VQA Level: 1

Learner Guide

Certificate I in Climate Change and Disaster Risk Reduction

Unit 1: CGHR0116

Demonstrate knowledge of hazard risks

Table of contents

Cover photo: Mt Garet, Gaua, Vanuatu.

(VMGD, 2011)

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Ministry of Education & Training
Government of Vanuatu

Vanuatu Ministry of Education and Training

PMB 9028
Port-Vila Vanuatu

Phone : (678) 22309
E-mail: education@vanuatu.gov.vu

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Introduction

This Learner Guide supports the unit of competency CGHR0116 *(Demonstrate knowledge of risks resulting from hazards and disasters in Vanuatu),* which specifies knowledge, skills and attitudes associated with learning about common natural hazards at a national and local level in Vanuatu. The unit is the first in a series of eleven units that comprise a training programme on climate change and disaster risk reduction at Certificate Level 1.

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-centred activities and assessment tools to foster learning of key concepts and skills. The competencies developed are in line with the key competencies promoted by VQA 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 first unit, CGHR0116, defines the standard required to: identify the most common hazards found in Vanuatu; illustrate how a hazard can become a disaster; distinguish between different types of hazard; identify community responsibility for the reduction of disaster risks; and identify hazard risks in a local community.

The development of all units was guided by consultations with government and non-government stakeholders in Vanuatu and was based on the SPC's Community Education Training Centre draft training unit *Community Based Disaster Risk Management and Climate Change* (SPC/GIZ/USP, 2013). The units have been produced with technical and financial assistance from SPC-EU Pac TVET and the SPC/GIZ's *Coping with Climate Change in the Pacific Island Region* (CCCPIR) programme. The University of the South Pacific's Pacific Centre for Environment and Sustainable Development (USP PACE SD) contributed to its technical review. The curriculum writer is Charles Pierce.

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 knowledge of hazard risks		
	VQA Level: 1	Credits: 6

The full unit standard will be handed 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 1 listed below. Please write in the names of all the units of competency that you are currently doing:

Title	VQA Level	Credits
Certificate I in Climate Change and Disaster Risk Reduction	1 & 2	46
……..	…	…
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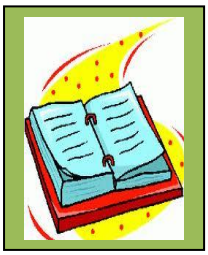
You will also be handed a Learner Workbook. This Learner Workbook should be used in conjunction with this Learner Guide. The Learner Workbook contains the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed as part of your Portfolio 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.

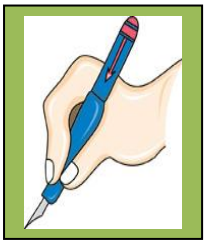
Enjoy this learning experience!

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	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 • ***Initiate and carry out research into types of hazards, their effects on humans and the environment, and the community response.***
Communication	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 • ***Present information both visually (using hand-drawn illustrations and technology) and verbally to individuals and groups on community responsibilities for reducing disaster risks and responding to the impact of climate change.*** • ***Use basic mapping skills such as direction, scale, key, etc.***
Teamwork	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 • ***Cooperate in a small group to produce a description and hazard map of a community, identifying areas, assets and people at risk.***
Information & Communication Technology	Having a range of basic IT skills • applying IT as a management tool • using IT to organise data • being willing to learn new IT skills • having the occupational health and safety knowledge to apply technology • having the appropriate physical capacity • ***Use the internet, phones, email, social media to access information on hazards and disasters, including photographs.***
Problem solving	Developing creative, innovative solutions • developing practical 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 • ***Analyse features of a village to determine areas that are at risk from natural and man-made hazards***

Self-management	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 • ***Reflect on knowledge and understanding of disasters and community life in the local area.***
Planning	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 • ***Plan the collection of information from a community in order to determine areas at risk from natural and human-made hazards.***
Learning (gaining new skills and knowledge)	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 • ***Participate willingly in group discussions to share knowledge, and engage in planning to use new knowledge and skills within communities to assist them to better prepare for, and manage, disaster risks.***
GESI (Gender Equity and Social Inclusion)	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 • ***Ensure that discussions and field surveys in the communities are inclusive of both male and female perspectives on disasters and disaster risk management.***

What am I going to learn?

