

Level: 2

Learner Guide

Certificate Level 2 in Climate Resilience

Unit 8:

Demonstrate ways in which communities are vulnerable to hazards and climate change



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*Cover photo: Flooding of low-lying area in Ngiwal village after Super typhoon Bopha
(NEMO, 2012)*

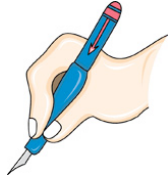
Introduction

This Learner Guide supports the unit of competency (*Demonstrate ways in which communities are vulnerable to hazards and climate change*), which specifies knowledge, skills and attitudes associated with learning about the impacts of hazards and climate change, and the vulnerability of people, communities and environments to these impacts. The unit is the eighth in a series of eleven units that comprise a training program on Resilience at Certificate Level 2.

The Learner Guide provides guidance and relevant educational resources that address the required elements and performance criteria. It is accompanied by a Learner Workbook that provides learner-centered activities and assessment tools to foster learning of key concepts and skills. The competencies developed are in line with the key competencies promoted by Palau to foster greater empowerment and success in the work place. Additionally, a Facilitator Guide for this unit provides further background knowledge and teaching notes for facilitators, trainers and teachers.

This eighth unit defines the standard required to: demonstrate the exposure of Pacific island countries to hazards, climate variability and climate change; interpret variables affecting a community's vulnerability to hazards and climate change; identify impacts resulting from a community's vulnerability to hazards and climate change; evaluate a local community's vulnerability to hazards and climate change; and apply knowledge to help a community become more aware of its vulnerability to hazards and climate change.

Icons



Activity to complete in the workbook



How am I doing?



Definition



Example

Course outline

Before we start...

Dear Learner - This Learner Guide contains all the information to acquire all the knowledge, skills, and attitudes leading to the unit standard:

Title: Demonstrate ways in which communities are vulnerable to hazards and climate change

The full unit standard will be provided a soft copy to you by your trainer/facilitator. Please read the unit standard in your own time. Whilst reading the unit standard, make a note of your questions and aspects that you do not understand, and discuss it with your trainer/facilitator.

This unit standard is one of the building blocks in your qualification at Certificate Level 2. You will also be given a soft copy of a Learner Workbook. This Learner Workbook should be used in conjunction with this Learner Guide. The Learner Workbook contains the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed as part of your Portfolio of Evidence, which will be required during your final assessment.

You will be assessed during the course of your study. This is called formative assessment. You will also be assessed on completion of this unit standard. This is called summative assessment. Before your assessment, your assessor/trainer/facilitator will discuss the unit standard with you.

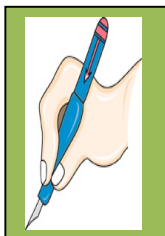
Enjoy this learning experience!

How to use this guide ...

Throughout this guide, you will come across certain re-occurring “boxes”. These boxes each represent a certain aspect of the learning process, containing information that will help you with the identification and understanding of these aspects. The following is a list of these boxes and what they represent:



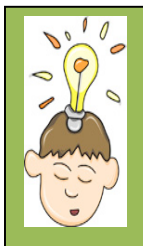
What does it mean? Each learning field is characterized by unique terms and **definitions**. It is important to know and use these terms and definitions correctly. They are highlighted throughout the guide in this manner.



You will be requested to complete **activities**, which could be group activities or individual activities. It is important to complete all the activities as your facilitator will assess them and they will become part of your portfolio of evidence. Activities, whether group or individual, will be described in this type of box.



Examples of certain concepts or principles will be shown in this type of box. Examples help you to relate what you are learning to a real life situation.



This type of box indicates a **summary** of concepts that have been covered, and offers you an opportunity to ask questions to your facilitator if you are still feeling unsure of these concepts.

My Notes ...

You can use this box to jot down questions you might have, words that you do not understand, instructions or explanations given by the facilitator, or any other remarks that will help you to get a better understanding of what you are learning.

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Key competencies / employability skills to be acquired

Competency/skill	Example of application
Initiative	<p>Adapting to new situations • developing a strategic long-term vision • being creative • identifying opportunities not obvious to others • translating ideas into action • generating a range of options • initiating innovative solutions</p> <ul style="list-style-type: none"> <i>Initiate ways to consult with the local community on its vulnerability to hazards and future climatic change, its assets of sustainable living, its priorities for development, and the building of greater resilience (especially among the most vulnerable members of the community).</i>
Communication	<p>Verbal or non-verbal that includes: • speaking clearly and directly • writing to the needs of the audience • understanding the needs of internal and external parties • persuading effectively • establishing and using networks</p> <ul style="list-style-type: none"> <i>Present information both visually and verbally (using hand-drawn illustrations and technology) to explain the vulnerability of communities to the impacts of climate change in Palau.</i> <i>Communicate personal experiences which demonstrate an understanding of the impacts of hazards and climate change in the local region.</i>
Teamwork	<p>Working with people of different ages, gender, race, religion or political persuasion • working as an individual and as a member of a team • knowing how to define a role as part of a team • applying teamwork skills to a range of situations</p> <ul style="list-style-type: none"> <i>Cooperate in a small group to conduct field investigations into vulnerability to hazards and climate change.</i> <i>Undertake activities and discussions in pairs and groups on concepts associated with vulnerability, resilience and the impacts of hazards and climate change.</i>
Information & Communication Technology	<p>Having a range of basic IT skills • applying IT as a management tool • using IT to organize data • being willing to learn new IT skills • having the occupational health and safety knowledge to apply technology • having the appropriate physical capacity</p> <ul style="list-style-type: none"> <i>Use the internet (optional) or printed resources to find examples of impacts of hazards and climate change in Palau and the Pacific region</i> <i>Use of mobile phones for taking photographs of examples of the impacts of hazards and climate change in the local area.</i>
Problem solving	<p>Developing creative, innovative solutions • developing practical</p>

	<p>solutions • showing independence and initiative in identifying problems solving problems in teams • applying a range of strategies to problem solving • applying problem-solving strategies across a range of areas</p> <ul style="list-style-type: none"> • <i>Determine why some people and some communities in Palau are more at risk than others, and evaluate the vulnerability and adaptive/coping capacity of a local community.</i>
Self-management	<p>Having a personal vision and goals • evaluating and monitoring own performance • having knowledge and confidence in own ideas and vision • articulating own ideas and vision • taking responsibility</p> <ul style="list-style-type: none"> • <i>Reflect on knowledge and understanding of how the impacts of hazards and climate change depend on vulnerability and exposure.</i>
Planning	<p>Managing time and priorities – setting timelines, coordinating tasks • being resourceful • taking initiative and making decisions • establishing clear project goals and deliverables • allocating people and resources to tasks • participating in continuous improvement and planning • developing a vision and a proactive plan to accompany it</p> <ul style="list-style-type: none"> • <i>Plan, collect, organize and analyze information on the sectors, people and assets of a local community that might be more exposed to hazards and climate change, and on the community's assets for sustainable living</i>
Learning (gaining new skills and knowledge)	<p>Managing your own learning using a range of learning options suited to the individual learning style– mentoring, peer support, networking; • having enthusiasm for ongoing learning; • being willing to learn in any setting • being open to new ideas and techniques • being prepared to invest time and effort in learning new skills</p> <ul style="list-style-type: none"> • <i>Participate in group discussions to share new knowledge and engage in planning to help a community become more resilient to hazards and climate change.</i>
GESI (Gender Equity and Social Inclusion)	<p>Valuing and supporting women and disadvantaged persons and equal opportunity for all in workplaces and communities • mentoring younger people • valuing and respecting older people • having respect for different cultural, social, religious and political values</p> <ul style="list-style-type: none"> • <i>Ensure that discussions in the communities are inclusive of both male and female perspectives on vulnerability and the impacts of hazards and climate change.</i>

What am I going to learn?

- Section 1: Demonstrate the exposure of Pacific island countries to hazards, climate variability and climate change
- Section 2: Interpret variables affecting a community's vulnerability to hazards and climate change
- Section 3: Identify impacts resulting from a community's vulnerability to hazards and climate change
- Section 4: Evaluate a local community's vulnerability to hazards and climate change
- Section 5: Apply knowledge to help a community become more aware of its vulnerability to hazards and climate change

What do I need to know?

Before you start this unit, you should have:

- knowledge of hazards and climate change acquired through the completion of the previous seven Units;
- knowledge of strategies for mitigating the causes of climate change and adapting to the negative effects of climate change
- first-hand knowledge and experience of the dynamics of a local community (leadership, decision-making, cultural and religious practices, cooperative activities, negative social forces, positive social forces, etc.);
- basic skills in mapping and the interpretation and construction of graphs and diagrams.

What are my learning outcomes?

When you have achieved this unit standard you should be able to:

- demonstrate the exposure of Pacific island countries to natural and human-made hazards, climate variability and climate change;
- explain how vulnerability to hazards and climate change depends on location and the access of individuals and communities to different assets of sustainable living;
- identify some of the impacts that result from a community's vulnerability to hazards and climate change;
- use field research to assess a local community's vulnerability to hazards and climate change, including its capacity to reduce risks and adapt to change;
- help a local community to become more aware of its vulnerability to hazards and climate change.

Introduction to the Unit

You are about to start on the eighth Unit of the Certificate Level 2 course on Climate Resilience. The previous seven Units were at Level 1, and this Unit is the first of four at Level 2 in this course. In this Unit, you are going to find out about ways in which the people and islands of Palau are vulnerable to hazards and climate change.

You will start by reviewing some of the natural and human-made hazards that affect the Pacific islands, and finding out how our islands are exposed to climate variability and climate change. You will go on to see that men, women, children, the elderly and people living with disabilities have different vulnerabilities to hazards and the effects of climate change, with some being more resilient than others. You will find that vulnerability depends on a community's location, and also on its access to the various “**assets**” of sustainable living - natural, physical, human, social and financial. You will learn how to analyze a risk map of the local community to identify the areas, people and assets that are more vulnerable to danger.

Following this, you will be in a position to identify some of the impacts that result from a community's vulnerability to hazards and climate change - impacts on the natural landscape, on ecosystems, on fresh water resources, on livelihoods and economic activities, on property and infrastructures, on human life, and on other human dimensions. You will give talks to each other on examples of these impacts from your local area or other parts of Palau.

After this, you will be asked to go out into the field and assess a local community's vulnerability to hazards and climate change. Your analysis of the community's assets of sustainable living will enable you to evaluate the community's adaptive capacity.

