev. Renster Andrew	Jusber Andrew			
Libea Kilafwa	Adelina Nena	Molley Edmond			
Jusmina Alik	Keller Nena	Dorothy Jason			
Sepe K Benjamin		Nellyn Henricky			
Sweetyona Tulensru		Hardy Elton			
		Robert Foster			
		Aj Edmond			
		Emton Tulenkun			

All consultations were facilitated by: Bond, Reed, Jason (KCSO and Utwe BR Management Board)

Annex 2: Inception Workshop Final Programme of Work

Tuesday 10 July

Time	Objective	Session	Format	Responsible
Session 1: Introduction and Background				
9:45		Official opening/prayer	Formal	KCSO/Utwe BR
10:00		Introductions and sharing	Roundtable/circle	UNESCO/KCSO/Utwe BR
10:15	*Morning tea and group photo*			
10:30	7 2	Introduction to this project: • Brief introduction and inception meeting objectives • Outcomes of community consultation meetings • Discussion about Utwe community consultations	Presentation Presentation Discussion	UNESCO KCSO
12:30	*Lunch*			
13:30	1 5	Presentations on recent relevant projects: • Building Resilience of communities and ecosystems (project in Walung and Malem) • Historical timeline/ climate story (Project in Malem) Developing a climate story/ historical timeline for Utwe	Presentation/ discussion Group work	KCSO, MCT KCSO
14:30	1	Presentation on: • Study on climate loss and damage in Kosrae	Presentation/ discussion	UNESCO
14:45		Review and conclusion of the day		

Wednesday 11 July

Time	Objective	Session	Format	Responsible
Session 2: Traditional knowledge—protocols and methods				

9:00		Review of Day 1	Discussion	UNESCO
9:15	3	Introduction: Traditional knowledge based approaches to climate change assessment and adaptation	Presentation/ discussion	UNESCO
9:30	3 5	Traditional knowledge on climate, agriculture, marine resources and water in Utwe and Kosrae: Practical work on seasonal/lunar calendar	Discussion/ small working groups	Kosrae HPO
10:30	*Morning tea*			
10:45	5	Practical work on seasonal/lunar calendar (cont.)	Discussion/ small working groups	Kosrae HPO
12:30	*Lunch*			
Session 3: Community mapping and asset monitoring				
13:30	1, 5	MCT/Nature Conservancy LEAP toolkit: Community mapping exercise	Presentation/ Discussion	Micronesia Conservation Trust
14:45		Review and concluding comments		

Thursday 12 July

Session 4: Reef resilience and mitigation of coastal erosion				
10:00	1, 6	2018 Coral Survey: Reef recovery and its threats in Kosrae. Guest presentation by Dr. Rob Rob van Woesik, Professor of Biological Sciences, Florida Institute of Technology	Presentation/ discussion	Florida Institute of Technology
11:00	*Morning tea*			
11:00	5	Report back on LEAP community mapping	Group work	MCT
12:00	*Lunch*			
Session 5: Climate change loss and damage matrix				
1:00	4	Climate change loss and damage matrix	Practical work	UNESCO

14:45		Summary of the day	Discussion	

Friday 13 July

Time	Objective	Session	Format	Responsible
9:30	4	Climate change loss and damage matrix (continued)	Practical work	UNESCO/KCSO
10:30	*Morning tea*			
10:45	4	Climate change loss and damage matrix (cont.)	Practical work	UNESCO/KCSO
12:30	*Lunch*			
Session 6: Adaptation needs and priorities				
1:30	6	Summary of adaptation needs and priorities identified during workshop	Presentation	UNESCO/KCSO
	6, 7	Adaptation needs and priorities for Utwe: discussion, additions and prioritisation	Plenary discussion	UNESCO/KCSO
2:15	7	Planning and follow up plans		UNESCO/KCSO
2:45		Meeting close		UNESCO/KCSO

UBR INCEPTION WORKSHOP Participants list			
NAME:	**GENDER**	**ORGANIZATION:**	**CONTACT infor./ TELL #**
FREDDY H. NENA	M	FMR	370-3031
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EMIUS NENA	M	USC	370-2281
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Facilitators: Dr. Serena (UNESCO), Ashley (KIRMA-HPO), Betty (MCT), Andy (KCSO), Bond (KCSO)			

Annex 3: Analysis of tools applied during inception workshop

Tool	Application method	Moderator	Results	Notes and lessons learned

Historical timeline	A similar timeline developed in a neighbouring community was shared. Utwe stakeholders decided to develop their own timeline.	KCSO	Workshop participants discussed and developed a list of major events including climate related events that resulted in loss and damage that they could recall from the 1800's to 2018. The draft historical timeline gave an overview of when and how the Utwe community has been impacted and how these events have changed over time, as well as identifying key events for further analysis. The construction of the timeline led to discussion of the following: • The severe impact that typhoons have had on Utwe, even though they strike very rarely (last significant typhoon in 1905). Will they strike more/less frequently with climate change? • The recurring impact of drought—the most severe droughts coming with el niño in 1982, 1984, 1997, 2016 • Coastal flooding (recorded in 2001, 2014, 2015 • Inland floods (recorded in 2014) have been exacerbated by the Finkol bridge when it was concreted in 1984. Utwe stakeholders argued that the bridge has impacted drainage and worsens inland floods.	The historical timeline, as elucidated, provides important entry points for further investigation. Much useful information was shared and discussed. However, much can still be considered. Validation should be carried out to determine if all inland floods, droughts and coastal floods have been recorded, particularly in the period from 1980-2000. This can provide a baseline for tracking climate change impacts and a tool for planning. It would also be useful to consider the impacts of the mangrove channel clearing, the Tafout dam, the Biosphere Reserve, the Isra dam, etc. on climate stressors.

Traditional calendar	A traditional calendar recorded in 19th C was shared with Utwe stakeholders. They worked in groups to consider the calendar, whether the 19th C data is still accurate today, whether it still guides their activities and how it may be relevant.	KIRMA—HPO, Kosrae State Cultural Anthropologist	Instead of a seasonal or annual calendar, Kosrae traditional activities are guided by a lunar calendar. Traditional names of days in the calendar encode what should happen on each day of the month with respect to: • Fish behaviour/availability • Tides • Sea calmness or roughness • Bird behaviour • Planting and harvesting (cultivated and wild) • Plant ecological cycles (wild and cultivated) • Insect behaviour • Weather and precipitation • Wind It was agreed that some people still use the calendar, mainly fishers, but that many people are forgetting its importance for guiding natural resource management. The example of the 9th Day is the day to harvest timber from the forest. This is in the middle of a dry time in the month and would be safest for the harvesters and less likely to cause further damage. For instance, during the rains, the soil is more likely to slide into the waterways and ends up on the reef as sedimentation. Harvesting trees at the drier time of the month can lesson soil erosion and reef sedimentation. A possible change in breadfruit seasonality was also discussed. Some agreed that it is changing, but others were not sure.	HPO is continuing to do research on this across Kosrae. It is recommended to do participant observation with fishers, farmers and elders to see how the lunar calendar is still guiding resource management. It is also recommended to do daily journals to see if the days have shifted (early observations suggest a two-day shift since 19th C) and if seasonality is shifting—for instance breadfruit seasonality has changed, but the reasons behind this are not clear. It is also recommended that interviews be carried out on the site of the activity. Any such activity should be coordinated with HPO. It is also suggested that the lunar calendar could be a useful guide for managing the Utwe Biosphere Reserve Buffer Zone. This may be considered by the UBR Board when revising the UBR Management Plan.

			Utwe stakeholders noted that they are not planting or harvesting according to this calendar any more.	

Mapping natural resources and social targets	Utwe community members and stakeholders engage in mapping natural and social resources, drawn from Micronesia Conservation Trust's Local Early Action Planning toolkit	MCT Capacity-building programme manager	Working in groups, Utwe stakeholders filled in a matrix containing different natural and social resources, discussing why they were important and their current status. After that, the groups drew maps indicating where those resources were to be found. Priority natural resources were coastal areas, upland forest, rivers and streams, mangrove forest. It was noted that upland forest is not declining and is well managed, but that coastal areas, mangroves and rivers are declining with poor or non-existent management effectiveness. In terms of social resources, historical sites and waterfalls are declining over time, while the Biosphere Reserve, farm roads, dams, spring water, playground, church, clinic, school, marina and bridges are all improving in condition. This suggests that social assets are currently more effectively managed than natural assets in Utwe	This activity was important for highlighting the relative neglect of natural resources in Utwe, but also showing the interdependence of natural and social resources in ensuring the well-being of Utwe community. On the basis of this reflection, Utwe stakeholders were able to focus subsequent discussions on management of those resources most at risk, including rivers, coastal areas and mangroves. As part of the Local Early Action Planning toolkit, this is one of a range of effective mechanisms. A reflection of the effectiveness of the current assessment by LEAP practitioners would be useful.

