Facilitators Guide for Outreach Toolkit: Adapting to a Changing Climate Support for Micronesian Communities

Document Content Developed by:

Meghan Gombos, Sea Change Consulting LLC

Scott Atkinson

Supin Wongbusarakum, The Nature Conservancy

These materials were developed through input from a workshop that was held from September 6-11, 2010 in Pohnpei, Federated States of Micronesia with representatives from the following agencies, organizations, and communities:

Chuuk Department of Agriculture
Commonwealth of the Northern Mariana Islands Coastal Resource Management Office
Conservation Society of Pohnpei
Conservation Society of Chuuk
Enipein Community, Pohnpei, Federated States of Micronesia
Federated States of Micronesia Community College
Federated States of Micronesia Protected Area Network
Federated States of Micronesia - Pacific Adaptation to Climate Change
International Organization for Migration
Island Environmental Services
Island Food Community of Pohnpei
Kosrae Conservation and Safety Organization
Marshall Islands Conservation Society
Marshall Islands Marine Resource Authority
Micronesia Conservation Trust
Namdrik Community, Republic of Marshall Islands
NOAA Coral Reef Conservation Program
Ngarchelong Community, Republic of Palau
Nimpal Channel MCA communities - Weloy, Yap
Pacific Islands Managed and Protected Area Community
Palau Conservation Society
Palau International Coral Reef Center
Pohnpei Department of Agriculture
Republic of Marshall Islands Environmental Protection Agency
Republic of Marshall Islands Office of Environmental Planning and Coordination
Sea Change Consulting
Secretariat of the Pacific Community
Sustainable Visions
The Nature Conservancy
United States Geological Survey
University of Guam
Yap Institute for Natural Science

A complete list of participants can be found in the workshop report through MCT and/or in the PIMPAC Management and Adaptation Planning Guidance.

Regional climate science information was also provided by
NOAA's National Weather Service.

Purpose of this facilitator guide

This document is aimed at providing talking points for the "Adapting to a Changing Climate" flipchart outreach tool. This document provides details about the concepts and information for each page of the flipchart to convey key messages about climate change vulnerability and adaptation.

Purpose of the flipchart tool

- To provide up-to-date climate change information (visually) to community leaders on the following topics:
    - What is climate change?
    - Why should they care about it and get involved?
    - What are the potential impacts to their community and the resources on which they depend?
    - What can they do to prepare for climate change?
- Ultimately to motivate leaders to:
    - Take action and be involved in climate change vulnerability and adaptation planning in a meaningful way, because they feel very informed and knowledgeable on the issue.
    - Engage the community in adaptation activities.

Target Audience

Traditional and official community leaders

Community members

NOTE: The facilitation notes help describe what the authors tried to convey on each page. This document is meant to be a guide for facilitators but can be modified to meet the needs of the managers and/or audience.

COVER PAGE (1): Adapting to a Changing Climate: (Translate into your own language – space is left to write it)

Where you at?! (translated into all the languages of Micronesia):

i. RMI - Kobed Ia?!
ii. Palau - Ke Bedul Ker?!
iii. Yap - Kan Taw Ngan!?
iv. Chuuk - En Ifa!?
v. Pohnpei - Ia Kowe!?
vi. Kosrae - Kom Piyac?
vii. Guam/CNMI (Carolinian)- Iya Igha Ullo Iye?!
viii. Guam/CNMI (Chamorro) - Manu Ni Gaige Hao?!

- Place the flipchart on an easel or location that is easy for the group to see and for the facilitator to flip pages.

- Explain the purpose of the presentation – provide an overview of why you are providing this presentation and what you will be talking about.

Page 2 (High Island) - Left side: A Healthy Micronesian Community

Facilitator's Notes: Numbers are on the illustration, and information below corresponds to the numbers.

- The left side of the page shows a healthy island community from ridge to reef and the associated resources and ecosystem functions – Point out the resources below and explain the following services they provide to the community.

1) Watershed

i. Intact native upland vegetation
   1. Provides protection from landslides
   2. Prevents sediment from polluting streams
   3. Filters pollutants to keep them from entering freshwater springs and lenses
   4. Helps maintain rates of rainfall through transpiration
   5. Provides habitat for important wildlife
   6. Prevents invasive plants from establishing themselves
   7. Provides opportunities for eco-tourism (bird watching, hiking, etc.)

ii. Intact riparian vegetation (next to rivers/streams)
   1. Protects water quality by capturing, storing, and filtering water through the soil before it gets to freshwater springs, lenses, rivers, and streams
   2. Holds stream bank soils in place and protects them from erosion and undercutting by floodwaters
   3. Protects the coral reef from sediment and pollutants
   4. Provides habitat for important wildlife

2) Coastline and Beaches

i. Intact vegetation along the shore and no development close to shore
   1. Provides nesting areas for sea turtles and essential habitats for shorebirds and intertidal invertebrates
   2. Shoreline protection from storm surges
   3. Stabilizes coastline to prevent or slow rates of erosion by absorbing and dissipating wave energy
   4. Helps prevent salt spray from getting inland to crops/homes
   5. Provides recreational areas for local residents
   6. Valuable for eco-tourism

3) Coastal Vegetation/ Mangroves

i. Healthy intact mangroves and/or other vegetation
    1. Provides protection from storm surges
    2. Stabilizes coastline to prevent or slow rates of erosion
    3. Helps prevent salt spray from getting inland to crops/homes
    4. Provides feeding grounds, nursery, and habitat for important fish and invertebrates
    5. Traps sediment from land and prevents it from getting onto the coral reef

4) Seagrass

i. Healthy intact seagrass beds
    1. Protect coastline from currents and therefore reduce erosion
    2. Provide critical habitat, breeding grounds, nursery areas, and food for important fish, invertebrates, and other marine life (e.g., turtles, marine mammals)
    3. Trap sediment from land, improving water clarity and preventing it from getting onto the coral reef
    4. Take up nutrients from land runoff as a food source, reducing harmful amounts of these nutrients from reaching the coral reef, where they can result in unhealthy algae blooms

5) Coral Reefs

i. Healthy coral reefs
    1. Provide a buffer against storm surges by breaking wave energy
    2. Provide nursery areas, habitat, and food for important fish, invertebrates, and other marine life (e.g., turtles, marine mammals)
    3. Used for recreation and tourism – can provide income

ii. Diverse invertebrates and fish species
    1. A wide variety of marine life is part of a healthier, stronger system that can withstand changes (impacts?)

iii. Big predator fish (e.g., sharks, groupers, jacks)
    1. Critical to balance reef fish and other marine populations and support healthy ecosystems

iv. Herbivores (e.g., parrotfish, rabbitfish, surgeonfish, urchins)
    1. Help prevent algae from overgrowing coral and potentially killing it

6) People/Children

i. People are able to sustain their families by using the resources directly and from diverse sources of income.
ii. People are aware of what makes the community healthy (natural and social resources) and take actions to protect them for future generations.
iii. People are able to practice their culture, and children can learn about island self-sufficiency through traditional knowledge and evolving cultural practices and have pride in their community.
iv. Homes safe from storms and landslides
v. Safe drinking water systems
vi. Variety of healthy foods available (through agriculture and fishery)
vii. Healthy, happy children
viii. Community demonstrating leadership
ix. Strong community ties
x. Availability of community services and good infrastructure
xi. Reliable transportation system in case of emergency evacuation

Page 2 (High Island)- Right side: Threats to a Healthy Micronesian Community

- The right side of the page shows an island community that has many threats from ridge to reef and is not healthy because the resources are degraded or depleted, and ecosystem services are lost – Point out the resources below and explain the following threats to the resources and services lost.