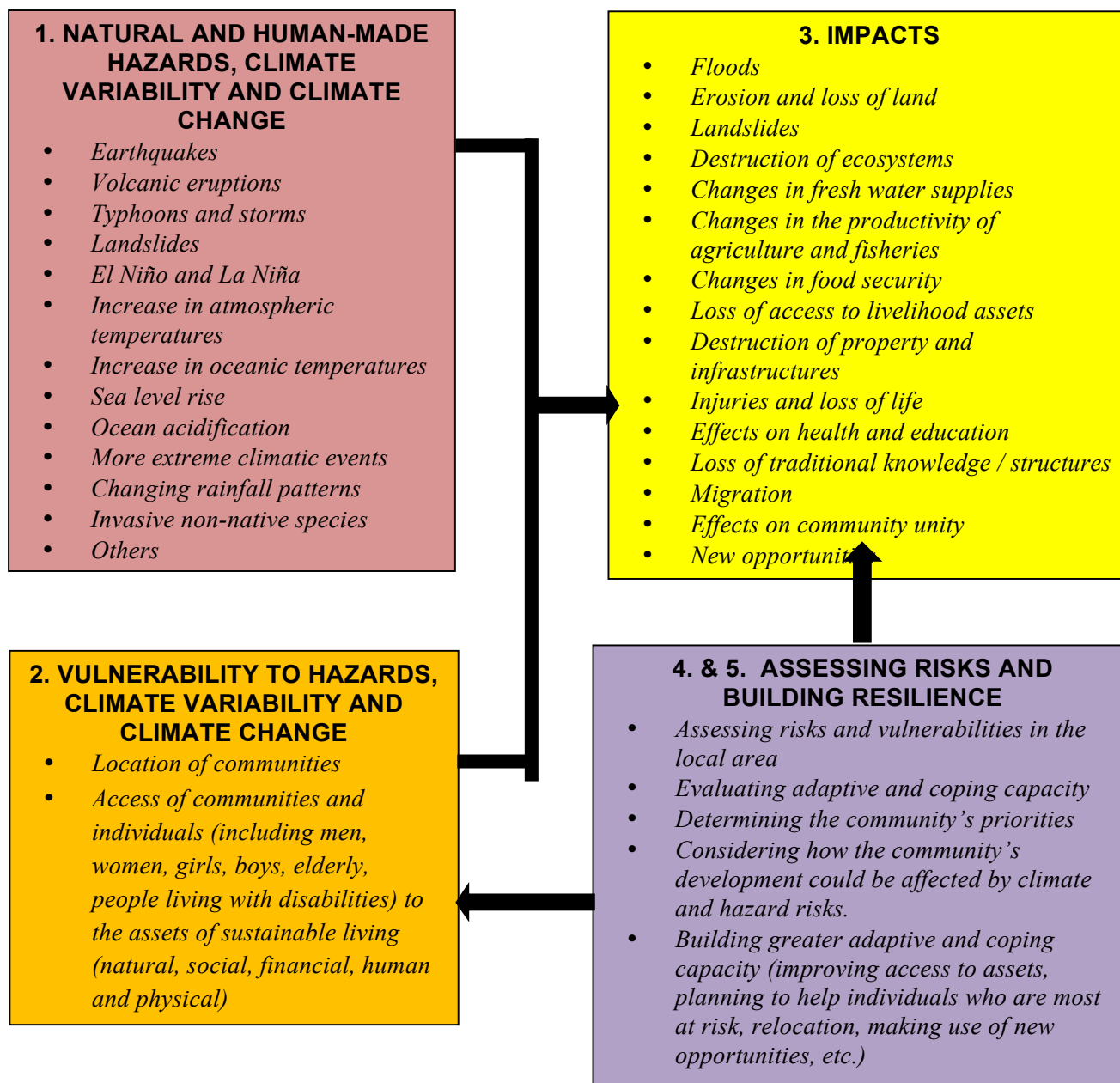
Finally, you will apply your learning to practical work in a local community, determining its priorities for development and working with the community to find out how hazards and climate changes might have impacts on these priorities. You will start to work with the community to encourage it to build up greater resilience to the risks that are expected to occur.

Before you start, it would be helpful for you to review some key definitions. “**Exposure**” refers to the way that people and assets are found in places that can be affected by hazards and climate change. “**Vulnerability**” means the extent to which people, families and communities are likely to suffer from a hazard and climate change because they don't have enough capacity to cope and adapt. “**Resilience**” or “**adaptive capacity**” means the ability to prepare and manage hazards and climate change. “**Impacts**” or risks are ways in which hazards and climate change affect

natural ecosystems and human societies, often causing damage or destruction, but sometimes bringing benefits. Impacts are great when the vulnerability of people and communities is high, and not enough resilience has been developed.

Fig. 1 shows you how the content of this Unit has been organized.

Fig. 1:



Section

1

Demonstrate the exposure of Pacific island countries to hazards, climate

After completing this section, you should be able to:

- 1.1 Identify natural and human-made hazards that affect the Pacific region;
- 1.2 Demonstrate how the Pacific islands are exposed to the effects of climate variability and climate change.

1.1 What are some of the natural and human-made hazards that affect the Pacific region?

Discuss these questions with your facilitator:

- Islands in the western Pacific lie close to the “Ring of Fire”. What natural hazards will therefore occur?
- Why do so many typhoons occur in the western part of the Pacific?
- Why are landslides very frequent in Palau and other Micronesian islands?
- Why are many Pacific islands affected by rising sea levels?
- Why are droughts a big problem in Pacific islands?
- What are some of the invasive species of plant and animals that are affecting Pacific islands? Are these natural or human-made hazards?
- Do most people in the Pacific islands live near the coast? Why does this make them more **exposed** to natural hazards?
- Are many Pacific islands remote from other places? Can they get help very easily when a natural hazard arrives?

Your answers to these questions will help you to understand why the Pacific islands are so exposed to natural and human-made hazards. You can refer to Figs. 2-7 to help you.

Fig. 2: The Pacific Ring of Fire

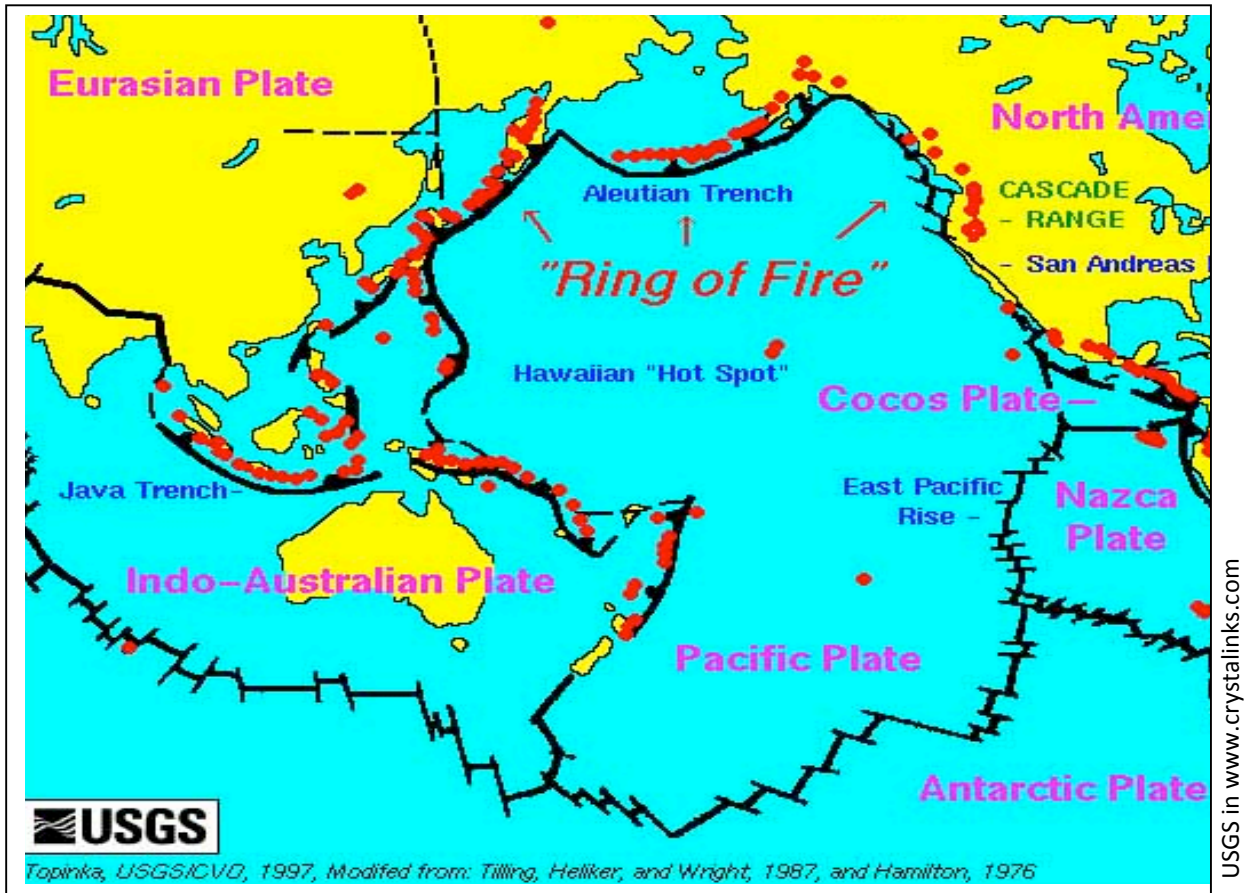


Fig. 3: Cyclone tracks in the Pacific since 1969

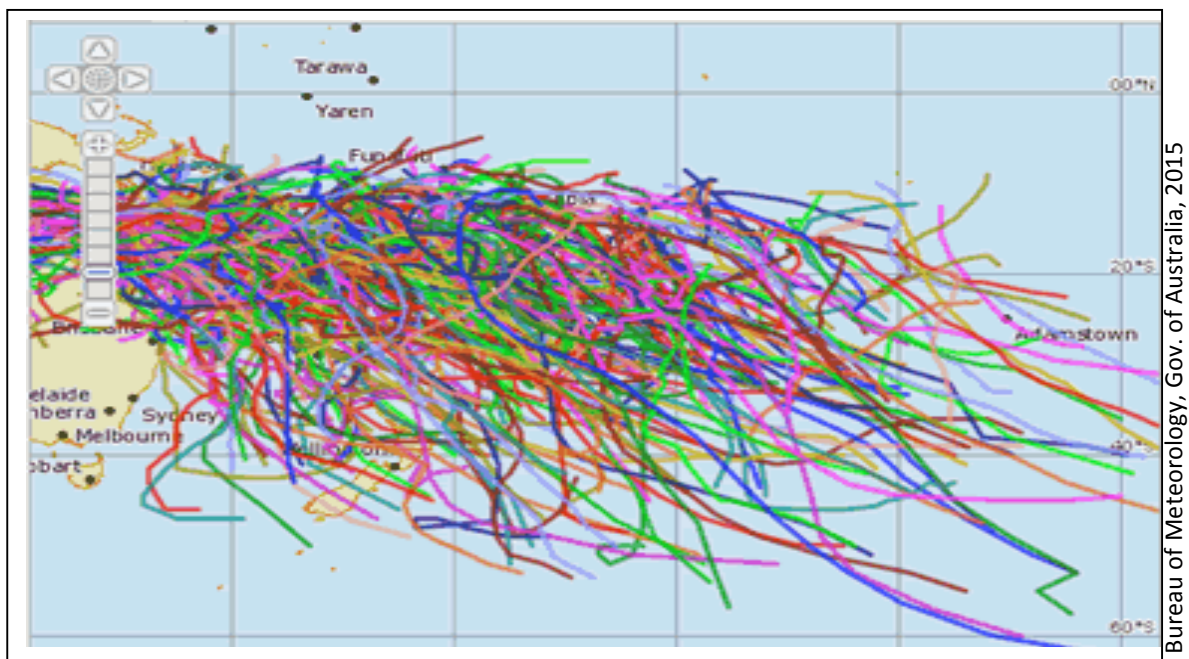


Fig. 4: Tarawa atoll, Kiribati



Carlo Iacovino / SPREP, 2014

Fig. 5: The remote island of Ureparapara, Banks Islands, Vanuatu



Pierce, C., 2013

This island has a sheltered anchorage but no airport and no roads.

Fig. 6: Mile a minute

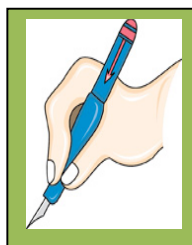


Land Resources Division, SPC, 2010

Fig. 7: Fire ant



DAFF, Queensland Gov., 2013



Now please
complete
Activity 1.1 in
your Learner
Workbook

My Notes:

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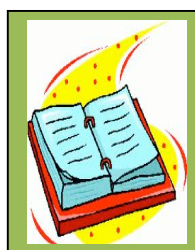
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1.2 How are Pacific islands exposed to the effects of climate variability and climate change?

In previous units, you learned about the difference between climate variability and climate change, and you also found out some of the effects of these changes on the atmosphere and oceans.