Loss and damage matrix	Building on the prioritisation of climate stressors and their impacts carried out during the community consultations, the historical timeline and the natural and social asset mapping exercise, a climate change loss and damage matrix was constructed in order to develop a climate story for Utwe. The participants selected a single event that occurred between 15-25 years ago and considered how that event impacted key assets and sectors.	UNESCO	The participants chose to focus on a drought that occurred during the el Niño event in 1997/98. The participants broke up into three groups (two groups of men and one of women). The three groups selected two sectors each (agriculture, fisheries, mangrove, homes/villages, health (women), children/family life (women). During a subsequent meeting, similar groups completed a similar matrix for flooding events that occurred in 2001 and 2014. The results are provided in **annex 8**. Main findings included the major impact that drought and inland flooding had on health, food security, agriculture and fisheries. It also provided a framework to think through the effectiveness of adaptation and coping measures that have already been tried and prioritising future adaptation measures.	This was an effective exercise that permitted the consolidation of the results of the previous exercises and helped Utwe community members to think through the impacts of extreme event on all natural and social assets. It was also useful for linking on-going challenges to climate and natural stressors, including how the degradation of natural resources, such as the reef, mangroves and waterways lead to increased vulnerability to climate stressors. As a follow-up, it would be useful to apply the same tool to other climate events (including inland floods and coastal floods). It would also be useful to validate the drought matrix with community members.

Annex 4: A priority list of actions for Ecosystem-based adaptation

Participants identified seven adaptation and intervention actions, which are ranked and prioritized as follows:

1. Crown of thorns (COT) – This is a call for immediate eradication and management action of COTs in Kosrae's reefs including Utwe. The eradication will involve collection of COTs from the reefs and training of local Utwe farmers to utilize the collected COTs for green fertilizer.
2. Mapping of natural springs and improve access to spring water – This intervention aimed to improve water security through sustainable water source access. KCSO and partners will facilitate a community workshop in Utwe to map out all the natural springs that can be used for drinking and cooking. Of these springs, one will be selected for access improvement. The goal is that community members will be able to access water from this source anytime of the year, including in times of disaster.
3. Aquaculture/ freshwater fisheries management – This intervention is intended to support livelihood diversification and provide income opportunities for the community. The decision is to focus giant clam farming. A feasibility study conducted by Simon Ellis of Marine and Environmental Research Institute of Pohnpei. The study recommended giant clam farming as a potential acquaculture for the UBR.
4. Mangrove restoration and management planning – This adaptation action will support mangrove restoration efforts in and adjacent to the UBR. Participants agreed to identify 3 mangrove gaps in and adjacent to the UBR and replant them with mangrove seedlings. As part of this intervention, mangrove awareness programs will be carried out including integrating mangrove management into UBR management plan, raising awareness in schools and educational programmes and developing communications materials.
5. Training program for Utwe community including Disaster Risk Management Training for the Utwe Women Organization – This intervention will support capacity development of community members specifically for women in Utwe. The Red-Cross Kosrae Chapter will conduct the training course.
6. Solid waste management
7. Hydroponics

A vote was held, ranking the options. Options 1-5 were selected by the participants as the priority actions.

Annex 5: A list of areas that require further elaboration and assessment.

Priorities for further community-based assessment

- Completion and validation of loss and damage assessment
- Monitoring and participatory assessment of impact of EbA activities

Priorities for further Traditional Knowledge-based assessment

Partner: HPO

- Traditional lunar calendar elaboration as it guides natural resource use, particularly for fisheries and forestry. Validation with elders and knowledge-holders.
- Changes in breadfruit seasonality. Interviews with farmers.
- Coastal medicinal plants that are vanishing
- Changes in tides: what is being observed?

Priorities for scientific data needs

Partner: KCSO, KIRMA

- Coral reef sedimentation analysis
- Water quality testing
- On-going hydrological monitoring of springs and drought tolerance
- On-going monitoring of reef recovery
- Climate data modeling downscaling (is there a precipitation shift?) (NIWA and BoM)

Priorities for social/economic development

- Development of Utwe Biosphere Reserve facilities and capacity (day tourists, visitor center, enforcement)

Annex 6: The role of traditional knowledge in project

A major challenge with a knowledge co-construction approach to climate change adaptation, or indeed, any sustainable development project, is ensuring that traditional knowledge-holders[5] are fully engaged throughout the process, including in defining the problem, planning, decision-making, implementation and monitoring and evaluation. This often requires on-going work by facilitators to ensure that group dynamics encourage a discussion of issues from a perspective that may be unfamiliar to many of the officials and professionals who generally coordinate and run climate change adaptation projects.

The key with a traditional knowledge-based approach, therefore, is not to document or "research" traditional knowledge so that "facts" can be extracted and applied in normal development structures and processes, but rather creating spaces for ways of working, partnerships, dialogues and decision-making processes that encourage the sharing and respectful consideration of different types of knowledge.[6] A knowledge co-construction approach is an on-going way of working that may be new and challenging to many implementers, both local and international.

In this sense, the knowledge co-construction is a process, during which all partners learn lessons and build capacities on climate change, traditional knowledge and wisdom of the environment, but also on listening to and learning from those who may not be used to speaking in development contexts.

As the above suggests, participatory methods are useful tools for nurturing a knowledge co-construction approach, especially when it gets stuck or if a few people are dominating the decision-making and knowledge sharing. Tools for eliciting and sharing traditional knowledge can also be useful. For instance, in the inception workshop, it was important that the work on traditional knowledge and the traditional lunar calendar was scheduled early in the workshop, so that participants were reflecting throughout on often barely remembered stories taught to them in school or by their elders when they were young. Discussions of how this knowledge was relevant to confronting the impacts of climate change and how much the elders may know recurred throughout the meeting. It also established the rule that sharing this knowledge was encouraged and would be taken seriously.

The scientists and technical experts knowledge had a strong influence in setting the scene, defining the scope of the problem and proposing activities and solutions. Nevertheless, in each proposed activity, the exchange between traditional knowledge and scientific knowledge provided an opportunity for identifying innovative solutions and building new approaches to adaptation that will provide learning for traditional knowledge-holders and scientists alike. A brief and simplistic analysis of the knowledge exchange that occurred during the discussion of each of the proposed activities is presented in box 1.

[5] For the purposes of this discussion, I use the term "traditional knowledge", which is more commonly used in Pacific Island Countries and Territories, as opposed to the more globally common "indigenous and local knowledge". The issue of nomenclature has been discussed many times (see for instance, Heckler, S. (2009) *Landscape, Process and Power: Re-evaluating traditional environmental knowledge*. Berghan Books)

[6] See, for instance Hill *et al.* 2016; the Bridging Indigenous and Scientific Knowledge about global change in the Arctic (BRISK) project (www.arcticbrisk.org); or a UNFCCC synthesis report (https://unfccc.int/resource/docs/2017/sbsta/eng/03.pdf).