- Explain that there are multiple natural and man-made threats/stressors facing natural resources and that those threats also threaten the way those resources provide benefits to the community. These threats all negatively impact food, income, and health of community members.

1) Threatened Watershed

i. Widespread clearing of native forests/vegetation
ii. No vegetation adjacent to streams
iii. Pollution (e.g., piggeries, trash)
iv. Sedimentation/runoff from cleared land
v. Bad agricultural practices (e.g., mono-cropping, overuse of fertilizers and pesticides, land clearing, removal of native vegetation)
vi. Overrun with invasive species that threaten native plants and animals; invasive plant species don't hold soil well
vii. Polluted freshwater sources (e.g. springs, lenses, rivers, streams)
viii. Clearing of vegetation adjacent to freshwater sources causing loss of water (from evaporation)
ix. Prolonged, severe droughts
x. Poorly planned development projects (no proper environmental mitigation in place)
xi. Unpaved roads
xii. Denuded landscape from burning

- SERVICES LOST: clean and safe water in rivers, streams, freshwater springs, and lenses; prevention of soil erosion and sediment getting onto coral reef; protection from landslides; protection from flooding; habitat for birds and animals; good soil for agriculture – all of these impact food, income, and health.

2) Threatened Coastline/ Mangroves/ Seagrass Beds

i. Clearing of native vegetation (mangroves/trees) along the shore
ii. Coastal erosion
iii. Dredging of sand – loss of seagrass

iv. Overharvesting of species that live in these areas (too many people harvesting, taking very large fish/shellfish that can supply the reef with more offspring, or taking very small fish/shellfish that were not able to reproduce)
v. Environmentally damaging types of coastal development (e.g., seawalls, roads without appropriate culverts)
vi. Saltwater intrusion and inundation of drinking supplies and gardens
vii. Invasive coastal species overrunning native species
viii. Loss of sea turtle nesting habitat

- SERVICES LOST: protection from storm surges; protection from coastal erosion; protection from sun/heat through shade; protection from flooding; protection from sedimentation; decrease and loss of nesting, nursery, and habitat for sea turtles, food fish, and shellfish

3) Threatened Coral Reefs

i. Overfishing (too many people fishing in one area, taking very large fish that can supply the reef with more offspring, or taking very small fish that are not able to reproduce); taking from spawning aggregations; taking too many herbivores, which can lead to algae smothering coral
ii. Destructive fishing practices – dynamite fishing, nets with small mesh, scuba spearfishing, spearfishing at night, abandoned gillnets
iii. Mass tourism, destructive tourism practices – walking on or touching the reef
iv. Sedimentation from cleared land can smother reefs
v. Increased nutrients from runoff can lead to crown-of-thorns starfish or algal outbreaks
vi. Climate-related threats, including
    - mass coral bleaching from sea surface temperature rise
    - increased ocean acidification, which can weaken and kill the corals
vii. Other threats – boating and anchor damage, oil spills, invasive species, coral mining

- SERVICES LOST: protection from storm surges, declining fisheries that provide food and income, decrease or loss of nursery areas and habitat for important fish and marine life that provide food and income, decreasing sand to replenish shoreline

4) Threatened People/Children

i. People are not able to sustain their families on the resources and have few sources of income because resources are depleted and other sources of income are not available.
ii. People are not aware of tools and approaches to help improve community health (natural resources and social resources) and are therefore not well equipped to take actions to protect them for future generations.
iii. Traditional knowledge and local cultural practices are not passed down to younger generations because the way of life has changed drastically.

iv. Homes and community infrastructure and services are located in flood zones.
v. No sustainable, local source of drinking water (bottled water is not sustainable)
vi. Damaged food crops, lack of food variety, dependency on imported foods
vii. Unknown future for children to live/stay in this area
viii. People working together less and lack of community cohesion
ix. Health issues
    1. Increased illness from water- and vector-borne diseases during flooding
    2. Physical stress and dehydration from extreme heat and drought
    3. Increased incidences of chronic illness (e.g., heart disease, diabetes) from dependence on processed, imported foods and unhealthy lifestyle
    4. Mental and emotional stress from
        a. Decline in food and drinking water sources
        b. Decline of income sources
        c. Limitations in ability to practice culture and contribute to community

- **These threats are likely to be worsened over time with climate change and variability.**

Page 3 (Atoll) - Top: A Healthy Micronesian Atoll Community

Facilitator's Notes: Numbers are on the illustration, and information below corresponds to the numbers.

- The top half of the page shows a healthy atoll community and the associated resources and ecosystem functions – Point out the resources below and explain the following services they provide to the community.

1) **Native Vegetation and Agriculture**
    i. Intact native vegetation
        1. Filters pollutants, keeping them from entering freshwater springs and lenses
        2. Holds soil and prevents erosion
        3. Holds water
        4. Provides protection from strong winds and salt spray
        5. Provides habitat and food for wildlife
    ii. Well-managed agriculture
        1. Provides food sources and income
        2. Prevents spread of invasive species
        3. Help prevents saltwater intrusion

2) **Freshwater Resources (Lens)**
    i. Intact freshwater lens, unpolluted and well managed
    ii. Wells designed and managed to allow sustainable use. There are freshwater catchments, storage, and well-maintained distribution systems.
    iii. Use of solar distillation systems to supplement water supplies during dry season

3) **Coastal Vegetation and Beaches**
    i. Intact vegetation along the shore and no development close to shore
        1. Provides nesting areas for marine turtles and essential habitats for shorebirds and intertidal invertebrates
        2. Provides shoreline protection from storm surges
        3. Stabilizes coastline to prevent or slow rates of erosion by absorbing and dissipating wave energy
        4. Helps prevent salt spray from getting inland to crops/homes
        5. Provides recreational areas for local residents
        6. Valuable for tourism
        7. Provides habitat and food for native wildlife
    ii. Healthy intact mangroves and/or other vegetation
        1. Provide protection from storm surges

2. Stabilize coastline to prevent or slow rates of erosion
3. Help prevent salt spray from getting inland to crops/homes
4. Provide feeding grounds, nursery, and habitat for important fish and invertebrates
5. Trap sediment from land and prevent it from getting onto the coral reef

4) Seagrass

i. Healthy intact seagrass beds
   1. Protect coastline from currents and therefore reduce erosion
   2. Provide critical habitat, breeding grounds and nursery areas, and food for important fish, invertebrates, and other marine life (e.g. turtles, marine mammals)
   3. Trap sediment from land, improving water clarity and preventing it from getting onto the coral reef.
   4. Uptake nutrients from land runoff as a food source, reducing harmful amounts of these nutrients from reaching the coral reef, where they can result in unhealthy algae blooms

5) Coral Reefs

i. Healthy coral reefs
   1. Provide a buffer against storm surges by breaking wave energy
   2. Provide nursery areas, habitat, and food for important fish, invertebrates, and other marine life (e.g., turtles, marine mammals)
   3. Used for recreation and tourism – can provide income

ii. Diverse invertebrates and fish species
   1. A wide variety of marine life is part of a healthier, stronger system that can withstand changes (impacts?)

iii. Big predator fish (e.g. sharks, groupers, jacks)
   1. Critical to balance reef fish and other marine populations and support healthy ecosystems

iv. Herbivores (e.g. parrotfish, rabbitfish, surgeonfish, urchins)
   1. Help prevent algae from overgrowing coral and potentially killing it

6) People/Children

i. People are able to sustain their families by using the resources directly and from diverse sources of income.
ii. People are aware of what makes the community healthy (natural and social resources) and take actions to protect them for future generations.
iii. People are able to practice their culture, and children can learn about island self-sufficiency through traditional knowledge and evolving cultural practices and have pride in their community.
iv. Homes safe from storms and landslides
v. Safe drinking water systems
vi. Variety of healthy foods available (through agriculture and fishery)

vii. Healthy, happy children
viii. Community demonstrating leadership
ix. Strong community ties
x. Availability of community services and good infrastructure
xi. Reliable transportation system in case of emergency evacuation

Page 3 (Atoll) - Bottom: Threats to a Healthy Micronesian Atoll Community

- The bottom half of the page shows an atoll community that has many threats across the atoll and is not healthy because the resources are degraded or depleted and ecosystem services are lost – Point out the resources below and explain the following threats to the resources and services lost.