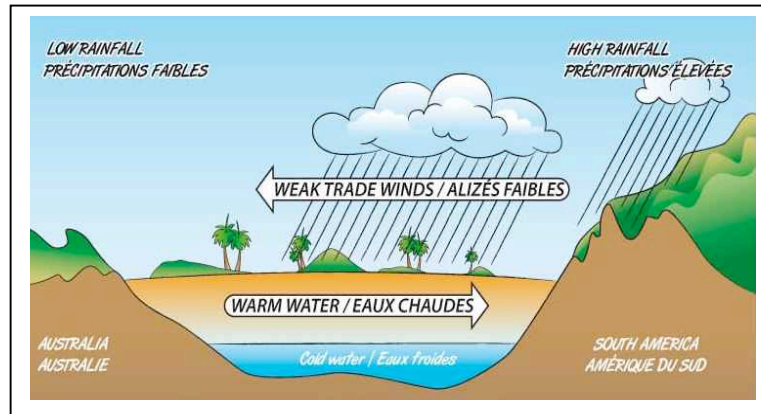
Climate variability means the way that climate **fluctuates** each year above or below a long-term average value. Warm and cold, wet and dry seasons are not the same from one year to the next. An important cause of such variability is when we experience El Niño and La Niña periods.

Climate change refers to a long-term continuous change (increase or decrease) in the climate, or average weather conditions. It can also refer to a long-term change in the **range** of weather (for example, more frequent and severe typhoons). Climate change happens very slowly.

Discuss these questions with your facilitator:

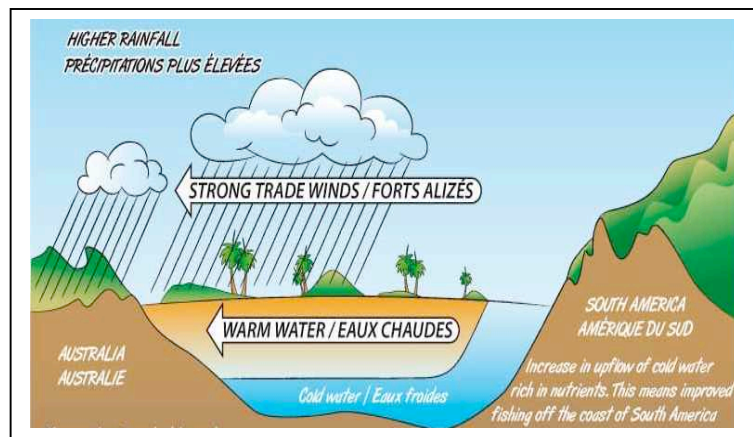
Fig. 8: An El Niño period

- During an El Niño period, what conditions of rainfall and temperature should we expect in the western Pacific islands? What problems might people have to face? Fig. 8 will help you to answer this question.



SPC & GIZ, 2014: A visual guide

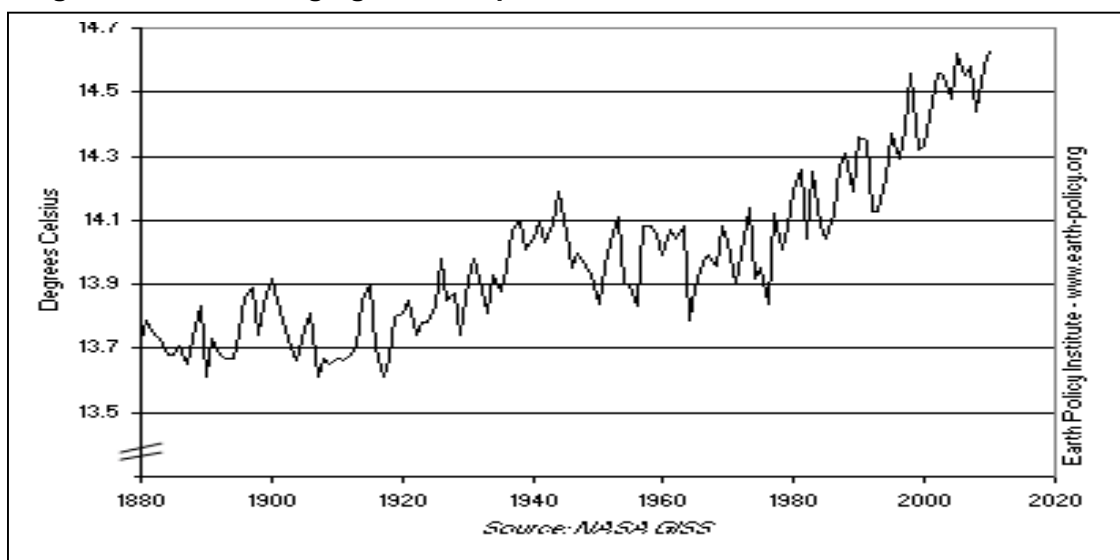
- During a La Niña period, what conditions of rainfall and temperature should we expect in the western Pacific islands? What problems might people have to face? Fig. 9 will help you to answer this question.



SPC & GIZ, 2014: A visual guide

- What has happened to atmospheric temperatures in the last 150 years? See Fig. 10. Why is this trend expected to continue?

Fig. 10: Average global temperature, 1880 to 2010



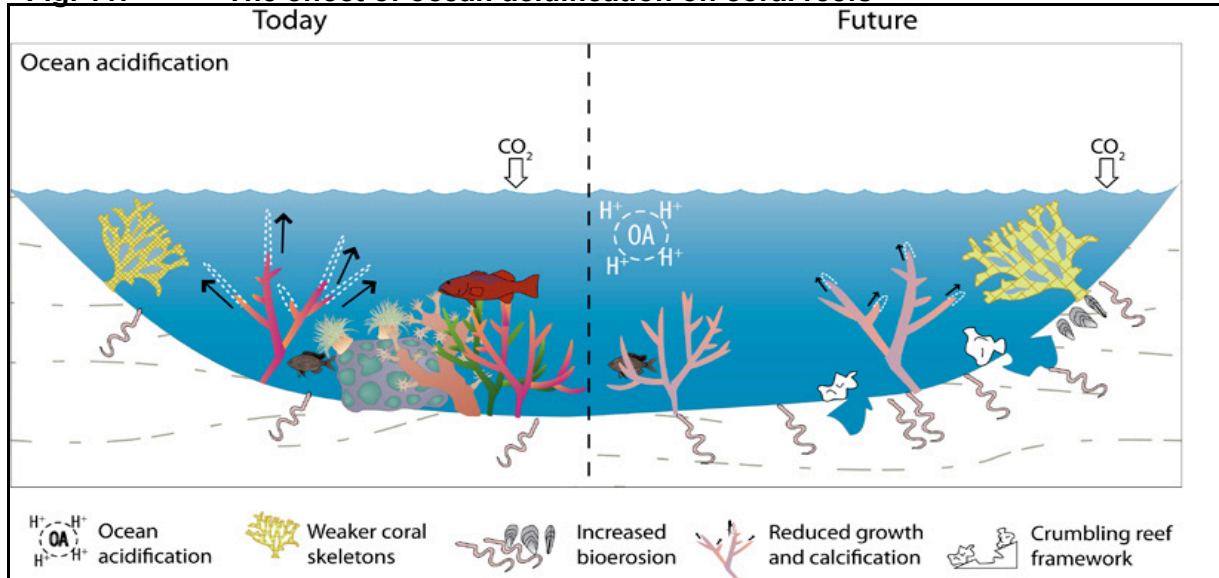
Earth Policy Institute - www.earth-policy.org

Earth Policy Institute, 2011

- What has happened to ocean temperatures over the same period?
- Why does an increase in ocean temperatures cause sea level to rise? Give two reasons. Which of these reasons is more important at present?

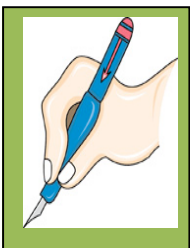
- What effect do warmer ocean temperatures have on coral reefs?
- Why is ocean acidification occurring at present? What effect does this acidification have on coral reefs? See Fig. 11.

Fig. 11: The effect of ocean acidification on coral reefs



SPC, 2011

- In future, scientists say that we will be exposed to more extreme climatic events. What does this mean? Can you give an example?
- Climate change is likely to bring changes in rainfall patterns. For Palau, it is predicted that there will be an increase in wet season rainfall and total annual rainfall, but a decrease in dry season rainfall
- Are Pacific islanders dependent on natural ecosystems for their foods and their livelihoods? Can you give some examples? Does this mean that they will be easily affected by climate change?



Now please complete Activity 1.2 in your Learner Workbook

My Notes:

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Interpret variables affecting a community's

Section 2

After completing this section, you should be able to:

- 2.1 take part in a “power walk” to find out whether everyone in a community is equally affected by hazards and/or climate change, and discuss the learning from this activity;**
- 2.2 define “vulnerability” and “resilience”;**
- 2.3 demonstrate ways in which men, women, boys, girls, the elderly, the sick and people living with disabilities have different vulnerabilities to hazards;**
- 2.4 identify the five main “assets” (“dimensions”) of sustainable living and their effects on vulnerability;**
- 2.5 use a risk map to identify and explain the sectors, the people and the assets of a community that might be more vulnerable to hazards and climate change than others;**
- 2.6 Demonstrate that some communities in Palau are more at risk than others.**

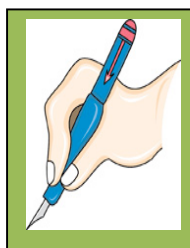
2.1 Is everyone in a community equally affected by hazards and/or climate change?

Is everyone in a community affected by a hazard in the same way?

Is everyone equally affected by changes in climate that have already been observed and changes that are predicted for the future?

Does it matter if you are a man or a woman, a boy or a girl? Will you suffer more if you are an old person, or you are sick, or you are living with a disability?

You are going to find out by doing a practical activity in which you play the parts of different people in a community, and go on a walk.



Please complete
Activity 2.1

My Notes:

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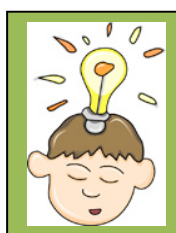
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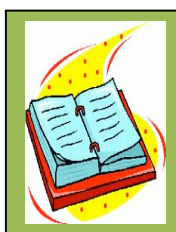
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Concept	I understand this concept	Questions that I would still like to ask
2.1 Effects of hazards and climate change on different people in the community.		

2.2 Definitions



Vulnerability: If a person is vulnerable, he/she is easily hurt, or his or her assets are easily damaged. We can apply this same concept to a community. According to Palau's National Emergency Management Office (NEMO, 2017), vulnerability means the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. In other words, a community is vulnerable to hazards and climate change when it suffers damage from their effects and is unable to recover from them without help from elsewhere.

Resilience, on the other hand, refers to the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions (NEMO 2017). In other words, a community is resilient to hazards and climate change if it has taken steps to prepare for and handle them, and is able to recover from the damage without external help. A resilient community can cope with hazards when they arrive. Resilience is the opposite of vulnerability.

2.3 The vulnerability and resilience of men, women, boys, girls, the elderly, the sick and people with disabilities

Vulnerability and resilience according to gender

Men and women work together to raise their families, produce food, generate income and shape their community. But they often perform different daily activities to meet

these goals. We need to recognize the different roles and needs of men and women, as this helps us to understand their different vulnerability to hazards and climate change.