Section 1: Identify the most common hazards found in Vanuatu

Section 2: Illustrate how a hazard can become a disaster

Section 3: Distinguish between different types of hazard

Section 4: Identify community responsibility for reducing disaster risks

Section 5: Identify hazard risks in a local community

What do I need to know?

Before you start this unit, you should:

- be able to read, write and handle numbers
- have knowledge and experience of natural hazards in Vanuatu
- have first-hand knowledge of a local village or neighbourhood
- have basic mapping skills - scale, direction, use of key, etc.

What are my learning outcomes?

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

- describe and give examples of common natural hazards found in Vanuatu;
- explain how and why a hazard can become a disaster;
- distinguish between hydro-meteorological, geological, biological, other natural and human-made hazards;
- take responsibility for the reduction of risks from disasters and climate change;
- identify hazard risks in a specific local community.

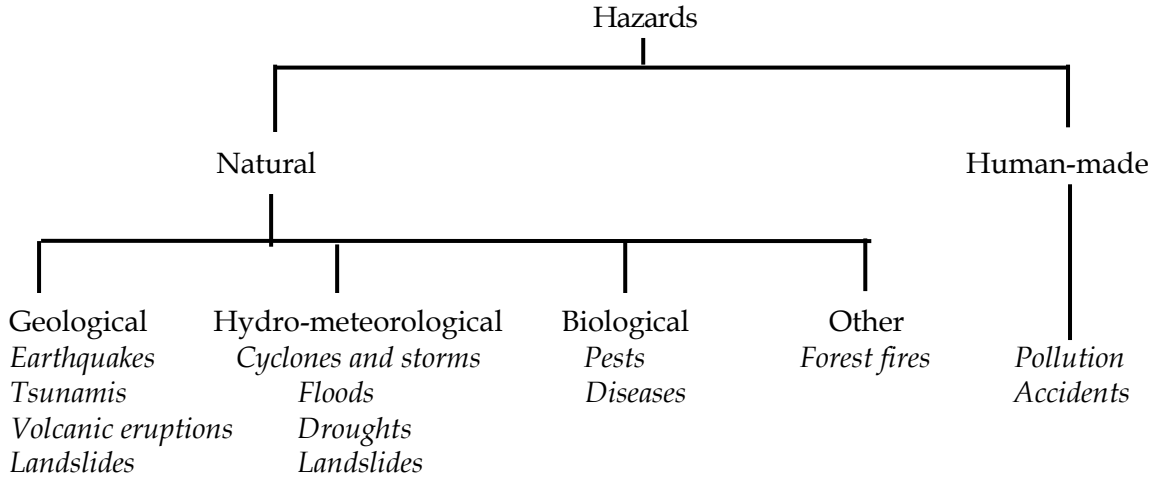
Introduction to the Unit

You are about to start on the first Unit of the Certificate I course on Climate Change and Disaster Risk Reduction. In this Unit, you are going to find out more about the natural hazards that affect Vanuatu and other parts of the Pacific region, and how they bring dangers or risks to people and the environment.

A "hazard" is a situation that gives a threat or danger to people, property, infrastructures, services and/or the environment. It may or may not end up as a disaster.

Some of these hazards result from movements inside the earth that produce earthquakes, volcanoes and tsunamis. We call these "geological hazards". Other hazard events are due to changes in weather and climate that result in storms, heavy rainfall, strong winds, periods of drought, flooding, high temperatures, landslides, etc. We call these "hydro-meteorological hazards". There are also biological hazards such as pests and diseases, other hazards such as natural fires, and human-made hazards such as pollution.

This diagram will help you to understand the different types of hazard:



In this Unit, you will learn about the difference between a hazard, an emergency and a disaster. For example, a "disaster" is a situation in which the level of destruction and injury in a community is so severe that the community is unable to cope or recover using its own resources. Can you think of any recent disasters that happened in Vanuatu? An "emergency", on the other hand, is an event that is tragic and/or destructive, but can be managed by the community itself, using its own resources.

You will also learn that actions can be taken to help a community to reduce the dangers or risks of disasters, and that you have a role to play in this. You are a student in a technical institution or rural training centre, and you should have good knowledge of your local community and environment. You can help reduce the harmful effects of natural hazards that would otherwise result in disasters, and you can strengthen your community's capacity to adapt to future hazards and to the effects of our changing climate.