- Explain that there are multiple natural and man-made threats/stressors facing natural resources and that those threats also threaten the way those resources provide benefits to the community. These threats all negatively impact food, income, and health of community members.

1) **Threatened Native Vegetation and Agriculture**
    i. Clearing of native vegetation for firewood and development
    ii. Unmanaged or bad agricultural practices – (e.g., no composting of taro patches, monocropping, removal of native vegetation)
    iii. Overrun with invasive species that threaten native plants and animals; invasive plant species don't hold soil well
    iv. Prolonged, severe droughts

    - SERVICES LOST: filtering of pollutants and protection of freshwater springs and lenses, protection from storm surges, protection from coastal erosion, protection from sun/heat through shade, protection from flooding, protection from sedimentation, loss of sustainable food sources

2) **Threatened Freshwater Resources**
    i. Pollutants on the ground that seep into freshwater lens
    ii. People collecting too much freshwater from wells so they are not able to recharge

    - SERVICES LOST: clean drinking water

3) **Threatened Coastline/ Mangroves/ Seagrass Beds**
    i. Clearing of native vegetation (mangroves/trees/shoreline shrubs) along the shore
    ii. Coastal erosion
    iii. Dredging of sand – loss of seagrass
    iv. Overharvesting of species that live in these areas (too many people harvesting, taking very large fish/shellfish that can supply the reef with more offspring, or taking very small fish/shellfish that were not able to reproduce)
    v. Environmentally damaging types of coastal development (e.g. seawalls)
    vi. Saltwater intrusion and inundation of drinking supplies and gardens

- SERVICES LOST: protection from storm surges, protection from coastal erosion, protection from sun/heat through shade, protection from flooding, protection from sedimentation, decrease and loss of nursery areas and habitat for food fish and shellfish

4) Threatened Coral Reefs

i. Overfishing (too many people fishing in one area, taking very large fish that can supply the reef with more offspring, or taking very small fish that are not able to reproduce); taking from spawning aggregations; taking too many herbivores, which can lead to algae smothering coral
ii. Destructive fishing practices – nets with small mesh, cyanide and native plants used to poison fish, breaking small corals, dynamite fishing, scuba/night spearfishing, abandoned gillnets
iii. Mass tourism, destructive tourism practices – walking on or touching the reef
iv. Sedimentation from cleared land can smother reefs.
v. Increased nutrients from runoff can lead to crown-of-thorns starfish or algal outbreaks.
vi. Climate-related threats, including
    - Mass coral bleaching from sea surface temperature rise
    - Increased ocean acidification, which can weaken and kill the corals
vii. Other threats – Illegal foreign fisheries, massive commercial harvesting, boating and anchor damage, oil spills, invasive species, coral mining

- SERVICES LOST: protection from storm surges, declining fisheries that provide food and income, decreasing or loss of nursery areas and habitat for important fish and marine life that provide food and income, decreasing sand to replenish shoreline

5) Threatened People/Children

i. People are not able to sustain their families on the resources and have few sources of income because resources are depleted and other sources of income are not available.
ii. People are not aware of tools and approaches to help improve community health (natural resources and social resources) and are therefore not well equipped to take actions to protect them for future generations.
iii. Traditional knowledge and local cultural practices are not passed down to younger generations because the way of life has changed drastically.
iv. Homes and community infrastructure and services are located in flood zones.
v. No sustainable, local source of drinking water (bottled water is not sustainable)
vi. Damaged food crops, lack of food variety, dependency on imported foods
vii. Unknown future for children to live/stay in this area
viii. People working together less and lack of community cohesion
ix. Health issues
    1. Increased illness from water- and vector-borne diseases during flooding
    2. Physical stress and dehydration from extreme heat and drought

3. Increased incidence of chronic illness (e.g., heart disease, diabetes) from dependence on processed, imported foods and unhealthy lifestyle
4. Mental and emotional stress from
    - Decline in food and drinking water sources
    - Decline of income sources
    - Limitations in ability to practice culture and contribute to community

x. Migration issue (communities are losing young adults in their teens, 20s, and 30s) to high islands so there are not enough people left to carry on some cultural practices and do things like maintain taro patches

- **These threats are likely to be worsened over time with climate change and variability.**

Page 4: What Are Climate Change and Climate Variability?

- Climate change is not new. Throughout history, the earth has warmed and cooled over very long periods of time. However, the earth is now warming at a much faster rate due to human causes, which are accelerating the "greenhouse effect."

- Many of the impacts of climate change will be seen in the long term (50+ years), while others are already noticeable.

Causes of Climate Change

- Gases that are released by various human and non-human activities trap heat in the atmosphere. These gases are called greenhouse gases and include carbon dioxide, methane, and nitrous oxide. Greenhouse gases are created from
    - ➔ Burning gas, oil, and coal for things such as
        - electricity (man-made)
        - automobiles (man-made)
        - planes (man-made)
        - factories (man-made)
    - ➔ Industrial agriculture, including intensive raising of livestock (man-made)
    - ➔ Deforestation (man-made)
    - ➔ Forest fires (natural and man-made)
    - ➔ Volcanoes (natural)

- Human causes of the release of these gases have increased significantly over the past 200+ years from the increased use of fossil fuels and land use changes, especially in the developed world.

- When greenhouse gases trap the radiated heat from the earth in the atmosphere and cause an increase in temperature on the earth, this is referred to as the "greenhouse effect."

- Founded in 1988, the Intergovernmental Panel on Climate Change (IPCC) includes scientists from around the world who have conducted independent studies about causes of increased rates of climate change. Those studies have been compiled into large reports. The fourth IPCC assessment report is from 2007. IPCC scientists agree that "Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values… The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use change, while those of methane and nitrous oxide are primarily due to agriculture." (IPCC, 2007)*

- These increased gases in the atmosphere are causing a faster increase in the temperatures of the atmosphere than what would occur naturally.

- Increased atmospheric temperatures will result in changes to climate and weather patterns globally.

Climate Variability

- While many climate change impacts may not be noticed for many years, there will likely be shorter-term changes to average weather patterns (annual rainfall, air temperature) that may be noticed sooner. The shorter-term changes in weather patterns are called "climate variability."

- While overall we talk about "warming," some areas are getting hotter faster and are experiencing more extreme events.

- In the Pacific region, short-term changes in weather are very dependent on cyclical El Niño/ La Niña events.

Reference:

*IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press: Cambridge, United Kingdom and New York, NY, USA.

Page 5: What Are El Niño and La Niña?

Normal Conditions

- In the western Pacific, a pool of warm water goes deep into the ocean; the heat makes the water molecules spread farther apart, increasing the water volume; since the extra volume can't go through the floor of the ocean, it expands upward, causing the sea level to rise.

- The ocean surface is about 1 foot higher in the western equatorial Pacific than in the eastern equatorial Pacific. Because of gravity, the higher sea level should flow back toward the east, but strong equatorial surface winds blowing east to west keep the water piled up in the west.