Here are some examples from the Pacific region:

- In many parts of Palau, it is men rather than women who are involved in commercial agriculture. They face pressures of declining income if their crops are destroyed by typhoons and yields decline because of climate change.
- Traditionally, men in the Micronesian islands clear the bush and large trees to prepare food gardens, but it is the women who look after the crops. Women do the harvesting and are responsible for food preparation.
- In fishing, women are more likely to gather shellfish and do near-shore fishing, while men are the ones who dive on the reef and do offshore fishing. Women often process the fish for home consumption and for sale in local markets, but sometimes the tasks are shared.
- Men and women have different priorities for water use. Men are more likely to want the water for agriculture and livestock production. Women's priorities are for the water to be used in the home, for drinking, cooking and washing. During periods of drought, which may become more frequent as our climate changes, these different **priorities** may lead to conflicts within the home.
- Water-borne diseases affect everyone. But when a community faces an outbreak of disease, such as after a severe typhoon, it is the women who usually look after the sick and the elderly, and who are under more pressure.
- Women often have traditional knowledge about water sources and useful medicinal plants. But in most communities, they are not involved in decision-making, so their knowledge is not put to full use.
- Women and children are the ones who cut and carry firewood and who spend long hours cooking over wood fires. This contributes to health risks from the inhalation of smoke.

Fig. 12: A woman planting taro in Ngetkib, Airai, Babeldaob Island Palau (Kitalong 2012)



Kitalong, A. 2012

- Men may want to use fuel in their fishing boats, while women's priority will be for the fuel to be used for cooking in the home.

- In many Pacific communities, priority is given to the education of boys rather than girls. Traditionally, girls are expected to raise children and do household duties, while boys are to become the **breadwinners** in the family. This situation is changing, especially in the towns, but in general, Pacific women still have less access to information than men. Thus they are often unaware of how to prepare for disasters and climate change, and this makes them more vulnerable.
- Traditionally, men have higher status than women and are the main decision-makers in the community. They have greater access to knowledge, power and resources. Women, on the other hand, tend to look after family care, social relationships, festivities and helping others in the community, especially in times of emergencies and disasters. But they lack equal access to decision-making. This means that communities are missing out on the knowledge, skills and capacities of half of their population! In turn, this makes the whole community more vulnerable to the impacts of future climate change. Using women's skills and capacities will make a community more resilient. (SPC & GIZ, 2013)

After reading the above points, whom do you think are more vulnerable to the difficulties caused by natural hazards and future climate change - men or women?

Vulnerability and resilience according to age and health

Elderly people are more likely to suffer from sicknesses and may have difficulty in moving around. When an earthquake, a tsunami, a landslide, a flood or another rapid-onset hazard arrives, they cannot run to a safe place, and so are very vulnerable. After a typhoon, they are more vulnerable to water-borne and vector-borne diseases such as diarrhea, typhoid, malaria and dengue. If there are extreme temperatures or droughts, they often get dehydrated or suffer from heat stress. In all these ways, they are some of the most vulnerable people in the community in the face of hazards and climate change. But on the other hand, elderly people have experience of previous hazards and disasters, and may possess useful knowledge about how to build up resilience in the community.

Babies and infants are also vulnerable to hazards and climate change. They depend on their parents to carry them to safety, and are easily affected by diseases such as diarrhea, malaria and dengue.

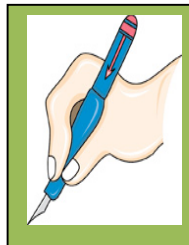
School children are also vulnerable. But they can move quickly and before the arrival of a hazard they can help to promote awareness, distribute warnings, organize evacuations and prepare safe houses.

Sick people are obviously unable to move quickly when a hazard event arrives, particularly if they are weak and confined to their beds.

Those with disabilities are also more vulnerable to hazards and future climate change. They require extra time to move from place to place, and may rely on the support of another person to get to safety. Think about people who are blind, or who lack arms or legs, or who are intellectually handicapped.

On the other hand, some people with disabilities have developed greater sensitivity to natural warning signs (noises, tremors, smells, etc.) that enable them to be aware of an approaching hazard before others.

Healthy people are much more resilient to hazards and climate change. They can think, prepare and move quickly!



Now please
complete
Activities **2.2**
and **2.3**
in your Learner
Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to
2.2 Vulnerability and resilience 2.3 The different vulnerability and resilience to hazards and climate change of men, women, the elderly, babies and infants, sick people and people living with disabilities.		

2.4 The five main assets (dimensions) of sustainable living

In order to find out how vulnerable a community is to hazards and climate change, we can try to assess whether people's livelihoods are sustainable. "**Livelihood**" refers to ways that people manage to meet their basic needs for food, water, shelter, and clothing. A "**sustainable livelihood**" is one that meets basic needs and at the same time can cope with stress and shocks and provide opportunities for the next generation (Chambers and Conway, 1992)

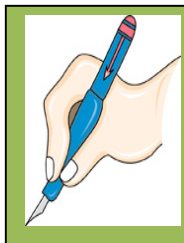
The International Fund for Agricultural Development (IFAD) is an agency of the United Nations that aims to **eradicate** poverty in developing countries, especially in rural areas. According to IFAD, sustainable rural livelihoods are based on the **assets** to which people can have **access** (IFAD, 2014). We can also use the term "dimensions" to describe these assets, because they cover different aspects or dimensions of living.

Assets or dimensions are things like natural ecosystems, technology, skills, knowledge, education, health, social support, and the ability to get credit or loans.

A sustainable community is one that has access to a wide variety of assets. It is less vulnerable and more resilient to the stress and shocks that come through hazards and climate change.

Here is a diagram that shows the five assets that are involved in sustainable living. Discuss this diagram with your facilitator.

Fig. 13: Assets of sustainable living



Now please complete Activities 2.4a and 2.4b in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
2.4 Five assets (dimensions) of sustainable living.		

2.5 Different assets and areas (sectors) of a community have different vulnerabilities to hazards and climate change.

In sections 2.1 and 2.3, you found out that the people in a community all have

different levels of vulnerability and resilience to hazards and future climate change.

In section 2.4, you discovered that the vulnerability of a community to hazards and climate change also depends on the community's access to a variety of assets. The greater the variety of assets accessible to a community, the greater will be their resilience.

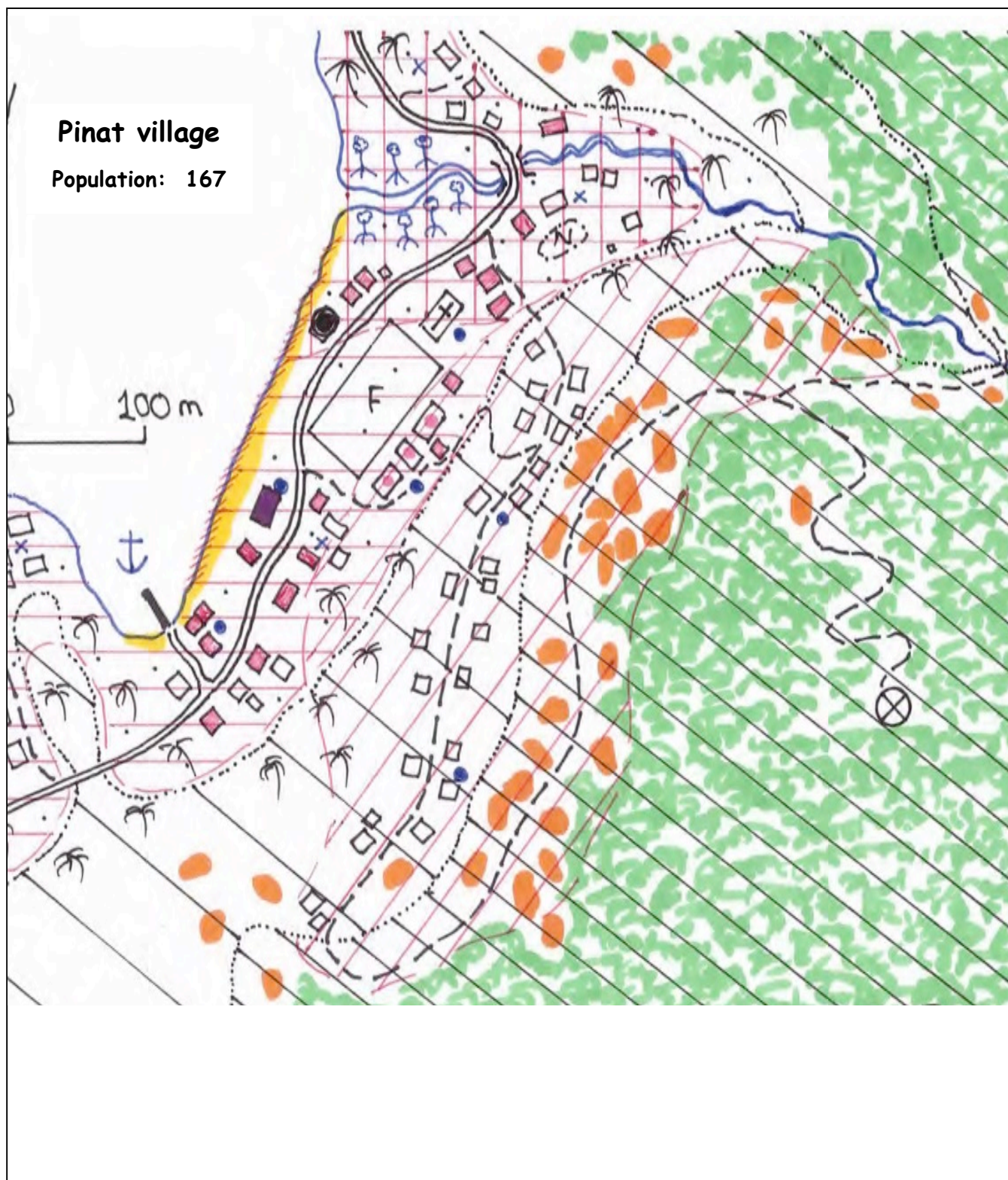
Some of these assets, however, can also be damaged by hazards and climate change, so increasing community vulnerability - natural and physical assets, for example, as well as some of the financial assets. Think of schools, health centers, piped water systems, wharves, bridges, tourist bungalows, ecosystems that support farming and fishing, food gardens, electricity generators, telecommunications towers, bai or traditional community meeting place, stores, religious buildings, community centers, sacred sites, burial grounds, and others.

In addition to the people and the assets of a community, there will be certain areas of the village or town that are at greater risk because of their location - they may be on the coast, or close to a river, or close to a place where landslides might occur.





























To assess the vulnerability of people, assets and sectors, it is important to produce a **risk map** of the community. You have already done this when you participated in the first Unit of competency. You will return to your own map in Sections 4 and 5. For the moment, let us look at an example of how a risk map helps us to assess the different vulnerabilities in a community.

It is suggested that you look again at the example of the risk map of the imaginary village of Pinat that was provided in your Learner Workbook. The map is provided below in Fig. 14, together with a key. Please study the map, and then discuss the questions on the following page with your facilitator and your fellow learners:

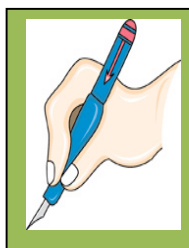
Fig. 14: Risk map of the imaginary village of PINAT



KEY

	Very steep slopes		Well
	Gentle slopes		Wharf
	Flat land		Anchorage
	Beach		Football field
	Building		Digicel tower
	School		Forest
	Church		Food garden
	Dispensary		Coconut plantation
	Cooperative store		Mangroves
	Nakamal		Area in danger of flooding from river
	Road		Area at risk from tsunamis
	Track or footpath		Area at risk from landslides
	River		Houses damaged by 2002 earthquake
	Water tank		Coastal erosion taking place

- How many buildings in Pinat are at risk from flooding from the river?
- Which part of Pinat is at risk from tsunamis?
- How many buildings are in danger of damage from landslides?
- Why do you think that landslides can occur in that area?
- Is coastal erosion taking place? Which community assets could be at risk if sea level rises?
- Which community assets could be damaged by a tsunami?
- Which community assets could be damaged by river flooding?
- Which sector of Pinat is most at risk? Why do you say this?
- Which hazards are likely to affect the community's water supplies?
- How do you think that a severe typhoon would impact on this community? Where should people go to shelter from the typhoon?
- What recommendations would you make to the chief of Pinat for making his village more resilient to hazards and future climate change?