Box 1: Examples of knowledge co-construction during inception phase
Alternative water source development (water security)
One of the major impacts of drought identified by workshop participants was the failure of piped drinking water, during the large drought in 1997-98. Community members had to take long journeys by canoe across the harbor to access other sources of drinking water. Traditional knowledge holders were able to name the springs that are the most likely to keep flowing during droughts. They will work with the state authorities to develop a plan to ensure access to sources of drinking water in cases of drought, but they will also work

Annex 7: Workplan for ecosystem-based adaptation

Activities	Implementer	Partners	Methodology & Approach	Output	Outcomes	Indicators/measures of success	Completion Date
Output 1.1: Iterative co-constructed loss and damage assessment implemented in Utwe Biosphere Reserve (Kosrae, FSM)							
Community consultations in 3 hamlets, with senior citizens, Utwe Women's Organization and Utwe Youth Organization	KCSO	UBR Management Board	Project introduction, FPIC and preliminary assessment activity	Consultation report and inception report	Full Utwe engagement with inception meeting Preliminary assessment results providing basis for inception meeting activities	--At least 25 Utwe stakeholders participating in inception meeting --Preliminary assessment results validated during inception meeting	July 18
L&D assessment and EbA planning	UNESCO and KCSO	MCT, KIRMA, UBR Management Board	Participatory meeting, including loss and damage assessment and EBA planning	Inception report, rapid L&D assessment, climate story, EBA priorities, work plan, draft budget	Draft agreement for EBA interventions and community-based activities	--Rapid L&D assessment --Implementable EBA work plan and budget --Successful validation meeting	July 18
EBA plan validation	KCSO	UBR Management Board	Validation workshop in UBR, including L&D assessment, climate story and EBA plan	Validated L&D assessment, work plan and methodology, including monitoring and data collection	--Completed rapid L&D assessment and climate story --Full community engagement in EBA measures	UBR engagement in agreed EBA measures	Oct- 18

Output 2.1 Reef resiliency: Crown of Thorns eradication							
2.1.A Preparatory meeting with dive operators, KIRMA, & local leadership	KCSO	KIRMA, Kosrae dive operators and other environmental stakeholders	Work with KIRMA and other technical agencies in Kosrae to organize the dive team and prepare dive schedule for the COT Eradication	Agenda and all other meeting docs prepared for the 1-2 meetings with technical team and local leadership	Meeting minutes produced with dive team, dive schedule, and list of supplies and equipment identified and confirmed.	organizing meetings successfully carried out	Oct 18
2.1.B Purchase of Equipment and materials needed	KCSO, UMG	Treelodge	Purchase of all equipment, materials, and supplies for the project will follow KCSO procurement policy.	Purchase orders are placed for all necessary equipment, materials, and supplies	Equipment, materials, and supplies are available before actual field work begins	All purchase and orders are completed.	Oct 18
2.1.C Diving & collection of COT from highly invested reefs in Kosrae including Utwe reefs	UMG, KCSO	KATO, Nautilus, local divers	10-15 consecutive days diving & collection of COT from shallow to 30 ft. at reefs highly invested as determined in recent survey and in Utwe	Equipment, materials, and supplies provided to diving team for their eradication/collection operation	Dive operation completed with COTs collected and stored safely.	All relevant stakeholders participate in the operation	Oct-Dec 18
2.1.D Monitoring impacts of CoT eradication	KCSO	UMG, KIRMA, Fisheries (FMR)	COT collection survey (pre and post). Baseline on start date and post at the end of collection	Data collected used to inform over survey period	# of COTs collected on a daily basis	Survey data collected and compared	Dec 18-July 19
Output 2.2. Livelihood diversification and income security (Giant Clam Farming)							

Coordinate and secure participation of the National Aquaculture Center in the Giant Clam Farming Project	KCSO, UBR	NAC, KIRMA	Email, telephone, and personal visit to NAC to secure their support and participation	Project activities introduced to NAC and support requested	# of *H. hippopus* seeds and supplies needed for the farm discussed and identified	Agreement to support the project is secured	Sept 18
Review of feasibility study and environmental impact assessment	KCSO, UBR	NAC, KIRMA	Work with NAC to review feasibility study in the Utwe context and Environmental impact assessment with KIRMA	Meeting with NAC and KIRMA scheduled	Meetings with KIRMA and NAC carried out	Feasibility study and EIA recommendations provided	Sept-Oct 18
Purchase of supplies and construction of 2 tables	KCSO, UBR	NAC, KIRMA	Coordinate with NAC representative to purchase *H. hippopus* seeds and supplies for the construction of the tables	Purchase orders are placed for all necessary materials and supplies	# of seeds purchased and construction of tables completed and ready for deployment	all materials are available to NAC for the construction of the tables	Nov-Dec 18
Training of Farmers/Scuba Certification	KCSO	NAC, Treelodge	KCSO will work with the 3 hamlets in Utwe to carry out all necessary improvement work to enable access of water source	training for farm and scuba scheduled with NAC and dive operator	training completed and dive certificate issued to 1-2 community members	Farmers are identified to participate in the trainings	Jan 19

Establishment of Farm	KCSO, experts (MERIP)	UMG	Consensus reached between KCSO and UBR on where to locate the farm	date and time of transport of tables and seeds agreed upon	tables are placed in the water with *H. hippopus* seeds placed on them	All agencies including community members participate in the deployment of tables and seeds	Jan 19
Monitoring of farm	Certified divers, KCSO	NAC, UMG, UBR	Recommendation on feasibility of farm	Sustainable management plan for farm	Farm is thriving with *H. hippopus*seeds in good condition. Utwe is committed to implementing plan	Recommendation on farm Sustainable management plan	Dec 18-Jul 19
Output 2.3 Coastal erosion and water quality: Mangrove Restoration and Management							
Community mapping and assessment of mangrove gaps	UBR, UMG	Survey and mapping, KIRMA, KCSO	Work with KIRMA and Utwe community to identify major mangrove gaps in the Utwe mangrove forests	host 1 meeting with KIRMA and UBR board to select mangrove gaps for replantation	scheduled for replantation is developed	3 mangrove gaps identified for each hamlet to replant	Mar 19
Meeting with UBR hamlets	UBR, KCSO	KIRMA	KCSO and KIRMA/Forestry will meet with the 3 hamlets to discuss # of seedlings to be collected and methods to be used for replantation	hold 3 separate meetings with Utwe hamlets	Hamlets learned types of seedlings to be collected and methods of replanting	Meetings completed	Mar 19

Collection and replantation of mangrove seedlings	Hamlets	KIRMA,	Coordinate with KIRMA/Forestry to confirm seedlings and appropriate dates for replantation	Each of the 3 hamlets agrees to collect 1,000 seedlings each for replantation	all 3000 seedlings collected, confirmed, and replanted	Community level participation is high	Apr-May 19
Mangrove Management Awareness raising	KCSO	UBR management team, KIRMA	KCSO and UBR board will integrate mangrove management into UBR management plan, raising awareness with officials responsible for enforcement, etc.	Draft new objective into UBR management plan to address mangrove management; and present mangrove management at the next Kosrae Conservation and Enforcement Task Force (KCET) meeting	Objective integrated in to UBR plan and meeting completed	Objective developed and ready for incorporation into the plan	Feb-Apr 19
Monitoring of mangrove regrowth, management and awareness	KIRMA, KCSO	UMG, Hamlets	Awareness survey (baseline in Oct 18, follow up in Jul 19).	Final activity report with results of awareness survey and mangrove monitoring	Utwe stakeholders with increased awareness of the ecosystem services provided by mangroves and showing increased commitment to their sustainable management	Seedlings surviving., Increased community support	Jul 19

Output 3.1. Reef resiliency and water quality: CoT Green fertilizer experiment							
Consultation and training meeting with UBR farmers	KCSO	KIRMA (Div of Forestry), UBR	KCSO, Forestry, and UBR committee will convene a meeting with Utwe Farmers to decide on who will participate in the green fertilizer experiment.	Agenda and invite letters distributed	meeting minutes produced showing selected farmers for "green fertilizer" experimentation	meeting scheduled and all participants receive and acknowledge participation	Jan 19
Farmers training for green fertilizer experiment with COT	KCSO	KIRMA (Div of Forestry), UBR, Utwe Farmer's Association	Div of Forestry will hold one-day session (meeting and field demo) with selected farmers on how to use COT as fertilizer.	Training materials and supplies secured	training completed	all selected farmers' participate in training	Jan 19

Experiment carried out using protocol developed by farmers, KIRMA and KCSO	KCSO	KIRMA (Div of Forestry), UBR, Utwe Farmer's Association	With support from KIRMA and KCSO, farmers will carry out experiment of using CoT as green fertilizer. KCSO will monitor outcomes, including if pilot results indicate that chemical inputs could be reduced as a result of CoT use and if supply chain could be maintained.	Recommendation on viability of use of CoT as green fertilizer	Recommendation produced	Farmers complete experiment and make recommendation. Recommendation supported with further data (supply chain analysis, agricultural and economic viability of CoT use vs. chemical inputs)	Jan-Apr 19
Monitoring & Evaluation	KCSO	KIRMA (Div of Forestry), UBR	Based on M&E framework	Recommendation on viability of use of CoT as green fertilizer	Recommendation produced	Experiment was monitored and recorded to enable the production of evidence-based (both TK and scientific) recommendation	Feb-Jul 19
Output 3.2. Improving water security through sustainable water source access in Utwe							
Community meetings to map and designate 1 site for improvement	KCSO	UBR Board	Work with UBR board and UMG to organize community meeting	Map of natural springs	Map of all natural spring developed by community and 1 site selected for access improvement	high community participation	Mar 19