- The warm pool also puts a lot of warm, moist air into the atmosphere. This leads to the routine development of thunderstorms and typhoons in the western Pacific.

- Eventually, "Mother Nature" redistributes the heat in the Pacific and sets off actions that initiate an El Niño.

El Niño Conditions

- The strong east-to-west surface winds weaken or become west to east. In the ocean, this sets up a wave that extracts heat from the ocean in the western equatorial Pacific and transports it toward the eastern equatorial Pacific.

- As the ocean heat moves eastward, so does the atmospheric area where thunderstorms and typhoons develop. By March, typhoons may develop around Pohnpei, by April around Kosrae, and around May and June in the Marshall Islands. This is the wet phase of the El Niño. After this wet phase, Micronesia is typically drier during El Niño. Drought begins to set in, and from the following January through April, conditions can be very dry in Micronesia.

- As the heat in the western Pacific moves eastward, the ocean volume in the west decreases and the sea level drops, sometimes by as much as a foot. In the eastern Pacific, the ocean volume increases and the sea level rises.

- Drought worsens the occurrences of fires and causes reduced water and food resources on the high islands. Drought is very severe on the low islands. The small aquifers become thinner and thinner. As sea level falls, saltwater eventually gets drawn into the freshwater lens. Eventually, the water becomes too salty to drink and may begin to damage or kill food sources.

- The clear skies, lack of wind, and intense sunlight at this time heat the western Pacific Ocean. This has led to severe mass coral bleaching in the past.

- Multiple-year El Niños are rare.

- Eventually, "Mother Nature" is satisfied with the redistribution of heat and re-starts the equatorial east-to-west surface winds. Sometimes the east-to-west winds get too strong, and they can lead to a La Niña event.

La Niña Conditions

- When the east-to-west equatorial surface winds increase, the warm water is mixed deeper into the ocean. This process shifts thunderstorm and typhoon development west of the normal locations and causes the sea level to rise as the ocean volume expands.

- The increased easterly surface winds can cause the sea level to rise as much as a foot above normal. This, coupled with high surf events, especially near new and full moon periods, can cause episodes of coastal inundation and flooding.

- As the northeast and southeast trade winds intensify during La Nina, they converge just north of the equator. They can create very wet conditions across Micronesia from Mili in the Marshalls, to Kosrae, to the southern Mortlocks in Chuuk State, to Satawal and Woleai in Yap State, and to Peleliu in Palau.

- Eventually, the trade winds and La Niña will relax, and conditions will revert back to normal/neutral.

- Multi-year La Niñas (2 or 3 in a row) are fairly common.

- It is unclear how climate change will impact El Niño and La Niña events and if they will become more or less frequent and severe. Scientists are not yet able to predict when an El Niño event will occur but when an event begins, they can predict the general weather/climate conditions for the next 7 to 9 months.

❖ However, it is very important to know if these events are occurring in any given year as it can help a community prepare for impacts from these climate events, such as drought and/or flooding. For example, it is important to have good water catchment systems in place so that during times of rainfall, communities can collect water and prepare for times of drought when an El Niño is predicted. Back-up water catchments should also be put in place to prepare for these severe dry periods.

Reference: http://www.prh.noaa.gov/guam/ensoPacific.php

Page 6: What Changes Can We Expect to See in the Region?

What does the science say?

- We discussed the causes of climate change previously and how the international community has studied and agreed that these changes are occurring more rapidly from human activity.

- Studies are also happening in Micronesia, and scientists are reviewing information for this region to try to understand how climate change will impact this region. However, we will not be able to predict "exactly" what will happen to any region, country, or community and therefore have to plan for uncertainty.

- Information presented here provides some idea about what we know will happen, what is likely to occur, and what we still don't know about changes to climate and impacts in Micronesia.

What does the science say will happen for certain?

- Sea level is rising.
  - According to Vermeer and Rahmstorf (2009), even for the lowest emission scenario in the IPCC, sea-level rise is likely to be 1 meter; for the highest, it may come closer to 2 meters (by 2100). **

- Sea surface temperature (SST) is increasing.
  - According to the IPCC Fourth Report (2007), mean global SST will rise by 3.5°C by 2100 (compared to 2010)*

- Air temperature is increasing.
  - According to different emission scenarios in the IPCC Fourth Report (2007), the average rate of global temperature rise by the year 2100 ranges from 2 to 4.6°C.***
  - For the next two decades, a warming of about 0.2°C per decade is projected for a range of emission scenarios (IPCC 2007).***

- Acidity of the ocean is increasing.

What are possible changes?

- Weather patterns become less predictable.
  - It's unclear how storm events will change. However, as sea levels rise, any storm events that occur could bring greater storm surges.
  - There is evidence some locations (e.g., Marshall Islands) are getting less rainfall. We don't know if this is part of a normal cycle (natural variability) or a result of global climate change.

- Based on a range of models, it is likely that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and heavier precipitation associated with ongoing increases of tropical sea surface temperatures. There is less confidence in projections of a global decrease in numbers of tropical cyclones.

References

*World Climate Research Program (WCRP) third Climate Model Intercomparison Project (CMIP3) multimodel dataset.

** Vermeer, Martin and Stefan Rahmstorf. 2009. Global sea level linked to global temperature. Proceedings of the National Academy of Science of the United States of America. 2009 December 22; 106(51): 21527–21532. Published online 2009 December 7. Doi: 10.1073/pnas.0907765106.

*** Intergovernmental Panel on Climate Change. 2007. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Eds. Solomon S, et al. Cambridge University Press, Cambridge, United Kingdom.

Page 7: Why Should Our Community Care about Climate Change?

Potential Impacts

- Climate change can be expected to impact Micronesian culture. It will have an impact on traditional and local ways that islanders utilize natural resources. Specifically it can impact:
    - Livelihoods and food security (e.g., taro patches/ fisheries)
    - Weather patterns and seasons (e.g., rain/ fruiting seasons)
    - Community health and safety (e.g., safe drinking water, cultural practices such as growing sakau)

Impacts We're Already Seeing

- Micronesians are already noticing changes in the climate, changes to the environment, and impacts from those changes.
    - Salt water inundation/intrusion
    - Increased coastal erosion
    - Flooding from storm surges or extreme high tides
    - Bleaching of coral reefs
    - Severe drought during the El Niño in 1997/1998

Page 8: How Will These Changes Impact Our Community?

Now that we know more about what changes we are likely to see from climate change and climate variability in Micronesia we can look at the potential impacts these changes may have on our community.

- **Sea level rise can cause →**
  - Stronger storm surges, flooding, saltwater inundation and intrusion, and coastal erosion, which can cause →
  - Loss of and damage to crops, homes, and coastal infrastructure. This leads to →
  - Health hazards, loss of food and livelihoods, decreased land for living, and problems with community services

- **Increased sea surface temperature of the ocean can cause →**
  - Coral bleaching, which can make corals weak or die and result in →
  - Loss of habitat and nursery ground for fish and marine life, and loss of coastal protection, causing →
  - Loss of food and/or income for community members who are dependent on fisheries and a loss of coastal areas where homes and farms may be located. This leads to →
  - Nutrition problems, loss of livelihoods, and decrease of land for living

- **Increased air temperature can cause →**
  - Increased stress on plants, crops, and people, which can cause →
  - A loss of food or a health hazard

- **Increased acidity of the ocean can →**
  - Make coral structures weaken, grow slower, or die and result in →
  - More damage from storm surges, which results in→
  - Loss of habitat and nursery ground for fish and marine life, and loss of coastal protection, causing →
  - Loss of food and/or income for community members who are dependent on fisheries and loss of coastal areas where homes and farms may be located. This leads to →
  - Nutrition problems, loss of livelihoods, and decrease of land for living

- **Changes in weather patterns can cause →**
  - Droughts if less rain or flooding/landslides if more rain, which cause →
  - Damage and loss of crops, homes, and infrastructure, which cause →
  - Health problems from water- and vector-borne diseases, and loss of food for community members

Page 9: Cumulative Impacts

Facilitator Note: Review the idea of cumulative impacts. Impacts from multiple threats on resources over time are referred to as ***cumulative impacts***. Use the threatened community on this page to show that the more threats occur in an area, the harder it is for resources and communities to recover from predicted changes.