Section 1 Identify the most common hazards found in Vanuatu

After completing this section, you should be able to:

1.1 give an actual example (date, name, location) of at least five hazard or disaster events in the local area or in Vanuatu;

1.2 for each hazard or disaster listed, explain some of its effects (long- and short-term impacts);

1.3 describe the response to the event by individuals, communities and the government.

1.1 Hazard or disaster events in the local area or in Vanuatu

Think about these questions:

- Has your community experienced a natural hazard, emergency or disaster in the last few years?
- What about you yourself?
- What were the effects of the hazard/emergency/disaster on different groups of people, their dwellings, roads, electricity supply, water supply, health care services, communications, transport, education, stores, food gardens, livestock and fishing grounds?
- When the disaster happened, what did people do? Were they frightened? Did they try to hide? What else happened?
- Were there different responses by different groups of people (e.g. women, men, children, elderly, poor, wealthy?)
- What steps were taken to recover from the disaster?
- Were any measures taken to reduce the risk of injuries and damage from hazards of this kind in the future?

Then read the following account (Fig. 1) of a recent natural disaster on the island of Santo that took place in March 2014.

Fig. 1

LANDSLIDE TRAGEDY CLAIMS FIVE LIVES

Flooding and landslides caused by Cyclone Lusi in the villages of Ukoro and Puarante in South Santo on 11th March has claimed the lives of two mothers, two girls and a three-year old boy. Two more people are still missing and believed to be buried by the landslide. Six more are injured and receiving medical treatment.

Kensley Mica, who was part of the Search and Rescue (SAR) team to Puarante said that the village had a total of 13 households. Of these, nine responded to the call to evacuate and move to higher ground before the incident.

But members of four households remained in the village.

As a result of the landslide, 19 houses, one Aid Post, two hot-air driers, one nakamal, and all livestock disappeared. The village was completely destroyed.

Daily Post understands that a team of officers from Luganville police, the VMF, Save the Children Fund, World Vision, the Environment Unit and Sanma Province have moved to the area to help locate and bury the victims' bodies.

Searching for bodies in Puarante. All houses have been destroyed.

Adapted from *Daily Post*, 18 March 2014

Now please complete Activity **1.1** and **1.2** in your Learner Workbook

My Notes

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Concept	I understand this concept	Questions that I would still like to ask
1.1 Hazard and disaster events 1.2 Short-term and long-term effects of hazard and disaster events. 1.3 Responses to disaster events		

My Notes …

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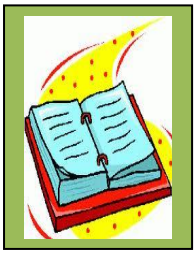
Section 2 Illustrate how a hazard can become a disaster

After completing this section, you should be able to:

2.1 define natural hazard, emergency and disaster;

2.2 give examples to explain how a natural hazard can become a disaster.

2.1 Definitions



According to Vanuatu's National Disaster Management Office (NDMO), a **natural hazard** is something natural that may cause disruption or damage to life, property and/or the environment. Floods, tropical cyclones, periods of drought, landslides, earthquakes, tsunamis, volcanic eruptions, fires caused by lightning and coastal erosion are all natural hazards. A hazard does not always end up as a disaster.

On the other hand, a **disaster** occurs when a hazard strikes a community and its impacts are greater than the community's ability to respond and get back to normal. In a disaster, a community does not have enough resources to cope with the destruction caused, and needs help from outside agencies such as the provincial or national government, or NGOs such as Red Cross, or from overseas aid donors.

A **disaster risk** refers to impacts on life, property and the environment that could happen if a hazard strikes a community.

Losses and difficulties that a community is able to handle using its own resources are called **emergencies.**

Now look at Fig. 2 and Fig. 3 below. For each photograph, say whether it shows a natural hazard, a disaster or an emergency.

DFAT, Gov. of Australia, 2014

Fig. 2:

Vanuatu Red Cross Society CEO, Jacqueline de Gaillande, and Australian High Commission First Secretary, David Momcilovic, with food supplies for communities in Santo and other islands affected by Cyclone Lusi.

Fig. 3:

Looking for sources of fresh water during a period of drought in West Tanna.