Environmental impact assessment and planning for improvement work	KCSO	KIRMA	Follow KIRMA requirements to secure development permit for the necessary improvement work	Application for Development Permit completed and submitted to KIRMA	Permit issued	Impact assessment conducted	Mar 19
Improvement work	KCSO	UBR	KCSO will work with the 3 hamlets in Utwe to carry out all necessary improvement work to enable access of water source	work schedule and plan developed	All improvement work completed	All 3 hamlets participate actively	Apr-May 19
Monitoring as per plan (including water quality monitoring)	KCSO	KIRMA	KCSO will monitor with input from KIRMA on water quality monitoring and environmental impact	Improved spring	Improved spring access managed to provide more water security for Utwe in times of shortage	Improved spring not negatively impacting water quality at spring and sustainably managed for shortages	Feb-Jul 19
Output 3.3 Water security: Disaster risk management training for Utwe women							
WASH Training for UBR Women's Organization (focus on droughts and floods)	KCSO	Red Cross Kosrae Chapter	Coordinate with RED Cross Kosrae Chapter and RED Cross Volunteers to carry-out a disaster risk management training for Women in Utwe	Red Cross Kosrae Chapter will implement a full training course on first-aid for all women in Utwe.	More women in Utwe will be WASH certified	Participation level of women is high Awareness is raised on WASH during floods and droughts	Jan 19
Output 4.1 Update Utwe Biosphere Reserve Management plan to improve climate resilience							

Management planning sessions to review and Update of the UBR Management Plan	KCSO, UBR Management Board	Micronesia Conservation Trust, USC, Farmers, Fishers, UFA, UWO (reps)	Work with MCT or other local partners to facilitate a review process to update the UBR management plan. The update of the plan should take into consideration results and recommendations from the EbAactivities and the recent evaluation of the UBR using MCT's MPA management effectiveness toolkit	KCSO and partners will carry out a series of planning and review sessions to update the UBR management Plan	New and updated objectives, activities, including lessons learned from other project outputs etc. are developed and included in the Plan.	all sessions are completed	May-Jun 19
2. Drafting and validation of updated management plan (technical support)	KCSO, UBR Management Board	MCT, UMG,	KCSO will work with partners to draft, validate and finalize the revised Plan before submission to the State Government for endorsement and submission to UNESCO MAB.	Validated plan	Plan effectively integrates EbA adaptation measures to increase adaptive capacity of UBR	Final draft is validated by UBR stakeholders.	Jun-Jul 19
Output 4.2. Education activities with youth and children focusing on traditional knowledge, traditional resource management and climate resilience							

School Program for Utwe Elem. School (focusing on traditional knowledge, tradition resource management, cultural demonstration, etc.)	KCSO	Kosrae Dept. of Education, Kosrae Historic Preservation Office	KCSO will carry out a series of school activities in collaboration with Utwe senior citizens and Historic Preservation Office to share information on traditional resource management and climate adaptation strategies with selected target grade from the Utwe Elementary School.	The team will have classroom presentations, cultural demonstrations, field trips, etc.	Understanding level of school children in Utwe about traditional knowledge is increased.	All activities planned and scheduled for this program is carried out successfully.	Oct 18, Jan 19, Apr 19
Summer 2019 Youth-to-Youth Program	KCSO	Utwe elementary school, Kosrae Historic Preservation Office	KCSO and partners will organize and carryout a one-week of fun and interactive learning experience for 7th graders in all the schools in Kosrae, including the Utwe Elementary school.	KCSO and partners will do presentations on various topics including "traditional knowledge" and other fun environmental activities.	Awareness level of school children on traditional knowledge, traditional resource management, climate resilience and water security throughout Kosrae will improve.	2019 Youth-to-Youth Program planning and activities completed successfully. Awareness raised with youth	Jul 19
Output 4.3. Information and awareness-raising materials							

Development of Information Materials	KCSO	UBR board	KCSO Education Program will work in partnership with UBR board to develop brochures and information materials for the UBR as well as utilizing KCSO newsletter to public articles about the UBR.	Quarterly newsletter will show articles on the UBR. Brochures and other information materials will be developed and distributed in schools, hotels, etc.	Support for the UBR continues to improve	All materials are developed to meet the requirements of KCSO and UNESCO	Oct 18 - July 19
Development of technical papers/products	UNESCO	KCSO	UNESCO, KCSO and other partners will share pilot results and outcomes in technical papers/products	At least two technical outputs published in appropriate outlets	Technical findings of activities and outputs distributed to stakeholders, including recommendations on experimental activities	Recommendations and technical outputs received by Kosrae, FSM and Pacific stakeholders	Oct 18-Jul 19
Project, evaluation and activity reports	KCSO	UNESCO	KCSO will prepare four evaluation and activity reports based on validation meetings and M&E framework	Inception report Activity report Mid-term evaluation report Final report	Awareness raised on appropriate methodologies and approaches to TK-based EbA in Pacific Islands communities.	Lessons learned from activities and outputs reflected upon, recorded, shared. Methodology refined. Opportunities for scaling up identified.	Oct 18-Aug 19

Annex 8: Rapid loss and damage assessment for Utwe Biosphere Reserve

The rapid loss and damage assessment carried out during the inception phase of this project is based on an approach first developed by Warner and van der Geest[7] and further developed by the University of the South Pacific's Pacific Centre for Environment and Sustainable Development in partnership with UNESCO.[8] The aim here was to shorten the assessment and use it as a tool for community-based knowledge co-construction and adaptation planning. As such the tools applied during the workshop were those most useful for encouraging compilation and analysis of the information already held within Utwe community. The presence of scientific and technical experts who engaged in the discussions was also very helpful for thinking through the connections between observed phenomena and offering potential solutions.

Although a number of tools were used that compiled the history, traditional knowledge resources, community and natural resources and primary needs of the community, the loss and damage matrix exercise was a powerful tool for bringing much of that information to bear on particular types of climate stressors and thinking through what adaptation and coping measure have already been carried out and what could still be tried.

To complement the 2013 study on loss and damage due to coastal erosion and flooding carried out by Monnereau and Abraham,[9] two loss and damage matrixes were completed by Utwe stakeholders with facilitation by KCSO and UNESCO: drought and flooding. The results of those two exercises are presented in this annex (Tables 1 and 2).

[7] Warner, K. and van der Geest, K. (2013) 'Loss and damage from climate change: local-level evidence from nine vulnerable countries', *Int. J. Global Warming*, Vol. 5, No. 4, pp.367–386, pg. 368

[8] Galloway, K. and S. Heckler (2017) 'Towards Climate Change Resilience: Minimising loss and damage in Pacific SIDS communities', UNESCO (avail at: https://drive.google.com/file/d/1nm1PyrkxYNXUrqhP0fLHhv8-_7SRKVuQ/view)

[9] Monnereau, I. and S. Abraham (2013) "Loss and damage from coastal erosion in Kosrae, The Federated States of Micronesia`, *Loss and Damage in Vulnerable Countries Initiative, case study report*. Bonn: United Nations University Institute for Environment and Human Security

Table 1: Loss and damage matrix for drought

During the 97/98 el niño, a strong drought was experienced that lasted for 8 months. Table 1 represents the compiled outputs of three working groups of 7-12 Utwe stakeholders, each of which chose two sectors, and was completed on 12-13 July 2018 : Group 1 (men): mangroves and homes/village; Group 2 (men): agriculture and fisheries; Group 3 (women): health and children/family

Sector	**Impact**	**What were the coping and adaptation interventions?**	**What were the impacts after intervention?**	**What is the explanation for the on-going impacts?**	**What could be done?**

Agriculture	--Shortage of food production (25-20 % of the harvest lost) --Shortage of food for pigs (some pigs died). --Decrease/loss of income --Fruit reproduction change --Farming areas dried up/relocation to wetland --Wild fire (3-5 HA) --Citrus canker --Upland agroforestry areas and lowland areas both dried up—soil dried and vegetation wilted and burnt --Coconut produced fewer and smaller fruits with less juice that had a different taste	--Diet change (1-2 meals a day) --Introduced or increased commercial fertilizer --New agricultural techniques --Sharing --Changing farming areas (from upland to swamp areas) (mostly vegetables) --Eradication of diseased citrus (landowners were given incentives to allow eradication) Pray to God	--Fruiting season has changed (specifically breadfruit used to be harvested throughout year, but not now) --Land dried up fast (barren) --Increase (eradication increase)—canker is still there --Citrus trees were destroyed, so not enough trees but canker is still around --Had to return to previous land afterwards (upland areas) --Some land has not returned to original state	--Out of our control "Mother Nature" --Land barren --Limited expertise --Some citrus replanting was done, but they're still juveniles (lemon)	--Technical advice on controlling citrus canker --Technical experts to understand and address reducing lime production --To introduce alternative varieties (for instance lemon instead of lime). --Lime trees are resistant—the ones that were not eradicated have recovered somewhat as long as the endemic disease levels are controlled.