1. **Degraded Watershed**
   - CC THREATS: change in weather patterns (e.g., increase or decrease of rainfall), rising air temperatures

   - EXISTING THREATS: Destruction of forests/vegetation, pollution (e.g., piggeries, trash), runoff from cleared land, monocropping

   - CC THREATS + EXISTING THREATS = CUMULATIVE IMPACTS AND INCREASED POTENTIAL FOR
     i. Damage or loss of crops and native plants, contamination or loss of drinking water, flooding of homes, soil erosion and landslides, sediment near shore and on reefs, invasive species, stress on people
     ii. Increased negative impact on food, income, and health of the community (e.g., vector- and water-borne diseases)

2. **Degraded Coastline**
   - CC THREATS: Sea level rise, coastal erosion, increased sea surface temperatures

   - EXISTING THREATS: Clearing of coastal vegetation, dredging of sand, unsound development of coastal areas and infrastructure, unsustainable clearing of mangroves for firewood and construction material, overharvesting

   - CC THREATS + EXISTING THREATS = CUMULATIVE IMPACTS AND INCREASED POTENTIAL FOR
     i. Flooding and damage from storm surges, coastal erosion, sedimentation on the reef, damage to habitat important for food fish and shellfish
     ii. Negative impact on food, income, coastal land, property, and health of the community

3. **Degraded Coral Reefs**
   - CC THREATS: Increased sea surface temperature, increased acidity of the ocean

   - EXISTING THREATS: Overfishing, destructive fishing practices, anchor damage, oil spills, invasive/nuisance species, dredging, runoff and sedimentation

- CC THREATS + EXISTING THREATS = CUMULATIVE IMPACTS AND INCREASED POTENTIAL FOR
    i. Coral bleaching and death, damage to habitat important for food fish and shellfish
    ii. Flooding and damage from storm surges, coastal erosion, decrease in fisheries as habitat is degraded and destroyed
    iii. Increased negative impact on food, income, coastal property

❖ Finally, given the unpredictability of future changes and cumulative impacts, review the "precautionary principle." Preparing for unknown changes is the best approach for long-term community resilience.

❖ With or without climate change impacts, these are things that will help our community be happier and healthier over time.

❖ "Protecting resources now = increasing chances of survival and ability to meet our community needs now and in the future"

Page 10: Title: Is There Anything We Can Do? What Are Communities Doing to Make a Difference?

- Emphasize that while this situation can be overwhelming, there are many things that a community can do, should do, and that they are likely already doing to be more resilient (prepare for, respond to, and recover from stresses) in the face of these changes.

- Here are some examples of communities in the Pacific taking action to prepare for, and adapt to climate change impacts.

- **Namdrik Atoll, Marshall Islands**
    - The community is experiencing
        - Accelerated rates of coastal erosion
        - Severe droughts in the past ten years that threaten drinking water supplies
        - Decline in fisheries

    - Actions the community is taking
        - Carried out a "vulnerability assessment" and "management and adaptation planning" process
        - Planting vegetation around coastline to stabilize the shoreline
        - Installing household water tanks to catch rainwater for consumption
        - Establishing marine protected areas to protect important food fish and other marine life that are important to them

- **Ngarchelong Community, Palau**
    - The community is experiencing
        - Mass bleaching of coral reefs occurred in '97/98
        - Concern that high water temperatures and bleaching coral could lead to the large-scale death of coral reefs and have a negative impact on the fisheries, tourism, and local way of life

    - Actions the community is taking
        - Working with State government, local conservation groups, and scientists to establish a marine managed area that is designed to support the resilience of the coral reef and fisheries over time
        - The community planning team is considering climate change in the design and planning of the MMA, recommending additional levels of

protection to areas that have shown resilience and/or recovery to past bleaching events, as well as important fish spawning aggregations

- **Tegua Community, Vanuatu**
    - The community of Tegua was located very close to the high-water mark on a low-lying atoll. The community had to stay in the same area as they shared one water tank and relied on freshwater springs at low tides despite the fact that these sources did not supply sufficient water for consumption and bathing.

    - The community experienced
        - Regular inundation from tidal surges and increased erosion of the islands
        - Flooding that created health problems from mosquitoes and water-borne diseases
        - Water scarcity because they had only one water tank and depended on freshwater springs at low tide for drinking and bathing water

    - Actions the community is taking
        - The Tegua community relocated to higher ground and rebuilt homes. The community is confident in their decision to relocate to higher grounds and have no regrets. They no longer experience any of the flooding or water shortages like they did in the old location.
        - They also installed several water tanks in the community, which resulted in an increase in the freshwater supply per family and health benefits from the ability to bath regularly in fresh water.

Page 11: Adaptation Strategies to Build Resilience of Coral/Fisheries and Coastal Vegetation

The best way to prepare for climate change and avoid negative impacts to important resources is to keep these resources as healthy and strong as possible. Therefore, reducing all threats that can damage them is critical for their long-term resilience to climate change and climate variability.

Each adaptation strategy requires a different amount of capacity/inputs, including money, people, and expertise. It is important to understand which natural and social resources are most important to you and most vulnerable to climate change to help decide which strategies to undertake.

Coral Reefs and Fisheries Adaptation Strategies
Climate change impacts to coral reefs and fisheries include coral bleaching, coral death, and loss of habitat. Below are some adaptation strategies to help build resiliency of coral reefs and fisheries and/or address impacts on communities from changes that may occur.

1) Establish a locally managed marine area (LMMA) – Establishing, designing, and managing the site can include rules and regulation of various human activities. Some rules might aim to reduce threats such as overfishing and habitat destruction while other rules may increase protection for certain species (e.g., herbivores, turtles). MMAs can be zoned to have different rules in different areas, where some areas are designed to have strict protections of certain species or habitats. These might include "no take" protections of spawning aggregations or mangrove areas. Important things to consider when designing an LMMA are the following:

    a. Protection of herbivorous fish (e.g., parrotfish, surgeonfish) that eat algae and lessen the chance of bleached corals dying
    b. Protection of spawning aggregations
    c. Protection of coral reefs that are near upwelling, flushing, and/or shading
    d. Protection of a range of habitats (beach, mangrove, seagrass, coral) to ensure important species are protected throughout their life

2) Pelagic fish aggregation devices (FADs) – Nearshore FADs can be deployed near the outer reef to attract pelagic species closer to the community. FADs can provide benefits to communities who are not able to sustain their populations based on the existing reef fish populations (because either the population is too large based on reef size or the reef is not healthy enough to support the community). This is a way to take pressure off reef species and provide food/income to community members. If pelagic FADs are considered as an adaptation strategy, it is critical

that they be well designed to ensure longevity. Expertise may be necessary to understand feasibility of this option.