Now please
complete
Activity 2.5
in your Learner
Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
2.5 Areas, people and assets of a community that may be more vulnerable to hazards and climate change than others.		

2.6 Some communities in Palau are more at risk than others

Different communities have different vulnerabilities to hazards and climate change, depending on their location and on their access to the assets of sustainable living. Let us consider some examples:

Location

Some settlements are close to where the hazard event occurs. For example, low lying villages along the coasts and the outer islands will suffer from sea level rise and typhoons, while those living at higher elevations will suffer less. During super typhoon Bopha the low lying villages along the east coast of Babeldaob and in Angaur and Peleliu were impacted greatly. During Super typhoon Haiyan, Kayangel a lowly atoll to the north was greatly impacted.



Fig. 15: House damaged by Super typhoon Bopha (NEMO 2012)



Fig. 16 Kayangel after Super typhoon Haiyan hit in 2013 (NEMO 2013)



Fig. 17:

**Track of
Super
typhoon
Bopha 2012
(CRRF 2012)**



For earthquakes, it is often the underlying rock that is important. Settlements built on raised coral reefs are normally more resilient than those built on sand or sediments near the mouth of a river. Of course, settlements near the coast will be much more vulnerable to coastal erosion, tsunamis and typhoons than those that are inland and higher up.

Physical assets - housing

Some communities have stronger houses built of concrete blocks, with roofs made of corrugated iron. These houses are more resistant to heavy rain, floods, landslides, ash falls and fire, and enable rain water to be harvested. They are resistant to typhoons if the roofing sheets are firmly fixed into the housing frame. So villages with many such stronger houses will be more resilient to these types of hazard. However, concrete and brick buildings are dangerous during earthquakes and can be unpleasantly hot during high temperatures.

On the other hand, traditional houses made of bush materials often more resilient to earthquakes than concrete houses, and are cooler inside. Those that have low roofs which almost reach to ground level can be quite resilient during typhoons (Fig. 18). Disadvantages of traditional houses are that they are prone to fire and easily damaged by landslides, and floods, and rain water harvesting is impossible.

Fig. 18: Traditional meeting house in Palau (Kitalong 2012)



Financial assets - cash

Communities that have many families in which people are earning an income will normally be better able to survive after a major disaster. Families already live in stronger houses and are able to purchase food and quickly pay for repairs to their properties.

Communities in which most people are subsistence farmers with little or no income are at a disadvantage when affected by typhoons, tsunamis, landslides and fires. They must repair their own homes with whatever materials are available in the environment, and wait for new crops to grow in their subsistence gardens. After a severe disaster, such as Super typhoons Bopha and Haiyan, emergency food supplies and tents will be provided by the National Emergency Management Office or by NGOs such as Red Cross, families, friends, and private citizens

Human assets - awareness and preparedness

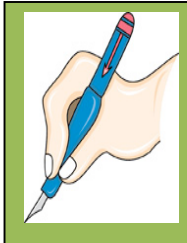
In recent years, the National Emergency Management Office (NEMO), provincial governments, Community Disaster and Climate Change Committees (CDCCCs), and non-government organizations have conducted awareness campaigns in all the islands of Palau to make people more aware of the risks of natural hazards and future climate change, and to help them make suitable preparations that will reduce the dangers of damage and loss. During 2017 NEMO used a Community Based Disaster Risk Reduction Toolkit to reach out to the communities.

Such preparations include the following:

- Identifying **evacuation routes** to safe places
- Building safe shelters for people in the community
- Better storage of drinking water
- Evacuation plans for schools
- **Emergency drills** to practice what to do when a hazard arrives
- Learning techniques of preserving fruit, root crops, fish and meat
- Relocating the village to higher ground
- Planting varieties of crops that are more tolerant of salty water or drought

You will learn more about these preparations in later Units.

Those communities that are aware of the impacts of hazards and have taken measures to reduce the impact of such hazards are going to be much more resilient than those communities that have not made any preparations at all.



Now please
complete
Activity 2.6
in your Learner
Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
2.6 Reasons why different communities in Palau have different vulnerabilities to hazards and climate change.		

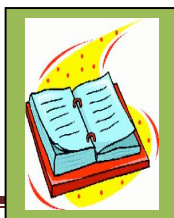
Identify impacts resulting from a community's vulnerability to

Section
3

After completing this section, you should be able to:

- 3.1 demonstrate that the impacts of hazards and climate change on communities and individuals are related to exposure and vulnerability;
- 3.2 identify some of the impacts of hazards and climate change on the natural landscape (floods, erosion, landslides);
- 3.3 identify some of the impacts of hazards and climate change on terrestrial and marine ecosystems;
- 3.4 identify some of the impacts of hazards and climate change on fresh water resources;
- 3.5 identify some of the impacts of hazards and climate change on livelihoods and economic activities such as agriculture, livestock, forestry, fisheries and tourism;
- 3.6 identify some of the impacts of hazards and climate change on property and infrastructures;
- 3.7 identify some of the impacts of hazards and climate change on human life (loss of life, injuries, stress, health and education);
- 3.8 identify some of the impacts of hazards and climate change on other human dimensions (ability to work, migration, traditional knowledge and structures, unity in the community, new opportunities, etc.).
- 3.9 describe examples of these impacts in Palau, making use of appropriate information provided by people in your local area.

3.1 The impacts of hazards and climate change depend on both exposure and vulnerability



Impacts are ways in which hazards and climate change affect natural ecosystems and human societies that are vulnerable. The effects are often **negative**, causing damage or destruction, and can result in an emergency or a disaster. Sometimes, however, the

effect is **positive** or **beneficial**.

Biophysical impacts refer to the effects on the natural environment. **Socio-economic impacts** refer to the effects on people's lives and on ways that they make a living or take part in economic activities. The effects on **food security** and on **sustainable development** are especially important.

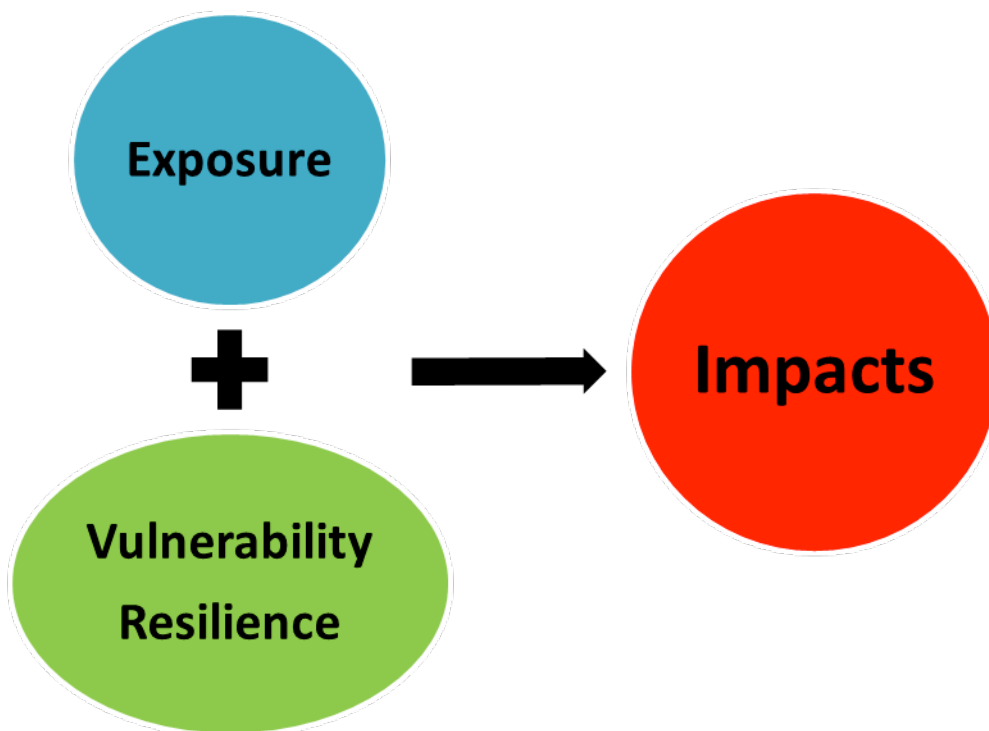
In Section 1, you saw how Palau and other Pacific islands are exposed to many kinds of hazard and the effects of short-term and long-term changes in climate. This is called **EXPOSURE**. In Section 2, you found out that people and communities have different levels of vulnerability to these hazards and climatic changes, depending on their location and their access to the assets of sustainable living - financial, social, natural, physical and human. This is called **VULNERABILITY**.

Now we are going to find out that the impacts of hazards and climate change on people and communities depend on both exposure and vulnerability. If a community has taken steps to strengthen its assets and improve its resilience, then the impact of a hazard can be less, and risks are reduced. Examples are the preparation of evacuation routes and safe houses, tree planting along the shoreline, covering wells, better recognition of women's skills and experience, and greater awareness of risks from tsunamis, landslides and super typhoons.

On the other hand, if individuals and communities take no steps to reduce their vulnerability, then the risks from hazards and climate change will be more severe.

Fig. 19 shows the relationship between exposure, vulnerability/ resilience and impacts

Fig. 19



Pierce, C., 2014

3.2 Impacts of hazards and climate change on the natural

landscape

Floods occur in low-lying areas next to rivers or along a coastline. River flooding takes place during or after storms or periods of heavy rain. Coastal flooding or inundation is caused by high tides, tsunami waves, sea level rise and storm surges during a super typhoon (Figure 20).

Figure 20. A large rubble berm from typhoon Bopha created a small lagoon on the east side of Angaur. Photo taken on 5 Dec 2012, 3 days after typhoon Bopha passed (CRRF 2014).



Erosion: In the Pacific islands, erosion means the removal of soil and rock fragments by rivers, waves and wind. River erosion takes place when heavy rain causes

the volume and speed of rivers to increase, and they erode the land on either side of their channels. Coastal erosion occurs when the shoreline is affected by very high tides, tsunami waves, storm surges and a general rise in sea level. Super typhoons, storm surges and tsunamis can also destroy living coral reefs that protect shorelines from erosion (Fig. 20). People increase their vulnerability to flooding and erosion when they build their homes next to a river, or very close to the shoreline, or in low-lying areas where water does not easily drain away (Fig. 21).

Fig. 21 Ngiwal village on the east coast of Babeldaob after Super Typhoon Bopha



NEMO 2012

Fig. 22. Mangroves removed in Ngetkib, Airai (Kitalong 2017)

Vulnerability is also increased when mangroves are removed (Fig 22), when beach sand and coral is extracted for building houses, and when people clear bush or forest on sloping land.



Landslides result from several causes. In Palau, landslides are common after earthquakes. They may also occur during and after heavy rain during storms and typhoons, when the soil becomes saturated with water and slides down a steep slope. People increase their vulnerability to landslides when they clear the bush for farming on steep slopes, or when they build roads, infrastructures or villages at the base of high ground where the underlying rock is known to be unstable or to break easily (Fig. 23).

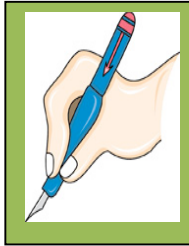
Fig. 23:

Landslide on the National Highway on Babeldaob Island after heavy rains



Kitalong 2010

Climate change is likely to bring greater risks of flooding, erosion and landslides in Palau. Why is this? Could these risks be reduced if individuals and communities take steps to improve their resilience?



Now please
complete
Activities 3.1
and 3.2
in your Learner
Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
3.1 The impacts of hazards and climate change depend upon both exposure and vulnerability.		
3.2 Impacts of hazards and climate change on the natural landscape.		