Fisheries	--Warmer temperatures --Coral bleaching --Loss of freshwater resources --Loss of income --Relocation of spawning grounds	--Rely more on imported food --Search for new fishing grounds --Trolling --Crab farms --Fish aggregating devices (off-shore) --Organizing fisheries organization (Utwe Fisheries Association)—to focus on off-shore fisheries	--Increased pressure on new reefs --Price increase on fisheries products (good for fishermen	--Management strategies are not in place --Fuel costs/fishing ground is too far	--For UFA to perhaps focus on coastal fisheries --Fish farming—feasibility study on small aquaculture has been done, but not necessarily on fish farming (rabbitfish) --Management strategy for reefs --Support for UFA --Freshwater fisheries development (freshwater shrimp) --Aquaculture (giant clams, coral)
Mangrove	Dried out and trees started dying, there were two wild fires, soil (20 years to recover)	--Forestry awareness raising (wild fire) --Replanting	--On-going habitat loss --Human harvesting	--Recovery duration is very long --Attitude --Lack of funding --Expert (CP)	--Programmes for helping with mangrove to learn best management practices --Prepare for drought (fire prevention, disease control)
	Partial loss of income	No coping and adaptation			

	Partial loss of food	Search for crabs in other habitats			
	Timber (for construction and firewood)— mangrove wood is highly flammable	Harvested from inland forest and continued to harvest dry trees for firewood. Opportunity to sell firewood to other villages			
	Were impacted by a root rot and got diseased	The diseased trees were harvested for firewood, too.	--Disease continued		
Homes/villages	--Lack of drinking water for cooking, shower, home gardens -- Higher utility bills	--Govt. provided tanks --Improved the road to access alternative water supplies --Provided services (cooperation of people)	--Disease continued: dengue fever, diarrhea	--Poor maintenance of water tanks --Lack of preparedness --Lack of income	--Better maintained water tank, keep improving access to springs, --New water supply from a damn. --Identify (hydrological survey) and dig a well --Maintain the spring so it stays healthy, make sure it's accessible. --Map springs and develop access for alternative water source when main sources fail.
	No water in the schools, health clinic	Brought in water in containers by principal, teach Pit toilets were flushed with saltwater		--Subsequently law was passed that school could not operate without water	

	Disease				--Have management plan to ensure that alternative sources stay clean and disease free.

Health	--Diarrhea, pink eye outbreak --Water shortage—had to travel on a canoe half an hour to fetch water --Were hosting delegation from Micronesia games, so the delegations received the piped water that was available --So women and others had to collect water from springs --Disabled are cared for by the families, but there were some special challenges	Go to hospital to seek attention	Hospital had limited space	--Community health clinic introduced two years ago—should reduce demand on hospital Maintenance of public water supply systems is weak	--Plans for people with disability --Govt. plans for ensuring equitable access to public water supply (especially on-going maintenance)

	Fruits died off—poor/low supply of fresh fruits, poor nutrition and diet	Flu shots, surveys Outreach services (prevention control)			--Health and hygiene training for UWO during drought and flood
	If no access to boat—difficult to access water	Borrowed canoes from relatives to seek water	Most managed to access water through sharing transportation, but still required time and effort and difficult for those looking after young children, the sick or elderly or people with disabilities	Utwe extended families look after each other, so important for making sure that no one goes without, but it adds extra strain to everyone to have to travel so far for water	--Ensure access to and sustainable management of alternative springs
Children/ family life	Not enough water—went to fetch water for everything (very time consuming—to go by boat)	--Conserved water --Improved access roads to springs --Extended the pipes to improve access to springs	--Siphoning water using the pipes altered the spring and the quality and flow of the water was impacted.		--Ensure access to and maintenance of spring (on private property) --Ensure sustainable management of pipes siphoning the springs.

	More expenses (for transport, gas and imported food) of trying to help children and families feel better because of illness	Government helped with water catchment—3 tanks (school, church, a private property) --Legislation/policy that schools don't operate during periods of hazards (when there's no clean water)			--Mothers/ caretakers need better awareness and better knowledge to prevent disease outbreaks. --DRM, hygiene training for Utwe Women's Organisation
	Children were more vulnerable to illness. Very young children were especially vulnerable—hard to keep everything clean	Relied on traditional medicine to supplement hospital treatment.	Local medicine helped prevent illnesses and treat disease		--Protect areas where traditional medicines grow (beaches, forest)

	Pigs were sick and dying. Led to loss of subsistence and income (pigs were destroyed)	--Some people bought new pigs and others were given them by friends and relatives. --Farmers built new pens and built them on higher ground.	Next time there was a drought, pigs were caged in cool areas, well fed and caged near water source (water lines), which helped reduce loss of pigs	The fact that pigs were caged in cooler areas near to water supplies had a significant impact on their survival	To further reduce L&D, it would be good to pay closer attention to the health of the pigs.

Table 2: Loss and damage matrix for flooding

This loss and damage matrix was carried out during an Utwe community meeting held on 21 September 2018 and facilitated by KCSO. Twenty four community members (20 men and 4 women) were split into 3 groups. Each group worked on two sectors and reported back. Feedback was given by other groups where they would all discuss. This matrix was based on an inland flood in 2014 and a coastal flood in 2001. Other minor floods were also compared to the latest.

Sectors:	**Impacts:**	**Coping/ adaptation interventions:**	**Impacts after intervention**	**Explanation for Ongoing impacts:**	**What next?**

Mangrove	✓ flooded mangrove areas ✓ ruined mangrove habitats ✓ debris trapped mangroves ✓ erode mangrove areas ✓ sediments in mangrove channels ✓ filled septic tanks which overflow to mangrove: Septic overflows, contaminate mangrove (organisms & trees) and people gets health isssues when harvesting mangrove resources.	✓ Mangrove channels clearing by State and local Gov'ts ✓ Rehabilitation of mangrove plants (KIRMA, KCSO) ✓ Community clean-ups at initiation of elders ✓ Clear and clean water outlets: interest groups are sometimes contracted by Muncipal/local Government, and Kosrae Public works by State Government	✓ Sediments in channels higher after clearing due to high rainfall and poor road construction-- sediments get trapped in channels. ✓ Re-planting mangrove plants at forest gaps (cleared). Community members noticed regeneration of mangrove trees in gaps from previous re-plantations. ✓ Community clean-ups still happen on an as needed basis and as determined by elders. Food is often served contributing to community cohesion and conviviality ✓ State and local government cleared and expanded some mangrove channels ✓ Logs from flood were used as firewood (easy) ✓ Easy to harvest freshwater eels, crabs, and mudfish-- Not only that the channels become wider but also ponds and wetlands were filled with eels, crabs, and mudfish from floods making it easy to harvest them. Some are washed up into residential areas where	✓ Debris remain in mangrove areas ✓ Mud deposits in channels (sediments) Mud, soil, and other debris from upstream are carried into channels and river mouths. These deposits are both from clearing, construction, backfilling, and runoffs. ✓ Erosion: During floods (inland and flashfloods) mangroves are washed into reef and ocean. It has changed from mangrove areas into beach. Inland sediments(road and upland) are also washed down into mangroves changing its composition ✓ Existing bridges are too small to flush water out. The water gets held/trapped at bridges creating an overflow. This overflow becomes the problem becuase it ruins residential areas, roads, and houses. ✓ No proper equipment to clear and create new channels and dikes. This would help the flow of water during heavy rains and floods. ✓ Some level of erosion is natural, so there is uncertainty about what	✓ Improve existing concrete bridges to allow freer water flow ✓ Ensure on-going maintenance of channels and proper equipment ✓ Appropriate design of bridges, culverts, and channels to ensure that they can withstand floods and flush water out ✓ Effective inspection of construction projects (culverts, channels, bridges) by government officials to ensure the safety and appropriateness of channel and bridges (as per previous point) ✓ Capacity-building on recognizing and managing preventable and damaging erosion.

			harvestors did not have to far to harvest them.	can/should be prevented and how to do that.	