3) Small-scale pond aquaculture – Aquaculture is a way of farming fish. For areas with a high population of people and lacking in natural resource health or abundance to support the population, aquaculture may be worth exploring. Some resources for both stocking fish and feeding fish are needed, and appropriate elimination of waste needs to be addressed to avoid impacts from pollution.

4) Supplementary or alternative livelihoods (that are less dependent on reefs) – Finding a means for alternative income not from fishing can reduce pressure on the reef and reduce the dependence of community members on marine resources that might be negatively impacted by climate change.

Coastal Lands and Vegetation Adaptation Strategies

Climate change impacts to coastal lands and vegetation include erosion, flooding, and loss of habitat. Below are some adaptation strategies to help build resiliency of coastal lands and vegetation and/or address impacts on communities from changes that may occur.

1) Replant vegetation (mangroves, pandanus, trees, shrubs) – Where coastal vegetation has been removed or cleared in the past, it can be replanted. It is important to consider replanting species that may be able to survive in specific locations (e.g., saltwater exposure) and/or provide additional benefits over others. Replanting vegetation near the shore can help stabilize coastlines, promote accumulation of sand, and slow erosion rates while also providing fruits (e.g., pandanus) or habitat for important species used for food (e.g., mangrove crab, other shellfish).

2) Establish community rules to protect mangroves, coastal vegetation, and seagrass beds – Establish regulations that prohibit destruction or do not allow development right behind mangroves or other vegetation. Work with local and national governments to ensure buildings and roads are not built on shorelines where they are susceptible to sea level rise.

    a. Protect mangroves – Placing specific protections on mangroves can help support long-term survival of this critical habitat. Mangroves can also be replanted where they have been cleared, to restore habitat and coastline protection. Additionally, in considering climate change impacts over time, it is important to consider restricting development too close to mangroves. As the sea rises, existing mangroves will be inundated and some may “drown.” If able, mangroves may migrate inland over time to survive flooding from sea level rise. Therefore, establishing regulations that do not allow development right behind mangroves will help protect this ecosystem and its functions over time.

3) Coastal protection - Seawalls, revetments, gabions, and groins are all possible strategies for stabilizing coastlines from erosion.

    a. “Hard options” – Hard materials such as stones or concrete are often used to build these structures to protect land from the ocean. While these structures can provide coastline protection they also can cause further erosion in other areas down-current on the shore. If hard options are considered necessary for protecting communities in the long term, it is critical that they be well designed with significant studies and engineering to avoid doing more damage than good. Therefore, it is very important to consult with engineers and other experts who can help design options to minimize further erosion of beaches. Hard structures tend to require significant amounts of human resources and funding to complete.
    b. “Soft options” are similar coastal protection approaches but are made from soft materials such as plants or sand bags. These materials can be used to build barriers or walls to slow erosion rates. Most soft options can be done for much less funding and with fewer human resources than hard options. However, they are also less permanent, and in some areas less effective, than hard options and may require more regular maintenance over time.

Page 12: Adaptive Strategies to Build Resilience of Terrestrial and Water Resources

Climate change impacts to terrestrial resources include flooding, landslides, and drought.

Terrestrial Adaptation Strategies

1) Establish community rules to protect upland vegetation and riparian zones from clearing and burning. Specific regulations can be developed at the community level to prohibit destruction of upland and riparian vegetation. This can be done as part of a management planning process for the area.

2) Eradicate or manage for invasive species. Where possible, invasive species should be managed or reduced. Prevent the introduction of invasive plant species, which are often less effective in holding soil. Communities can work with local conservation organizations to develop strategies for invasive species management.

3) Apply wise agricultural practices that minimize the clearing of land and erosion of soil.

4) Restore upland native vegetation.

The biggest climate change impact to water resources is drought, threatening freshwater supplies.

Water Resources Adaptive Strategies

1) Fix leaky pipes to existing water tanks to ensure that available rainwater is being captured for use. Many freshwater supplies are lost to leaks that, if repaired, can save important drinking water resources. If leaks are too large to fix, it is important to contact someone who can help with repairs to help ensure that sufficient water resources are available in times of drought.

2) Install household or community water catchments and tanks to conserve for times of limited rain or drought.

3) Protect reservoirs and freshwater lenses – Ensure areas that provide drinking water are free from pollution and managed (e.g., “no cut zones”) to avoid evaporation.

4) Ensure wells are designed and managed to allow sustainable use.

5) Use of solar water filters to filter contaminants from well water, making it suitable for use to water crops; use solar distillation systems to supplement drinking water in remote areas.

Page 13: Adaptation Strategies to Build Resilience of Agriculture and Community Well-Being

Climate change impacts to agricultural resources include flooding, saltwater inundation, and drought.

Agriculture Adaptation Strategies

1) Use and enhance traditional agroforestry practices, diversify new agriculture methods, and use shade trees to protect from drought. High-value plants can be used to generate more income with smaller plots of land.

2) Avoid clearing forests and monocropping! Having multi-crop agriculture helps to protect plants from periods of low rainfall. Specifically, taller trees can provide shade to low plants and protect them from high temperatures and low rainfall.

3) Move crops inland, away from inundation areas. To avoid flooding and saltwater inundation from high tides and storm surges, agriculture should be moved away from flood zones and inundation zones.

4) For low-lying islands, raise taro patches through traditional practices of filling with compost or where needed through the use of concrete beds (e.g., in Yap). Controlled environments such as greenhouses may be needed to protect raised crops from salt spray and extreme heat.

5) Use and enhance traditional food preservation methods (e.g., breadfruit, pandanus, coconut vinegar/molasses) to promote self-sufficiency, enhance community livelihood, and prepare for times of low food production or drought. In times when food is abundant, food preservation can be considered as a way to save some of those foods for times when there may be less food or foods are out of season. Various ways of preserving food are being explored at Palau Community College.

6) Salt-tolerant species are now being explored at Palau Community College to understand if certain species of plants (e.g., taro) can grow after being exposed to salt. They are looking at species that grow in low-lying islands and may be exposed to inundation regularly. If these species exist and are “salt tolerant,” they may be shared around the region to be used in areas of inundation.

7) Encourage local communities to consume a wide variety of locally produced and more nutritious traditional foods. “Go Local!”

Climate change impacts to community well-being include increased occurrence or strength of weather events (e.g., drought, storms, floods) and associated social impacts (loss of food and water resources, negative impacts to income-generating activities, and negative impacts to health).

Adaptation Strategies to Support Community Well-being

1) Apply traditional and local knowledge about natural resource management. Traditional and local knowledge often includes practices that minimize damage to natural resources while allowing for sustained use.

2) Build partnerships with local agencies and organizations that can support climate change adaptation planning and activities (e.g., resource management, meteorological services, hazard management, health services, community colleges).

3) Provide climate information and warnings and build awareness for better preparedness for known and potential climate change impacts. It is important that community members understand the climate and non-climate threats facing the resources in their community and what they can do about them. It is also important that they understand future climate scenarios so they can decide how best to prepare in their homes and communities.

4) Encourage and reward people for supporting and complying with adaptation strategies for natural resources and ecosystems.

5) Ensure people know about and have access to emergency routes and services for extreme events (e.g., floods, typhoons). Ensure evacuation routes are clear of debris to facilitate escape. Use areas of high elevation for evacuation from storm wave surges, tidal surges, and tsunamis. Large school buildings, community centers, clinics, and churches make good evacuation centers for typhoons. Knowing what to do in times of an extreme event can be the difference between life and death. It is important that community members know about potential hazards and what to do in case those hazards occur.

6) In low-lying areas (and on low-lying atolls), put new buildings on stilts to prevent flooding.

7) Install lightning protectors on buildings.