3.3 Impacts of hazards and climate change on terrestrial and marine ecosystems

Fig. 24 Swamp forest in Babeldaob (Kitalong, A. 2010)

An **ecosystem** is a group of living organisms and non-living elements of the environment that are found together and affect each other. There are **terrestrial ecosystems**, which are found on the land, and **marine ecosystems**, that are found along the coast and in the oceans. Examples of ecosystems are rain forests (Fig 24), secondary forests or bush, food gardens, mangrove swamps, rivers, coral reefs, beaches and grass fields. Each ecosystem has its own group of plants and animals that live together and depend on each other.



So how are terrestrial and marine ecosystems affected by hazards? How are they going to be affected by climate change? Can humans increase the vulnerability of ecosystems to hazards and climate change? Here are some examples:

- The rise in global temperatures and changes in seasonal patterns of temperature and rainfall is going to increase **heat stress** in the plants and animals of terrestrial ecosystems. This may cause native species to die and even become extinct. Non-native species, on the other hand, may like the warmer conditions and invade

forests and gardens. In these ways, **biodiversity** will decrease.

- In marine ecosystems, warmer conditions and stronger typhoons can remove certain species and upset the way that species depend on each other in the food chain or food web. The whole balance of the ecosystem is affected. Climate change is already causing the degradation of coral reefs through ocean acidification and ocean warming
- Extreme weather events can cause the death of plants and the migration of animals, birds and fish to other areas.
- Higher temperatures are likely to make forests more vulnerable to fires.
- Bush fires and typhoons have negative effects on plants in the short-term, but when the plants grow back again, their growth is stronger than before and there is more space for other species to appear.
- Human-made pollution from plastic bags and other litter, waste materials, engine-oil, poisonous gases emitted by vehicles, etc. damage marine and terrestrial ecosystems, particularly reefs, beaches and rivers.
- When individuals and communities build houses and infrastructures along the coastline, this can damage beach, mangrove and reef ecosystems and make them more vulnerable to coastal erosion.
- When rain forest is removed for logging purposes, the secondary forest that grows back again is less resilient to storms and heavy rainfall. When forests are removed for food gardens and commercial agriculture, the natural **nutrient cycle** is disturbed, soils become poorer and can suffer from erosion, and less water is returned to the atmosphere through transpiration.

All these changes to coastal and forest ecosystems are going to affect the lives of village people who depend on them for their food, their building materials and for items that are important in their cultural practices. And they will affect the lives of people living in urban areas, who also consume food that comes from nearby ecosystems.

3.4 Impacts of hazards and climate change on fresh water resources

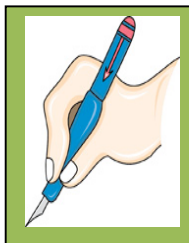
Geological hazards such as earthquakes and volcanic eruptions can affect a community's supplies of fresh water and also cause risks to health. For example, earthquakes can break water pipes in villages and urban areas, and also damage septic tanks. Ash falls from distant volcanic eruptions can produce a haze for days impacting air quality.

Hydro-meteorological hazards such as high temperatures, heavy rainfall, typhoons and droughts have an impact on fresh water resources. Climate change is likely to

make these impacts even greater.

Think about the following impacts of climate change on fresh water resources:

- In the future, Palau is expected to have more days of extreme rain, which will lead to flooding of streams and rivers. In times of flood, wells and other water sources can get contaminated by mud and dirty water if communities do not take steps to cover and protect them.
- There are likely to be more days of extreme heat and long periods of drought. This will increase the rate of evaporation. Streams may dry up, and rivers will have only a little water in them. It will be very easy for the precious water stored in wells and rain water tanks to become contaminated by leaves, human and animal waste and rusty cans. However, communities can increase their resilience to these risks by harvesting rain water by means of corrugated iron roofs and protected water tanks. They can also ensure that all wells are properly covered and introduce other water conservation measures.
- As sea levels rise, salt water can find its way into underground supplies of fresh water that are found near the coast. This is called **salt water intrusion**. Once fresh water has been contaminated by sea water, it takes a long time for it to become pure again.
- Typhoons and storms can also destroy piped water systems and damage storm drains, gutters and septic tanks.



Now please complete Activities 3.3a, 3.3b and 3.4 in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
3.3 Impacts of hazards and climate change on terrestrial and marine ecosystems.		
3.4 Impacts of hazards and climate change on fresh water resources		

3.5 Impacts of hazards and climate change on livelihoods and economic activities

Agriculture, forestry and fisheries

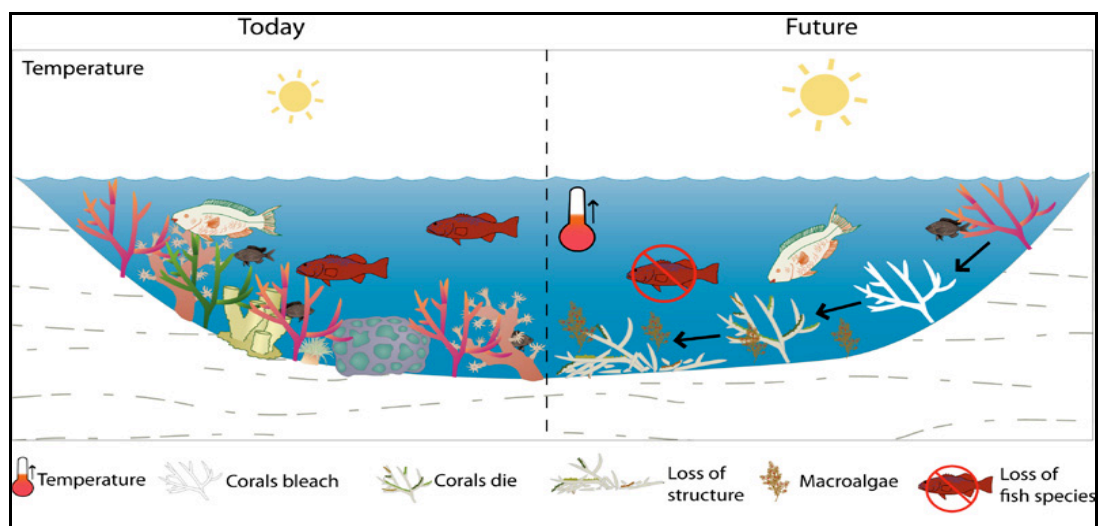
Hazards such as typhoons, droughts and floods have an impact on forests, soils, coral reefs and crops. Climate change is going to affect the health of forests, soils, crops and coastal fisheries, and so impact on food production.

Think about the following:

- Warmer temperatures and changes in rainfall patterns are likely to encourage more invasive species like mile-a-minute, which spreads into forests and gardens, and more pests and diseases, which will affect crops and animals.
- Changes in climate are likely to affect the flowering and fruiting of certain tree species, pollinators and seed dispersers, which will impact on crop production. Yields of root crops such as taro and tapioca are likely to be less.
- Livestock will be stressed by longer periods of drought and warmer temperatures.
- As sea levels rise, forests, cash crops and food crops in coastal areas could be affected by salt water intrusion and by an increase in coastal and river-bank erosion. Floods and droughts may damage forests and re-forestation schemes.
- Fisheries and marine resources are going to be affected as ocean waters get warmer (Fig. 25), more CO₂ is absorbed from the atmosphere into the ocean (Fig. 11), and there are more intense typhoons. Typhoons, tsunamis and storm surges damage wharves, boats and cause injuries and loss of life. More severe storms and typhoons will cause more damage to reefs. Reefs will degrade because of warmer temperatures and greater ocean acidity, also because disease becomes more likely.

Fig. 25:

How warmer ocean waters will impact on coastal fisheries



SPC, 2011

- In general, climate change is likely to result in reduced catches of fish and increasing damage to coral reefs. As ocean acidification increases and coral reefs become degraded, they will no longer be able to function as vital feeding grounds for many fish species. If communities do not take care of their reefs and inshore

fisheries, and continue to pollute and over-fish them, then coastal fishing grounds become even more vulnerable.

- It is possible that increased rainfall and flooding may improve conditions for fresh-water fish, so that the production of fish from rivers and freshwater lakes could increase.
- Scientists think that changes in ocean temperatures, ocean currents and food chains are likely to make species of tuna move further east in the Pacific, leading to reduced tuna stock in the western Pacific and more in around islands in Polynesia.
- Natural forest products such as fruits, nuts and cooking resources such as banana leaves are vulnerable to drought and extreme heat.
- When soils become **waterlogged** through storms or long periods of heavy rainfall, root crops may rot in the ground and cannot be eaten.
- Subsistence food gardens are very vulnerable to typhoons (Fig. 26). Root crops, vegetables and fruit trees are severely damaged or destroyed. Families may not have any food from their gardens for several months, and must depend on rice, noodles, and tinned fish or meat - if they can afford them.

Fig. 26:

**Damage to
Coconut trees
in Kayangel
after Super
Typhoon
Haiyan in 2013**



NEMO 2013

Tourism

In general, hazards and climate change have a **negative effect** on tourism in the Pacific. Tourism brings more money to Palau than all other forms of economic activity, but it is very vulnerable to natural and human-made hazards and to climate change. Those who work in the tourism industry will be affected.

Think about the following:

- How do tourists feel when they experience a severe earthquake during their holiday?
- What happens to the number of overseas tourists when a typhoon passes through Palau? Why?

- How do tourists feel when they come to Palau and there are long periods of heavy rainfall?
- Many visitors come to Palau to dive on our coral reefs. What is going to happen to reefs as ocean temperatures rise and oceans become more acidic? How will this affect tourism?
- Where are most of Palau's hotels situated? How will they be affected by tsunamis, sea level rise and coastal erosion? By building hotels and resorts right on the coast does this increase vulnerability to hazards and climate change?



Fig. 27: Large trees fallen from combination of storms and erosion in Koror State Rock Island Southern Lagoon



Kitalong, A., 2017

- What happens to the beautiful white sand beaches after a typhoon or a tsunami (Figure 27)?
- Should mangrove forests along our coasts be cleared to make room for tourist developments? Will this increase our vulnerability to hazards and climate change?

3.6 Impacts of hazards and climate change on property and infrastructures

Floods, typhoons, earthquakes, tsunamis, fires, landslides, coastal erosion and sea level rise can damage our buildings and infrastructures such as roads, airports, schools, hospitals, wharves, sea walls and bridges. Vulnerability to destruction depends on the location of the buildings or infrastructures, on the materials used for construction, and on their design. Look at the picture (Fig. 28) below:

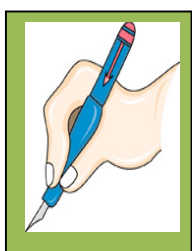
Fig. 28:
Destruction
in
Kayangel
Elementary
School
after Super
Typhoon
Haiyan
2013



NEMO, 2013

Traditional buildings made local materials are easily damaged by storms, strong winds, landslides, floods and fire, but may be more resistant to earthquakes than buildings made from concrete and steel. Also, the traditional design of houses in many parts of Palau may be more **resilient** to typhoons).

So do you think that people can reduce the vulnerability of their buildings and infrastructures to the risks brought by hazards and climate change? In what ways?



Now please
complete
Activities 3.5
and 3.6
in your Learner
Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
3.5 Impacts of hazards and climate change on livelihoods and economic activities.		
3.6 Impacts of hazards and climate change on property and infrastructures.		