Agriculture	✓ ruined farms & home gardens (crops, vegetables) ✓ Minor land-slides, soils washed away ✓ sediments fertilize soils ✓ Invasive species outbreak (toads, white flies, etc.) ✓	✓ re-vegetation/ re-planting crops ✓ Elevation of access road and other farm roads ✓ Clearing of channels and rivers ✓ Back-filling ✓ Landscaping ✓ Invasive eradication carried out by community members under contract with Kosrae State Govt.	✓ Flood cleared farming areas that hadn't been reached by previous floods ✓ Road trenches/ channels filled again due to human activities (clearing and earth moving) and rain ✓ Backfilling/ Landfilling ✓ Access road and farm roads ✓ Invasive outbreaks	✓ Poor practices on various invasive sp., for instance, a fungus that was introduced to control white fly, but was not effective. Also giant African snail, which has been subjected to over a dozen eradication campaigns, but still spreading ✓ Poor maintenance for access/farm roads	✓ Eradication is on-going by State and local Gov'ts, but could be based on a better understanding of data on eradication, including being cautious about introducing bio-agents ✓ Seek Alternative and other agricultural practices (tolerant crops and other farm tech.)

Fisheries	✓ Huge piles of sediments in reef and later into ocean ✓ smothered corals (sand covers coral) ✓ loss of marine habitats (eroded sea-grass and moved corals) ✓ Impacted fishing (less fish)	✓ Coastal and underwater clean-ups ✓ Fishermen workshop ✓ No fishing on impacted areas	✓ Some debris collected and removed but some remain ✓ Less sediments ✓ Sedimentation ✓ Marine debris continues ✓ Decline in fisheries ✓	✓ A sense that sedimentation is naturally occurring and we have no control over it ✓ Debris may be from currents and other sources ✓ Decline in fisheries can be from other climate impacts (no study)	✓ Do a study to better understand fisheries decline ✓ Do a study on sedimentation to determine its impacts on reef and make recommendations for controlling sedimentation ✓ Raise awareness on causes of sedimentation and how to control them.

Home/village	✓ clogged water-ways & drainages ✓ ruin road with debris ✓ Land-line problems (electricity, telephone, and internet) ✓ ruin graves ✓ In some cases, it killed and washed away pigs ✓ ruin homes & vehicles	✓ clearing of blocked water ways ✓ public works road improvement ✓ recommendations for householder solar and generators ✓ Pig pens relocated to drier areas ✓ community clean-ups and sharing (helping each other)	✓ standing waters remains & lack of maintenance, leading to increased mosquitos and mosquito-borne diseases ✓ road improved & cleared ✓ Some pigs still in vulnerable areas, so a few pigs still killed	✓ use proper engineering for roads and culverts ✓ lack of funding (expensive to re-build bridges and hire engineers)	✓ Continue community clean ups ✓ Request appropriate bridge from government ✓ Develop a community graveyard in a safe area to protect graves ✓ Designate new graveyard sites (on a family-by-family basis)
Health	✓ Contamination from pig pens and septic (communicable diseases) ✓ Water borne diseases (white spots, rashes, etc.) ✓ Mentally affected (stress, emotions, etc.)	✓ regulation on septic tanks and use concrete septic ✓ Awareness programs focusing on disease prevention, including Zika, dengue, etc.	✓ Septic tank regulation is in place but enforcement is weak. Not every household has septic. ✓ Use local medicine ✓ Medical treatment from Hospital	✓ traditional medicinal herbs not always accessible ✓ lack of funding for sewers ✓ lack of regulation & policy (septic, and pigpens)	✓ Strengthen policies on regulation of septic tanks ✓ Develop a sewerage system ✓ Protect and improve access to traditional medicinal plants (beaches, forests, gardens)

Children/ family-life	✓ Dirty water (washing, drinking, cooking) ✓ Diseases, including flu and diarrhea ✓ Home evacuation ✓ Minor oil spills from cars contaminated drinking and showering water ✓ Children, parents and teachers were emotionally affected and stressed by the experiences ✓ Expensive (it is necessary to buy clothing, food, drinks, but too costly for many households) ✓	✓ Relocation, both temporary and permanent, informal and state sponsored ✓ Family clean-ups ✓ Vaccination ✓ Health awareness programs	✓ Awareness programs worked however, the same diseases happened the next time including new ones. ✓ Homes that were badly affected were evacuated.	✓ Catchments contaminated by rats and other pests ✓ Purchase of damaged properties ✓ Medical bills	✓ Health and safety awareness programs in school. Disaster drills to be practiced regularly.

Annex 9: Monitoring and evaluation framework for the implementation phase

The monitoring and evaluation will be participatory and based in part on the Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation (PMERL) approach.[10] As the aim is to build adaptive capacity in Utwe, including the ability to innovate and experiment and to collect, analyse and disseminate information, the monitoring and evaluation should be implemented as much as possible at the local level.

Community-based monitoring and validation meetings will be held:

- Validation meeting 1 (October 2018): to validate loss and damage assessment, EbA workplan and M&E framework, carry out baseline awareness survey
- Validation meeting 2 (March 19--at half-way point): to reflect on initial progress and evaluate if changes should be made
- Final validation meeting (July 19): to reflect on results of activities and quantitative data, to undertake awareness survey and plan for follow up and next steps

These meetings will form the primary method of implementing the participatory planning, monitoring and evaluation process. Qualitative and quantitative monitoring data will be reviewed and the community will participate in qualitative monitoring, reflect on their own capacity and resilience. These meetings will form the basis of evaluation reports, which will be combined with activity reports to ensure that lessons are learned from all activities and all stakeholders. The outcomes of these meetings and of activities will be documented in the following reports:

1. October 2018: The inception report (including outcomes of validation meeting) (for Outcome 1, Output 1.1) (UNESCO and KCSO)
2. January 2019: Activity report (Outputs 2.1, 2.2, 3.1, 3.3) (KCSO)
3. April 2019: Combined activity report (Outputs 2.3, 3.2, 4.1) and mid-term evaluation report (including March validation meeting)
4. August 2019: Combined final project report, activity report (Outputs 4.2, 4.3) and final validation meeting report, including results of awareness survey and evaluation of all activities (table 2)

Data collection methods

Quantitative indicators will measure the biophysical impacts of some outputs, for instance, survival rates of the giant clam farm; the number of mangrove seedlings planted, the number of participants in trainings or awareness-raising activities and the impact of spring development on water quality. These will primarily be monitored by KCSO, but in some cases, where the Kosrae State Government or other partners are collecting relevant data, this will be used. For instance, under the terms of the environmental impact assessment and permits that KIRMA will provide for the giant clam farm initiative and the improved water source, they will monitor the environmental impacts of these activities. KCSO will collect and share the data, as well as coordinate with partners to ensure regular monitoring of crown of thorns densities.

An awareness survey will be carried out using focus group questionnaires at the beginning and end of the project to track indicators of adaptive capacity. These will focus on capturing narratives of behavior

[10] See, for instance CARE (2014) *Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation: A revised manual for local practitioners*. Accessed 4 September 2018 (https://careclimatechange.org/wp-content/uploads/2014/12/2014_PMERL.pdf)

change, community engagement and awareness on climate change, natural resources management and traditional knowledge.