8) Ensure people know about and have access to health services to cope with climate-related stressors (physical and emotional). Changes to the environment and/or lifestyle can have impacts on the health of community members. These can be physical impacts (e.g., diseases, heat stroke) or mental/emotional (e.g., stress-

related issues such as high blood pressure). It is important that community members know about and have access to health clinics or programs to deal with possible changes from climate change.

9) Engage in alternative livelihood programs to diversify income sources. This may be especially important in communities where livelihood is limited or mainly based on resources that could be impacted from future climate change, such as fisheries. Providing other opportunities to gain income can be important to those who are dependent on one source of income, which may be negatively impacted.

10) Work with other communities to share lessons and experience. In the Marshall Islands, outer island communities are being linked through a radio network, which allows them to communicate regularly with other communities and local conservation organizations in the network. Through this network, community members share experiences and can access technical support from experts as they implement adaptation strategies and conservation actions locally.

11) Organize the community and build effective community-based organizations and leaders. An organized community with good leadership is more likely to be able to cope with future uncertainties.

Page 14 & 15: How Can We Understand What Is Likely to Happen in Our Community?

- Review again the healthy and threatened communities, but this time, add in climate change terms. Use the different communities to help explain the following terms.

- **Vulnerability:** the degree to which human or natural systems are unable to cope with negative impacts of climate change. Vulnerability is a function of exposure, sensitivity to climate events, and the capacity of the systems to adapt to impacts from these events.

- **Resilience:** ecological and/or social capacity to absorb, respond to, and bounce back from external stresses and disturbances while still being able to maintain the community's core functions.

- Therefore, if you increase resilience of a community or resources, you will decrease their vulnerability.

- RESILIENCE AND VULNERABILITY
    - The healthy community is more resilient.
    - The threatened community is more vulnerable.

- **EXPOSURE:** the extent to which a system comes into contact with climate conditions or specific climate impacts. Point out the following:

    - Vulnerable/ threatened community – Houses and agriculture here are more exposed to climate change events such as storm surge and inundation due to sea level rise because they are built low and close to shore.

    - Resilient/healthy community – Houses and agriculture here are less exposed to climate change events such as increased storm surge due to sea level rise because they are built higher and away from shore (behind mangroves).

- **SENSITIVITY:** the degree to which a built, natural, or human system is negatively affected by changes in climate conditions (e.g., temperature and precipitation) or specific climate change impacts (e.g., sea level rise, coastal erosion).

    - Vulnerable/ threatened community – Community members and natural resources are more sensitive here because there are several man-made threats that have degraded or damaged the marine resources, and the community is very dependent on fisheries for food. They are also dependent on government resources for fresh water in times of drought since they have no water storage system.

- Resilient/healthy community – Community members and natural resources are less sensitive here because the resources are very healthy and the community has a wide variety of food sources including multi-crop agriculture, seasonal fruits, and a wide range of diverse species in the mangroves and reef. Community members have well-maintained rainwater catchments at their houses and have a community water reservoir as well for times of drought.

- **ADAPTIVE CAPACITY:** potential, capability, or ability of built, natural, and human systems to adapt to impacts of climate change and variability with minimal potential damage or cost.

    - Vulnerable/ threatened community – There is low adaptive capacity here because community members are not aware of how to protect their resources or how to adapt to climate change. They do not have alternatives for their livelihoods or access to the resources they need to be able to make changes. They do not have partnerships with local health and hazard management organizations and are not able to plan for emergencies such as flooding and droughts.

    - Resilient/healthy community – There is high adaptive capacity here because community members are aware of how to protect their resources and how to implement strategies to adapt to climate change. They have livelihood alternatives, are willing to make changes, and able to access the resources that support them to do so. They have been working with local health and hazard management organizations to help them plan for emergencies such as flooding and droughts and implement strategies to address critical community needs.

Review again:

- (Healthy Community) More resilient and less vulnerable – the healthy community has been building their resilience over time. They have been reducing their exposure and sensitivity and building their adaptive capacity. Therefore they are less vulnerable to climate change.

- (Threatened Community) More vulnerable and less resilient. This community is more exposed and more sensitive and has lower adaptive capacity.

Page 16: What Can We Do in Our Community to Prepare for these Changes?

- Based on the predictions of climate change in Micronesia, we learned that we can identify how these changes might impact our communities and prepare for these changes by developing a **management and adaptation plan**.

- To incorporate climate change adaptation into the existing planning processes used in Micronesia, the "PIMPAC management planning guidance" has been adapted to include a vulnerability assessment and adaptation strategy development. As such, the vulnerability assessment is not a separate process from the planning process; it explores all threats, not just climate change.

- The planning process can help community members understand how these changes are likely to impact the community and the resources that are important to them. In other words, it will help the community understand the vulnerability of their target resources to climate change.

- **As you talk about this page, review the steps for management and adaptation planning on the flipchart.**

- Highlight that there are many things that communities have already been doing that can help them prepare and adapt to CC and other threats.

The next page provides specific tools that can be used to carry out a vulnerability assessment.

Page 17: Vulnerability Assessment

This page is focused on providing more details about the vulnerability assessment part of the planning process.

There are specific tools in the vulnerability assessment matrix we can use to help understand the vulnerability of the community and its resources to climate change.

Vulnerability assessment matrix – The vulnerability assessment matrix helps bring together information collected through the tools listed below in an organized way. These tools help a community understand the vulnerability of their priority social and biophysical resources to climate impacts. Definitions in Appendix A.

- **Collection and review of climate change science information**
- **Historical timeline**
- **Seasonal calendar**
- **Community mapping**
- **Socio-economic assessment and monitoring**
- **Biological assessment and monitoring**
- **SWOT analysis**

These tools will help answer the following questions:

- How vulnerable are our priority resources to climate change impacts and other threats?
    - Exposure
        - Who is most exposed to these impacts?
        - Where do they live?
        - Which resources are most exposed? In which area?
    - Sensitivity
        - Who is dependent on impacted resources for income and subsistence needs, and to what extent?
        - How healthy are the resources currently?
        - Are there additional stressors beyond CC that are impacting these resources?
        - Are these resources being managed effectively?
        - In an emergency, how able is our community to evacuate and/or communicate to outside the hazard area?

- Adaptive Capacity
  - What opportunities exist in our community to deal with impacts on these resources (e.g., alternative and supplementary livelihoods, diversity and availability of food options, social network, local environmental governance)?
  - What barriers might exist that would keep our community from adapting to these changes (e.g., political/regulatory, physical barriers, competition for use, degraded ecosystems, lack of climate information or access to it)?
  - What resources/opportunities/strategies already exist to help our community adapt to possible impacts?
  - What are the major gaps/challenges in adapting?

- Prioritizing Resource Targets
  - Which resources are most important for us to protect?
  - Which resources are most vulnerable to climate change and other threats?

- Additionally, this information can be assessed again in the future to determine changes that have occurred over time and if vulnerability is increasing or decreasing.

Page 18: Taking Action: A Community Plan To Build Resilience

Going back to the threatened community, explain that this community decided to explore their vulnerabilities further and develop a plan to manage their resources and adapt to climate change.

After going through a vulnerability assessment, this community realized they were highly vulnerable to climate change impacts. Specifically, their reefs, water resources, coastal crops, and infrastructure were all highly vulnerable because they are exposed to climate events, the ecosystem is degraded due to cumulative impacts, and the community is not familiar with resource management and climate change adaptation.

Given the known and unpredictable changes to future climate conditions, the community has developed a Management and Adaptation Plan. This plan will guide them in how to restore and improve management of natural resources so that their ecosystems are more resilient to these changes.