3.7 Impacts of hazards and climate change on human life

Injuries and loss of life

During emergency and disaster events, communities often face loss of life and people with severe injuries. Fortunately during Super typhoon Haiyan and Bopha there were no fatalities. Here are some global examples:

- When Cyclone Uma hit Efate and the islands of TAFEA province during the night of 7th February 1987, 55 people lost their lives. (NDCC, 1987)
- The Aitape tsunami of 17th July 1998 that affected the north coast of Papua New Guinea resulted in between 1,600 and 2,200 deaths. (Davies, H. et al, 1998)
- The Tohoku earthquake and tsunami waves that affected the east coast of Japan on 11th March 2011 resulted in 15,828 known deaths. (Japan Talk, 2011)
- Flooding of the Yangtze and Yellow Rivers in China during 1831 resulted in a death toll of between 1,000,000 and 4,000,000 people. (CBC, 2010)
- 280,000 people were killed by the Indian Ocean tsunami of 26th December 2004. (BBC, 2005)
- An earthquake in Haiti on 12th January 2010 killed over 220,000 people and injured at least 330,000. (World Vision Australia, 2010)
- A heat wave in Europe during 2003 caused approximately 70,000 deaths. (Science Direct, 2008)

Health

As well as injuries, emergency and disaster events will affect people's health. Some suffer from fear and stress during the event itself. Many continue to face mental and emotional stress after the hazard has passed, because of the loss of loved ones, destruction of homes, evacuation to temporary shelters, lack of food and water, and worries about the loss of livelihoods.

Physical illnesses are common after the disaster event has passed. There may be outbreaks of diseases like typhoid and diarrhea, which are spread by contaminated water and open **sewage**. A further problem may be malnutrition, since local, healthier foods such as root crops, vegetables and fruits may have been destroyed. Diseases such as TB spread rapidly when people are crowded together in temporary shelters without

adequate food, and the mosquitoes that breed rapidly in stagnant pools that remain after floods and storms can give rise to cases of malaria and dengue fever.

Climate change is likely to have negative effects on people's health. Some examples:

- Very hot days can affect the health of very young, elderly and sick people, who become dehydrated and easily exhausted.
- As temperatures get warmer, outbreaks of infectious diseases carried by insects, parasites, viruses and water are likely to increase. There will be more cases of water-borne diseases such as diarrhea and typhoid. **Vector-borne diseases** such as malaria and dengue are likely to increase as warmer, wetter conditions favor mosquito-breeding sites.
- Warmer ocean waters are likely to favor more cases of ciguatera poisoning. This is an illness caused by eating reef fish that carry **toxins** which have come from coral and algae. Such toxins may increase as the water gets warmer.

As with other impacts, these dangers can be reduced if people heed warnings and prepare properly for the onset of hazards. For example, families who store emergency food and fresh water before a typhoon arrives are generally more resilient than those who take no precautions at all.

Education

Disasters events such as typhoons can have a big effect on education, when classrooms are damaged and schools are forced to close. Figure 31 shows the destroyed elementary school in Kayangel after Super Typhoon Haiyan hit in 2013. In Palau, typhoons, heavy rain and drought also impact on the production of cash crops, particularly taro and tapioca and coconut. This affects the ability of families to pay school fees and send their children to school. Often the Government must step in and pay the fees that parents are unable to meet. In major disasters such as Super typhoon Haiyan, the National Government must allocate funds for assistance to the suffering and for the reconstruction of roads and buildings, and this means that less money may be available for education.



Climate change will make these impacts worse. Think about the following:

- Warmer temperatures and more extreme weather events will increase the impacts of droughts, storms, typhoons, landslides and floods. There will be more damage to buildings and infrastructures, and less money will be available for the education sector.
- More and more students will be absent from school when there is damage to school buildings and families lose their homes and their livelihoods. In general, girls will be affected more than boys, since parents traditionally favor the education of boys rather than girls.
- If children are malnourished because of lack of healthy food, they will not perform well in school.

- There is evidence that warmer temperatures affect the concentration of children and teachers in the classroom, leading to poor performance in school.

3.8 Impacts of hazards and climate change on other human dimensions

Here are some questions for you to think about and discuss with your facilitator:

- How is a person's ability to work affected by hazards such as typhoon, earthquakes, droughts, periods of heavy rainfall, and extreme temperatures? Are people who work in towns affected? Are subsistence farmers affected?
- What happens to family life if people are forced to leave their homes after a disaster?
- As our climate gets warmer, with more extreme weather events, will this make more people move from rural to urban areas? Why? And what will be some of the consequences?
- Are graveyards and sacred sites in coastal areas going to be affected by sea level rise (Figure 29)?

Fig. 29 Cultural site in Kayangel destroyed by Super Typhoon Haiyan

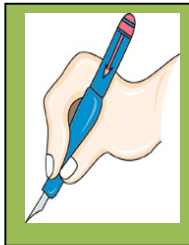


NEMO, 2013

- In Palau, there are certain plants, animals and “stones” that are important in custom. Taro is used in traditional marriage and death ceremonies. As our climate changes, some of these plants and animals will disappear. Will traditional knowledge and cultural practices be affected?
- Will climate change have an impact on community structures? Will there be more conflict over natural resources? Will this lead to a break-down of the

unity that exists in many rural communities? Or will it make people care more for each other and make their communities even more unified?

- Do you think that any new opportunities may arise because of climate change? Can the production of certain crops be increased because of the warmer temperatures? Are there any other ways in which people might benefit?



Now please complete Activities 3.7, 3.8a and 3.8b in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
3.7 Impacts of hazards and climate change on human life (injuries, loss of life, stress, health and education).		
3.8 Impacts of hazards and climate change on other human dimensions (ability to work, migration, traditional knowledge and structures, unity in the community, new opportunities)		

3.9 Examples of the impacts of hazards and climate change in Palau

Now you are going to find your own examples of ways in which hazards and climate change are having an impact on people and the environment in Palau, and examples of how greater resilience to these risks might be built.

We have looked at these impacts under seven headings:

- Impacts on the natural landscape
- Impacts on terrestrial and marine ecosystems
- Impacts on fresh water resources
- Impacts on people's livelihoods and economic activities
- Impacts on property and infrastructures
- Impacts on human life
- Impacts on other human dimensions

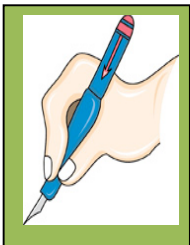
You are going to work in small groups to find out examples of these impacts and then present your findings to the rest of the class. You may wish to leave the classroom and talk to various people in the local community to do your research. For example, you might find it useful to talk to elderly people, teachers, nurses, youth, fishermen, farmers, and both males and females.

This photograph (Figure 30) shows the impacts of Super Typhoon Haiyan on Kayangel

Fig. 30: Kayangel after Super Typhoon Haiyan hit in 2013



NEMO 2013



Now please
complete
Activity 3.9
in your Learner
Workbook

My Notes:

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Marc Hénon, 2015



Concept	I understand this concept	Questions that I would still like to ask
Actual examples of impacts of hazards and climate change on the local community, on one particular island, or in other parts of Palau		

Section

4

Evaluate a local community's vulnerability to hazards and climate change

After completing this section, you should be able to:

- 4.1 conduct a SWOT analysis of a local community's assets of sustainable living ;
- 4.2 use the findings to assess the community's "adaptive and coping capacity".

4.1 SWOT analysis of the assets of a local community

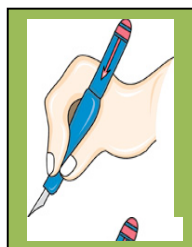
One way of finding about the ability of a community to adapt to climate change and to reduce its vulnerability to disaster risks, is to do a **SWOT analysis** of its dimensions of sustainable living. This means finding out about the community's assets and looking at them in terms of the strengths (S) and weaknesses (W) of the community, the opportunities (O) that exist, and the threats (T) to these assets.

Please look at this example of a SWOT analysis for the imaginary village of PINAT:

Dimension of sustainable living	Which assets are strengths?	What are the weaknesses?	What are the opportunities for improvement or development?	What are the threats (things we feel we cannot influence)
NATURAL ecosystems, biodiversity, trees, plants, atmosphere, sea, reefs, fish, land, water, wildlife, etc.	<ul style="list-style-type: none"> • River • Sandy beach • Wildlife in bush • Mangroves • Good sources of fresh water • Coconuts • Food gardens • Fishing grounds 	<ul style="list-style-type: none"> • Food gardens are on steep slopes • People don't respect taboos on fishing • Cutting down of mangroves • Pollution 	<ul style="list-style-type: none"> • Replanting of mangroves • Better enforcement of fishing taboos 	<ul style="list-style-type: none"> • Food supplies may be affected by droughts and extreme rainfall events • River floods • Beach erosion • Landslides • Sea level rise
PHYSICAL	<ul style="list-style-type: none"> • School 	<ul style="list-style-type: none"> • Bridge is collapsing 	<ul style="list-style-type: none"> • Protection of 	<ul style="list-style-type: none"> • Buildings on

housing, infrastructures, buildings, water supply, energy supply, sanitation, communications, transport, etc.	buildings provide safe shelter • Strong wharf • Dispensary • Digicel tower • Good road • Football field • Mobile phones	• Most houses are of bush materials • Wells and tanks not protected • Buildings in flood zone	wells and tanks • Reconstruction of bridge • Tourist facilities could be developed	coast affected by erosion • Church and dispensary in danger from river flood • Damage from earthquakes
HUMAN health, education, skills, knowledge, ability to work, coping with disability, etc.	<u>Community</u> • All children in primary school • Dispensary <u>Men</u> Skills in farming and fishing <u>Women</u> Skills in farming and housework	• Secondary sch. far away • Many cases of malaria • Many elderly people • 7 men and 14 women have disabilities • Adult illiteracy	• Women's group interested in learning about solar fruit drying	• Further outbreaks of vector-borne diseases such as malaria
SOCIAL tradition, customs, status, religion, extended family, relationships, service to others, leadership, etc.	<u>Community</u> • Tradition still strong <u>Men</u> • Village council <u>Women</u> • Mother's Union	<u>Community</u> • Religious conflict • Weak council <u>Men</u> • Too much kava <u>Women</u> • No part in decision-making	<u>Community</u> • New youth program encourages service to others	<u>Community</u> • Out-migration <u>Men</u> • Land disputes <u>Women</u> • Lack of empowerment
FINANCIAL pigs, mats, other livestock, cash, etc.	• Traditional wealth • Cash from copra	• Low copra price • Only one small business • Few telephones	• Small business initiatives for women	• Falling copra prices • Livestock / crops affected by CC

Now find the risk map of your local community that you produced in CGHR0116, and use this as a basis for doing a similar SWOT analysis of that community. Note that you can complete the information for natural and physical dimensions by using the information you have already recorded on your map. When you collect information on human, social and financial dimensions you will have to talk to people in the community, and it is important to distinguish between the responses for women and those for men.



Please complete Activity 4.1 in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
4.1 SWOT analysis of the dimensions of sustainable living in a community		

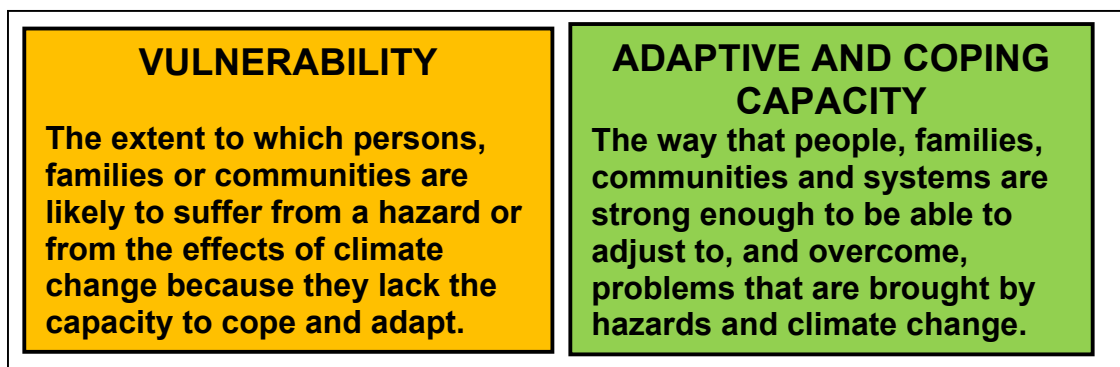
4.2 Evaluating a community's adaptive and coping capacity

Adaptive capacity is similar to resilience. According to the Intergovernmental Panel on Climate Change, it means “the ability of a system to adjust to climate change, to moderate (reduce) possible damages, to take advantage of opportunities, or **to cope with** consequences.” (IPCC, 2001). Adaptive capacity is based on the ability of individuals, households and communities to have access to the five dimensions of sustainable living - human, social, physical, natural and financial (Care International, 2009).