Outputs 2.2 (giant clam farming) and 3.1 (crown of thorns green fertilizer experiment) are community-based experiments, so the monitoring will be based on stakeholder perceptions of efficacy, feasibility and potential further development. In each case, the specific monitoring protocol will be developed jointly with the community members who will be undertaking the experiment. However, some output indicators are proposed to guide stakeholders.

To enable on-going monitoring and adjustment of a complicated multi-stakeholder work plan , a progress monitoring table will be used by KCSO staff to keep an overview of progress made towards each output, corrective action taken and observed impacts, both intentional and unintentional (see table 1). This table will be shared with community stakeholders during validation meetings to enable reflection on project progress.

Table 1: Sample of a progress monitoring table

Activity	Undertaken by whom?		When?		Who benefits and how? (Number of people, composition, how did they benefit?)		Any unanticipated impacts?		Adjustments to the plan	
	Planned	Actual	Planned	Actual	Planned	Actual	Positive	Negative	Adjustments to meet shortfalls	Adjustments to respond to opportunities

Table 2 is a list of proposed indicators for each outcome and output, based on identified needs and available resources. This table will be reviewed, adjusted and validated during validation meeting 1 in October 2018.

Outcomes and outputs	Proposed Indicators	M&E event	Frequency	Responsibility	Means of verification
Outcome 1: The development of an iterative, co-constructed approach climate change related loss and damage assessment and planning at the community level	*Indicator 4: UBR stakeholders satisfied that L&D assessment reflects their concerns*	Validation meeting (Oct 18)	Once	KCSO, UNESCO	Inception report (Oct 18)
Output 1.1: Iterative co-constructed loss and damage assessment implemented in Utwe Biosphere Reserve (Kosrae, FSM)	*Indicator 1: Loss and damage assessment completed and used for EbA planning* *Indicator 2: Number of UBR stakeholders participating in L&D assessment (including women and community organisations)* *Indicator 3: Community expressing approval of EbA plan*	Validation meeting 1 Community consultations, Inception meeting, Validation meeting 1 Validation meeting 1	Once Three times Once	KCSO, UNESCO	Inception report (Oct 18)

Outcomes and outputs	Proposed Indicators	M&E event	Frequency	Responsibility	Means of verification
Outcome 2. Based on loss and damage assessments generated under outcome 1 and building on local and traditional knowledge, ecosystem-based adaptation to mitigate the impacts of coastal flooding in Utwe Biosphere Reserve successfully implemented.	*Indicator 1: Clear understanding of the importance of reef and mangrove resilience and how natural resources management can mitigate the impacts of coastal flooding is expressed by UBR stakeholders* *Indicator 2: UBR stakeholders engageing with EbA activities for reef resilience and coastal protection (including women and youth)*	Awareness surveys (Oct 18, Jul 19)	Oct 18 (baseline), July 19	KCSO, UNESCO	Inception report, activity reports and project report
Output 2.1: Improve reef resilience through invasive species control (crown of thorns eradication	*Indicator 1: Number of CoTs removed and recovered* *Indicator 2: Number of Kosrae stakeholders trained in CoT eradication* *Indicator 3: CoT density*	Cot eradication training, recording during 10-15 consecutive diving days and follow up dives every two months	(Oct-Dec 18, March, May, July),	KCSO, KIRMA, KCET	Activity report (Jan 19), project report (Aug 19)

Outcomes and outputs	**Proposed Indicators**	**M&E event**	**Frequency**	**Responsibility**	**Means of verification**
Output 2.2: Reduce pressure on reef through livelihood diversification and income security (giant clam farming)	*Indicator 1: Number of tables/larvae surviving* *Indicator 2: Number of Utwe farmers trained in farm management and maintenance* *Indicator 3: Environmental impact on farm site (TBD by state environmental agency)* *Indicator 4: UBR farmers self-assessment of viability of giant clam farming* *Indicator 5: Development of UBR plan for sustainable management of farm, including plan for income distribution, management of larvae to repopulate the wild vs. community use vs. income generation, etc.*	Validation meeting 2 (Mar 19), validation meeting 3 (Jul 19), on-site monitoring and self-reporting	Jan-Jul 19	KCSO, Utwe BR, (NAC and KIRMA)	Activity report (Jan 19), validation meeting, project report (Aug 19)

Outcomes and outputs	**Proposed Indicators**	**M&E event**	**Frequency**	**Responsibility**	**Means of verification**
Output 2.3: Maintain coastal protection through mangrove restoration and management	*Indicator 1: List or map showing major mangrove gaps.* *Indicator 2: Mangrove management integrated into UBR Management plan* *Indicator 3: Number of seedlings planted/surviving* *Indicator 4: Increase in community support for sustainable mangrove management*	On-going during activities Awareness survey (October 18, July 19)	Twice (baseline and end of project)	KCSO, Utwe BR	Inception report (Oct 18), revised UBR management plan, project report (Aug 19)

Outcomes and outputs	Proposed Indicators	M&E event	Frequency	Responsibility	Means of verification
Outcome 3: Based on loss and damage assessments generated under outcome 1 and building on local and traditional knowledge, ecosystem-based adaptation to improve water security in Utwe Biosphere Reserve successfully implemented.	*Indicator 1: Clear understanding of the importance of how natural resources management can improve water security is expressed by UBR stakeholders* *Indicator 2: UBR stakeholders engaging with EbA activities for water security (including women and youth)*	Awareness surveys (Oct 18, Jul 19)	Oct 18 (baseline), July 19	KCSO, UNESCO	Inception report, activity reports and project report
Output 3.1: Improve water quality through reduction of agricultural inputs (natural fertilizer experimentation by Utwe farmers)	*Indicator 1: TK evidence-based recommendation on replacement of chemical inputs by CoT and other natural fertilizers formulated by participating farmers and shared with Kosrae stakeholders*	On-going monitoring as per participatory planning, activity validation meeting 3 (Jul 19)	On-going by farmers and extension agents (Jan - May 19) and project end	KCSO, Utwe farmers association, KIRMA	Activity report (Apr 19), recommendation, and project report (Aug 19)

Outcomes and outputs	**Proposed Indicators**	**M&E event**	**Frequency**	**Responsibility**	**Means of verification**
Output 3.2: Improve water security and drought resilience by mapping natural springs and developing an alternative water source	*Indicator 1: Map of natural springs* *Indicator 2: One spring improved* *Indicator 3: Water quality impact on improved site*	Water quality monitoring by govt, activity validation during workshop 2 (Mar 19), water quality monitored as per government protocol	Twice (Mar and July 19)	KCSO (KIRMA)	Activity report (Apr 19) and project report (Aug 19)
Output 3.3: WASH training with Utwe Women's Organization (with focus on droughts and floods).	*Indicator 1: Women expressing increased awareness of how to manage water-related health and sanitation in emergency situations*	Activity report (Jan 19) and awareness survey (Oct 18, Jul 19)	Twice (baseline Oct 18, final Jul 19)	KCSO, Kosrae Red Cross Chapter	Activity report (Jan 19) and project report (Aug 19)

Outcomes and outputs	Proposed Indicators	M&E event	Frequency	Responsibility	Means of verification
Outcome 4: Awareness-raising, education and policy improvement programme focusing on traditional knowledge, community-based climate resilience and Biosphere Reserve Management	*Indicator 1: Increased community awareness on traditional knowledge, traditional resource management strategies, climate resilience and water security* *Indicator 2: UBR stakeholders engaging with EbA and TK activities (incl. women and youth)*	Awareness surveys	Oct 18 (baseline) and outcome survey (Jul 19)	KCSO, UNESCO	Inception report (Oct) and project report (Aug 19), outputs
Output 4.1: Update Utwe Biosphere Reserve Management plan to improve climate resilience	*Indicator 1: Updated management plan with climate resilience incorporated*	Validation meeting 3 (Jul 19)	Jul 19	KCSO, UBR Management Board	Updated management plan, project report (Aug 19)

Outcomes and outputs	**Proposed Indicators**	**M&E event**	**Frequency**	**Responsibility**	**Means of verification**
Output 4.2: Educational activities with youth and children focusing on traditional knowledge, traditional resource management strategies, climate resilience and water security	*Indicator 1: Number of children and youth participating in activities* *Indicator 2: Knowledge level on traditional knowledge, traditional resource management strategies, climate resilience and water security for students*	School survey (pre and post intervention) Awareness survey	Awareness survey: Oct 18 and Jul 19	KCSO, Department of education	Inception report Activity report Project report
Output 4.3: Information and awareness-raising materials targeting an array of stakeholders	*Indicator 1: Number and type of publication*	Materials launches and distribution	On-going	KCSO, UNESCO	Publications, reports and stories