They also plan to act now to develop more and diverse systems for drinking water, income, and food crops to be more likely to be able to deal with long-term changes.

This community's Management and Adaptation Plan includes the following components:

COMMUNITY MANAGEMENT AND ADAPTATION PLAN SUMMARY

Resource Targets

1. Water resources
2. Food fish, as well as grouper and bumphead parrotfish
3. Marine turtles
4. Coral reefs
5. Community agriculture
6. Traditional use of natural resources (e.g., customary, social, and cultural use)

Vision: A healthy community with intact natural resource base that provides for community well-being including food security, sustainability of income, and quality of life

Non–Climate Change Threats and Impacts

1. Overfishing resulting in shifts in population structure, decline in population size, and loss of predators and herbivores
2. Destructive fishing (using chemicals and explosives) destroying reef and marine life populations
3. Clearing of coastal vegetation resulting in coastal erosion
4. Sedimentation due to clearing of mangroves smothering and killing reef and seagrass
5. Pollution from piggeries causing too many nutrients on the reef, which promotes algae growth, and also contaminates the fresh water
6. Anchor damage destroying coral

CC Threats and Impacts

1. Increased extreme rainfall events causing runoff and sedimentation
2. Increase in sea surface temperature causing coral bleaching
3. Increase in air temperature with long dry periods causing drought and limiting water supplies
4. Sea level rise causing coastal erosion and inundation
5. Increase in ocean acidity weakening corals and reef structure

Vulnerability (HIGH)

1. High Exposure to CC Impacts: Homes and crops are near the shore.
2. Highly Sensitive to CC Impact: The ecosystem is degraded due to non–climate change threats. Community is highly dependent on resources that are or will be impacted by changing climate and thus very sensitive to climate change.
3. Limited Adaptive Capacity: The community has not planned well, has limited understanding of effective management and adaptation, and has not developed capacity to cope with changing climate impacts.

Solutions

- **Reduce Exposure**
    - Move crops, houses, and important infrastructure of community services away from coastal areas.
    - Build new homes on stilts.
    - Elevate planting plots.

- **Reduce Sensitivity**

    - Address non-climate threats effectively.
    - Restore and protect mangroves to reduce coastal erosion.
    - Restore and protect native vegetation.
    - Move piggeries away from the shore and freshwater sources.
    - Create a managed area to protect spawning aggregations and populations of herbivorous marine animals.
    - Develop alternative income programs for fishermen such as tourism facilities.
    - Install community rainwater catchments.

- **Increase Adaptive Capacity**
    - Provide outreach and awareness programs so community members know how to reduce threats and prepare for climate change impacts.
    - Strengthen livelihood diversification and enabling institutional support.
    - Partner with relevant organizations to better prepare for climate impacts, such as with local health organizations to help prepare for increased heat events and to decrease likelihood of water- and vector-borne diseases.
    - Build strong social networks.
    - Work with adjacent communities to protect resources and apply for grant funding.
    - Form a community team to develop and implement the Management and Adaptation Plan.

Page 19: How Can We Work Together to Be More Resilient?

- The work being carried out at a site level can have meaningful and positive effects in addressing climate change impacts to your community, such as
    - Protection of coastline from storm surges
    - Improved fisheries management
    - Sustainable sources of food and fresh drinking water

- However, most natural systems will require a broader approach than at the community level to secure long-term success and resiliency.

- Your community can be a part of a larger protected area network around your state, country, or region to increase the resiliency of these natural resources, help protect them from the impacts of climate change on a broader scale, and ultimately increase the benefits they provide your community.

Point out the following things:

❖ **Protected area networks** are multiple protected areas that are designed to increase natural resource resiliency by keeping specific areas healthy so as climate change occurs they are able to withstand the additional stressors such as sea surface temperature rise and ocean acidification. They do this through

- **Connectivity** – It is important to consider how systems may be connected to one another. Many natural systems within your community may be influenced by or influence other systems in other communities. For example, many seeds and young (e.g., coral, mangroves, coconut palms) are spread to other areas outside your community, just as species in other communities may spread to your community area through winds and current. Therefore, if a group of areas are healthy they are more likely to be able to withstand changes and provide non-protected areas with sources of seeds, larvae, juveniles, and adults.

- **Replication** – It is important for similar ecosystems to be protected in many areas over a broad space. Replication of these protected systems ensures that if one area is negatively impacted, there are likely other areas that can support recovery of damaged areas. Some areas are naturally more resilient to climate change impacts and may be able to survive climate events more than others, for instance, an area of reef that has not bleached or an area that has bleached but recovered. These areas should be considered for protection so they can help provide badly impacted and/or non-protected areas with seeds, larvae, juveniles, and adults to support recovery.

- **Representation** – Protection of all types of ecosystems important for natural resources throughout all of their life stages (seed, larvae, juvenile, adult). It is important to have protected areas that include "representative habitats" for various life stages (e.g., coral reefs, reef flats, seagrass beds, mangroves, beaches, upland forest).

❖ **Community Sharing and Learning Networks** are multiple communities that work together to share and help each other increase community well-being and resiliency. They do this through

- Informing and raising awareness
- Sharing lessons, knowledge, resources, and experience

Existing groups that can be utilized to share this information include watershed groups, women's groups, school groups, church groups, etc.

Page 20: Is There Any Help for Our Community to Adapt to Climate Change?

- This section will emphasize some of the larger efforts that may be considered as support systems for local efforts (e.g., Micronesia Challenge, national policies)

- It will provide information for a few of the regional support mechanisms like the Micronesia Challenge and Micronesia Conservation Trust but then leave blank areas for local agencies to fill in their own local information.

- **Each jurisdiction should fill in local agencies, organizations, and efforts that can provide support to communities for management and adaption planning.** Consider:

    - International Donors

    - The Micronesia Challenge

    - Micronesia Conservation Trust

    - National Government (Policy and Agencies)

    - Local Organizations
        - Health
        - Hazard/Disaster Management
        - Resource Management and Conservation
        - Education and Research
        - Meteorological Services

    - Community Groups

APPENDIX A

VULNERABILITY ASSESSMENT TOOLS

- **Collection and review of climate change science information** (graphic)
    - Provides a review of the most up-to-date climate change science information and predictions for the region. This information is critical for the community to prepare for and adapt to future climate scenarios.
- **Historical timeline** (graphic)
    - Captures local/historical knowledge about past climate events and trends to help understand and prepare for likely impacts from climate change.
- **Seasonal calendar** (photo)
    - Captures information about annual seasons and associated natural and social events that happen during those seasons as well as any changes being noticed in seasonal events.
- **Community mapping** (photo)
    - Captures and visually displays information about the community, including where important resources are physically located in the community and related information. This can help the community to understand who and what might be most vulnerable to climate change impacts.
- **Socio-economic assessment** (photo)
    - Socio-economic assessment helps provide information about social, economic, and cultural relationships between the community and their natural resources, as well as about resource governance. The information will help determine if there are any particular community members or groups that are more vulnerable and why. Several tools can be used, including many of those discussed here (mapping, historical timeline, seasonal calendar, SWOT) or through other methods such as household surveys, key informant interviews, and focus group sessions.
- **Biological assessment** (photo)
    - Biological assessment will help capture information about the current condition of the resources, as well as threats that might be impacting resources. This information can be collected again in the future to help understand changes in the resources.
- **SWOT analysis** (graphic)
    - A SWOT analysis captures information on Strengths, Weaknesses, Opportunities, and Threats to the community and its resources. This information can help a community develop adaptation strategies based on available knowledge, resources, and partnership and explore ways to overcome challenges.