Coping capacity is normally used when considering disasters. It means the ability to face and manage difficult conditions, emergencies or disasters (UNISDR, 2009)

A simple way of looking at adaptive and coping capacity is that it is the opposite of vulnerability (Fig. 31).

Fig. 31



Pierce, C., 2014

The SWOT analysis also helps us to understand the adaptive and coping capacity of a community to the impacts of hazards and climate change. By looking at the strengths and opportunities, we can see whether a community is going to be able to adapt to warmer temperatures, more frequent extreme weather events, and stronger typhoons.

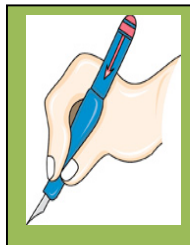
For the moment, we can try to make a simple evaluation of a community's adaptive and coping capacity by referring to the five groups of assets that are involved in sustainable living.

Look back at the SWOT analysis of Pinat village (p. 53). Study the five groups of assets that are shown. Also think about these questions:

- Do the people in this community have economic assets?
- Do many people have access to finance?
- Does the community have access to technology, e.g. warning systems, new varieties of crops, mobile telephones?
- Is the population mostly **literate**, with easy access to information about hazards and climate change?

- Are the **infrastructures** strong? Think of the houses, roads, bridges, water supply systems.
- Does the community have strong institutions (government, village council, etc.) that can make quick decisions, are efficient and transparent, and act in the best interests of all sections of the population?
- Is there **equity**? Do all elements of the population (males and females, rich and poor, educated and uneducated) have equal opportunities and equal access to resources?

So what do you think of Pinat village's capacity to adapt to climate change and to cope with hazards? Low? Medium? High?



Now please complete Activities **4.2a** and **4.2b** in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
4.2 Evaluation of a community's adaptive and coping capacity.		

Section 5

Apply knowledge to help a community become more aware of its vulnerability to

After completing this section, you should be able to:

- 5.1 determine the priorities of a local community for improving its way of living;**
- 5.2 work with a local community to identify the hazards and changes in climate that might affect these priorities;**
- 5.3 provide assistance to a community to help it develop more resilience to hazards and climate change.**

5.1 Priorities for sustaining and improving a community's way of living

Imagine that you ask this question to the people of Pinat village: "In what ways do you think that your community's way of life could be improved?"

They might give you these answers:

- "Stop all the young people leaving the village."
- "Have other sources of income, so that we don't just depend on copra."
- "Have better access to secondary schooling."
- "Fix up all our land disputes."
- "Make our food gardens more productive."
- "Get rid of malaria and make our population healthier."
- "Ensure that there are always plenty of fish available."
- "Have stronger houses."

You might then ask them to think about ways in which hazards and climate change might prevent them from achieving these goals. For example, climate change is likely to make food gardens less productive, because of higher temperatures, droughts, and heavy rainfall events.

Now think about the local community with whom you have been working. To help the people understand the risks they face from hazards and climate change, you are firstly going to try and identify the improvements they would most like to see in their village. In other words, what are their **priorities**? Remember that women may have different views to men, and that old people may have different opinions to the younger ones.

5.2 How hazards and climate change may affect a community's priorities

After finding out the community's priorities for sustaining and improving their assets for sustainable living, you can now help them see how hazards and climate change could impact on their hopes and their goals. Hopefully, this will enable them to consider the steps that can be taken to reduce the effects of these risks.

Here are the steps to follow as you work with your community:

1. List the hazards and the projected climate changes that would impact on the community and its environment.
2. Discuss how these hazards and changes in climate would impact on the environment. These are called the **biophysical impacts**
3. Discuss how the biophysical impacts will affect the community's priorities. These are called the **socio-economic impacts**. They may be different for men and for women, for different age groups and for those in the community who are the most vulnerable.
4. Indicate whether they are short-term or long-term impacts, and evaluate the level of risk.

Here is an example of how your findings could be tabulated. This table is for the whole community. You could also have separate tables for priorities identified by men/boys, women/ girls, people living with disabilities.

Priorities of the whole community	Hazards that could impact	Changes in climate that could impact	Bio-physical impacts	Socio-economic impacts	ST/ LT	Level of risk
1. Improve food security	Drought Typhoons Heavy rain Tsunamis	Warmer temperatures. More extremes.	Floods Sea level rise Erosion Warmer seas	Less food. Fewer fish. Less income.	ST LT LT	High High Medium Medium
2. Get rid of malaria	Typhoons Heavy rain Sea level rise	Warmer temperatures. More extremes	Floods Wet soils	More breeding sites for mosquitoes	LT	Medium
3. Stop rural-urban migration	Typhoons Earthquakes Landslides Tsunamis Drought	Warmer temperatures. More extremes.	Damage to ecosystems Sea level rise Ocean acidification	Damage to food and cash crops. No other sources of income.	ST LT	High Medium

5.3 Building adaptive and coping capacity

When you meet with individuals and families in your community, you can start encouraging them to think more deeply about how they can build up their adaptive

and coping capacity. You have already studied about adaptation and will study more about traditional adaptation methods in the next Unit. You can therefore offer some practical suggestions. Also, there may already be some awareness in the community of steps that can be taken. However, it will be useful to talk about some of these issues now.

Here are some questions that you can ask when you are meeting with people in your community. Discuss these questions first with your facilitator and see whether there are any others that you might wish to add.

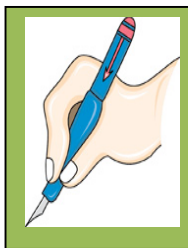
- Which livelihood assets can be improved, and how? For example, could local taboos be placed on reefs to help rebuild stocks of fish and shellfish?
- Does everyone have access to livelihood assets in the community?
- Can plans be made to help those individuals who are most at risk?
- Should the village, or some buildings in the village, be relocated? If so, where?
- Should future plans be made for the development of the community that take hazards and climate

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make these plans?

Please complete
Activities 5.1,
5.2 and 5.3 in
your Learner
Workbook

My Notes:

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Concepts	I understand this concept	Questions that I would still like to ask
5.1 Community priorities for sustaining and improving its way of living.		
5.2 How hazards and projected climate change can impact on community priorities.		
5.3 Plans for building greater adaptive and coping capacity in the community		

Glossary

Access	Ability to obtain something.
Adaptive capacity	Ability to adjust to climate change, to moderate (reduce) possible damages, to take advantage of opportunities, and to cope with consequences.
Assets	Things of value to a person, a community or an organization; community assets include schools, water supply systems, ecosystems that support farming and fishing, technology, education, health, social support, etc.
Biodiversity	Variety of animal and plant species in the world or in a particular habitat; a high level of variety is usually considered desirable.
Biophysical impact	How hazards and climate change have an effect on the natural environment.
Breadwinner	Person who earns the money for the family.
Climate change	Long term continuous change in the climate or in the range of weather (e.g. more extreme events), measured over several decades, hundreds of years or millennia, and supported by statistical evidence.
Climate change projection	An estimation of future climate that comes from the study of models and the use of computers to calculate mathematical equations.
Cope with	To be able to face and manage difficult conditions, emergencies or disasters.
Degradation	When the environment, or an ecosystem, loses its quality, or is spoilt.
Dimension	An aspect or a feature of something
Ecosystem	A group of living organisms and non-living elements of the environment that are found together and affect each other.
Emergency drill	An occasion when people practice what they should do in a dangerous situation such as an earthquake, a fire, a tsunami or a typhoon.
Equity	Quality of being fair-minded; an appreciation of what everyone should have, no matter who they are.
Eradicate	Destroy completely, or put an end to something
Evacuation route	Path, track or road that people can follow to take them away from a place that is likely to suffer damage from a typhoon, tsunami, earthquake or other fast-onset hazard.
Exposure	When people and assets (natural, physical, economic, social, human and financial) are present in places that can be affected by hazards.

Fluctuation	A variation, or an up and down movement, or an alternation between increase and decrease.
Food security	When all people at all times have access to sufficient, safe, nutritious food that enables them to maintain a healthy and active life.
Geological hazard	Hazard originating under the earth's surface, caused by plate tectonics and the release of magma from underground.
Hazard	A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Heat stress	Worry, discomfort or difficulty caused by high temperatures
Hydro-meteorological hazard	Hazard caused by weather and water systems - typhoon, storm, depression, intense rainfall event, flood, erosion, strong winds, drought.
Impact	How something affects or causes a change in something else; how hazards and climate change affect natural ecosystems and human societies, often causing damage or destruction, but sometimes bringing benefits.
Infrastructures	Buildings, roads, communications, power supplies, etc. that are needed for a society or a business to operate
Literate	Able to read and write.
Livelihood	Ways in which a person obtains or meets his/her basic needs in life - food, water, shelter, clothing etc.
Marine ecosystem	An ecosystem that is found in the ocean or along the coast; examples are mangrove swamp, coral reef, beach, open ocean.
Negative effect or impact	An impact that causes damage, harm or distress.
Nutrient cycle	Way that minerals, elements and compounds move round and round between the soil, plants and other organisms in an ecosystem; for example, a tree takes up iron from the soil through its roots, and then the iron becomes part of the tree's leaves; when leaves decay and fall to the ground, the iron is returned to the soil.
Ocean acidification	Increase in the acidity of the oceans, caused when sea water absorbs the extra carbon dioxide produced by human populations.
Open sewage	Human waste that flows over the ground surface.
Positive impact	An impact that brings something constructive, useful or beneficial.
Priorities	Things that are considered to be the most important, to be done or considered first.

Resilience	Ability of a person, household or community to cope with hazards, to prepare for hazards and climate change, and to recover from disasters that occur.
Resilient	Able to cope with, and recover from, injury, stress or damage.
Risk map	Map that shows the areas of an island or a community that are in danger from hazards such as typhoons, earthquakes, sea level rise, coastal erosion, floods.
Salt water intrusion	When salt water from the ocean finds its way into underground supplies of fresh water that are found near the coast.
Sewage	Human waste that normally travels along pipes to septic tanks or sewage tanks.
Socio-economic impact	How hazards and climate change have an effect on people's lives and on ways in which they make a living or take part in human activities.
Sustainable development	Using natural resources without spoiling the ability of future generations to meet their own needs; economic development that takes place without using up natural resources.
Sustainable livelihood	Ways in which a person or a community is able to meet their basic needs for food, water, shelter, etc., and at the same time can cope with stress and shocks and provide opportunities for the next generation.
SWOT analysis	Finding out the strengths of, weaknesses of, opportunities for, and threats to a community or an organization.
Terrestrial ecosystem	An ecosystem that is found on the land; examples are rain forest, secondary forest, food garden, freshwater stream, river, lake, football field.
Vector-borne disease	Infection or illness that is transmitted between people by being carried by insects such as mosquitoes, ticks, bugs and flies.
Vulnerability	The extent to which persons, families or communities are likely to suffer from a hazard or from the effects of climate change because they lack the capacity to cope and adapt.
Vulnerable	Easily hurt, affected or damaged.
Waterlogged soil	Soil in which all the tiny air spaces between the particles are full of water.

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Illustrations

Fig. number	Source
Cover	National Emergency Management Office 2012
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