Annex 10: Baseline awareness survey methods and results

Focus group surveys were held in late October and early November 2018 with youth, children women, elders and Utwe community members. Summary results are shared below:

Utwe Elementary School Survey Questionaire (26 October 2018):

Utwe Elementary School (10/26/18)	
Names	**Gender**
JD Edmond	M
Riley Abraham	M
Jefferson Waguk	M
Martin Andrew	M
Morgiana Vernet	F
Flossy Nena	F
Dianne Rodney	F
Atina Obeth	F

Responses

Question 1: Mangroves

- Why are mangroves important for climate change?
  - Mangroves trees are used for shelter and firewood
  - Mangroves are habitats to many organisms
  - Mangroves give us food (crabs, shellfish, mudfish, etc.)
  - Mangrove areas blocks strong wind, and breaks big wave from entering our homes
- What are Utwe's main challenges in managing mangroves?
  - Deforestation
  - Littering
  - Lack of enforcement
  - Leakage of septic tanks
  - Overharvesting

Question 2: Reefs

- What is required to keep reefs healthy?
  - No littering- to the sea/ reef.
  - Manage overharvesting
  - Lessen the use of oil (outboard motors)
  - Enforcing the law to protect the sea and our reef.
  - Walking on the reef is prohibited.
  - Lessen the use of marine sand/ gravel from the coastline.
- What are the impacts of climate change on the reef?
  - Flood
  - Heavy rain wash sediments into our reefs contaminating marine habitats
  - High heat kills corals and dries up ponds
  - Tsunami

Question 3: Water security

- What will be the likely impacts of climate change on your rivers/springs/ water supply?
  - Surface water temperature increase and cause vanishing of spring/ river/ water supply.
  - Flooding cause unclean and dirty water (drinking/ showering)
  - Living organism in the river disappear
- What can Utwe do to lessen the impact to drought and flood?
  - Burning of trash is restricted during drought or sunny season.
  - Water preservation needed to control water loss
  - Upgrade and renew spring waters area and water catchments.

Question 4: Traditional knowledge and traditional resource management strategies

- What are your ideas for using traditional Kosraean knowledge for managing mangroves, reefs or rivers/springs? (2-3 ideas)
  - What are barriers to applying those ideas?
    - Community involvement in activities- not all community members may involve
    - Some activities (mangrove replantation, fresh water springs) had been performed- but monitoring and maintenance needs to be reconsidered
  - What could help you to apply those ideas?
    - Organize a core team to oversee project activities and involve key stakeholders
- Have you used traditional knowledge to predict weather, king tides, climate, floods or drought?
    - Heavy rain will cause flood

Question 5: Climate resilience

- Do you feel like you understand how the activities in this project are expected to make Utwe less vulnerable to the impacts of climate change?
- Somewhat- activities are possible to carry out but does not now the impacts
- What would you like to know more about in relation to climate change adaptation?
- Will the activities really make Utwe less vulnerable to climate change impacts

Utwe Senior Citizen Survey Questionnaire (30 October 2018)

Utwe Senior Citizens	
Names	
Emius Nena	
Kersin Tilfas	
Maxon Nena	
Margy Orlando	
Benista Benjamin	
Lucy Killin	F
Magrina Tulenkun	F
Susin Waguk	F

Responses

Question 1: Mangroves

- Why are mangroves important for climate change?
- Mangrove holds our soils and coastal beaches from erosion
- Mangrove protects our residential areas from strong winds, waves, and currents
- Vegetation- preserve our mangrove resources
- Mangrove trees are still used for shelter and fuel (firewood)
- What are Utwe's main challenges in managing mangroves?
- Deforestation- mangrove gaps are still in place
- Overharvesting- the population has increased over the past years creating higher demand for lumbers/timbers
- Regulations on mangrove resources (trees, crabs, fish) makes it hard to harvest

Question 2: Reefs

- What is required to keep reefs healthy?
- Use anchorage- install more buoys
- Dispose trash properly because they smother corals and other marine habitats
- When harvesting marine resources (fish) only take what is needed
- What are the impacts of climate change on the reef?
- Tides are getting higher than before, different tides came at different moon phases
- Less fish as well as size of fish- fishing sites are getting remote
- Sea surface temperature has increased causing fish to migrate to better grounds

Question 3: Water security

- What will be the likely impacts of climate change on your rivers/springs/ water supply?
- Intense and frequent floods
- Dirty water from floods and heavy rains
- Dried rivers and streams during sunny days
- What can Utwe do to lessen the impact to drought and flood?
- Awareness programs to educate people on how prepare for drought and flood
- Clear blocked channels to control flow of water during floods
- Sharing and caring
- Improve (pavement) and maintain the road to move people into higher grounds

Question 4: Traditional knowledge and traditional resource management strategies

- What are your ideas for using traditional Kosraean knowledge for managing mangroves, reefs or rivers/springs? (2-3 ideas)
    - What are barriers to applying those ideas?
        - Non-compliance of resource users: (for example, mangrove trees are used as source of income, cooking, and lighting)
        - Fresh water springs are privately owned and may be restricted to public. Some are remote to public access and accessing it may be expensive
    - What could help you to apply those ideas?
        - Support from State Government
- Have you used traditional knowledge to predict weather, king tides, climate, floods or drought?
    - Moon phases to predict tide (Kosraean lunar calendar)
    - Horizon to predict weather (red being sunny and gray for rainy)
    - Rain sound and duration in upland areas to predict floods (loud rain and heavy rain are likely to bring flood)
    - Sun to tell time (location to sun tells you what time)

Question 5: Climate resilience

- Do you feel like you understand how the activities in this project are expected to make Utwe less vulnerable to the impacts of climate change?
    - Improving access to springs will secure water for the entire village because the current one needs to be improved. Sometimes there will be no water due to pressure and . Need to install a light to use during night time
- What would you like to know more about in relation to climate change adaptation?
    - How can we better adapt to climate change because it happens naturally
    - How will these adaptation activities help Utwe

- Linking the inland road to climate change adaptation. Imposing the improvement of the road to Kosrae State Government. This will encourage people to move to higher grounds

Utwe Youths Survey Questionaire (10 November 2018)

Utwe Youth Association	
Names	**Gender**
Ezra Maver	M
Kidson Jonithan	M
Hardy Elton	M
Hardy Noda	M
Yamato Melander	M
Lucy Nena	F
Nena Maxon	M
Alice Wilton	F
Kenye D. Abraham	F

Responses:

Question 1: Mangroves

- Why are mangroves important for climate change?
  - Holds soil from eroding and works as a filter- it filters trash and debris from going into the reef
  - Protects our land from strong winds, currents, and waves
  - Reduce sedimentation or erosion- from streams and rivers to sea
- What are Utwe's main challenges in managing mangroves?
  - Clear cutting for firewood and housing materials
  - Hard for enforcement officers to monitor perpetrators
  - Restrictions (rules and regulations) on mangrove resources (tress)

Question 2: Reefs

- What is required to keep reefs healthy?
  - Public awareness on the importance of reefs
  - Strengthening existing policies on reefs for perpetrators
  - Creating regulations on harvest sizes of fish- incorporate a fish size monitoring program
- What are the impacts of climate change on the reef?
  - Sea level rise and strong waves moved sand into our reefs and smother corals
  - Increase in surface water temperature due to overheating (dry seasons)

- Heavy rain causes soil erosion- washing down sand/ particles upland downstream to the reef

Question 3: Water security

- What will be the likely impacts of climate change on your rivers/springs/ water supply?
  - Drought dries out rivers and streams
  - Water tanks emptied out due to less rain
  - Before, only heavy rain causes erosion but now even short rains cause erosions and minor slides
  - The water system (water dam) is not treated so when there's heavy rain- water for drinking, hygiene, and cooking are dirty

- What can Utwe do to lessen the impact to drought and flood?
  - Water lines needs to be upgraded and fixed- minor leaks and low pressure
  - Community awareness programs on water preservation and maintenance
  - Road side clean-ups to maintain water pipe system- to minimize floods and leaks
  - Land filling to elevate homes and move inland/ upland