SPC/GIZ CCCPIR, 2014

2.2 How does a natural hazard become a disaster?

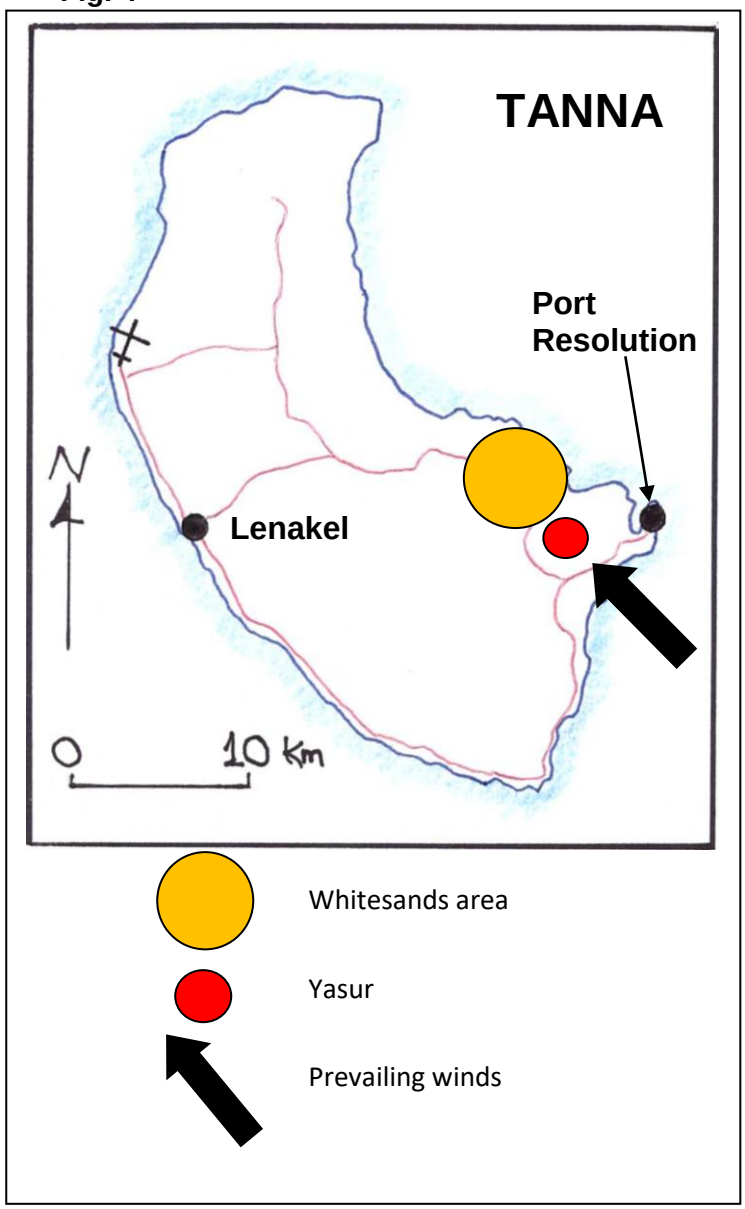
Natural hazards such as heavy rainfall, seasonal periods of drought and earthquakes are common throughout Vanuatu. For thousands of years, people have learned to live with them and cope with their impacts. It is only when people are unable to cope with a hazard, and need outside help, that it becomes a disaster.

The magnitude, or size, of a disaster depends on three things:

- The strength, or **intensity**, of the hazard.
- The **exposure** of the community to the hazard, for example, for how long the hazard occurs, or whether the community is in a place that is close to the hazard.
- The **vulnerability** of the community. This means the extent to which the community cannot cope with the impacts of the hazard.

Let's consider an actual example (Fig. 4). Eruptions from Yasur volcano on Tanna take place every few minutes. When the eruptions become more severe, with more volcanic dust thrown out, villages in the Whitesands area are exposed to the falling dust and to acid rain. This is because the prevailing winds from the south-east carry the dust and acid rain to the north-west. People living in Port Resolution are not affected. We can say that villages in Whitesands are more exposed to the hazard. They are also more vulnerable because when the acid rain falls on their gardens, their food supplies are destroyed and they need help. The dust also falls on to roofs, and may cause them to break.

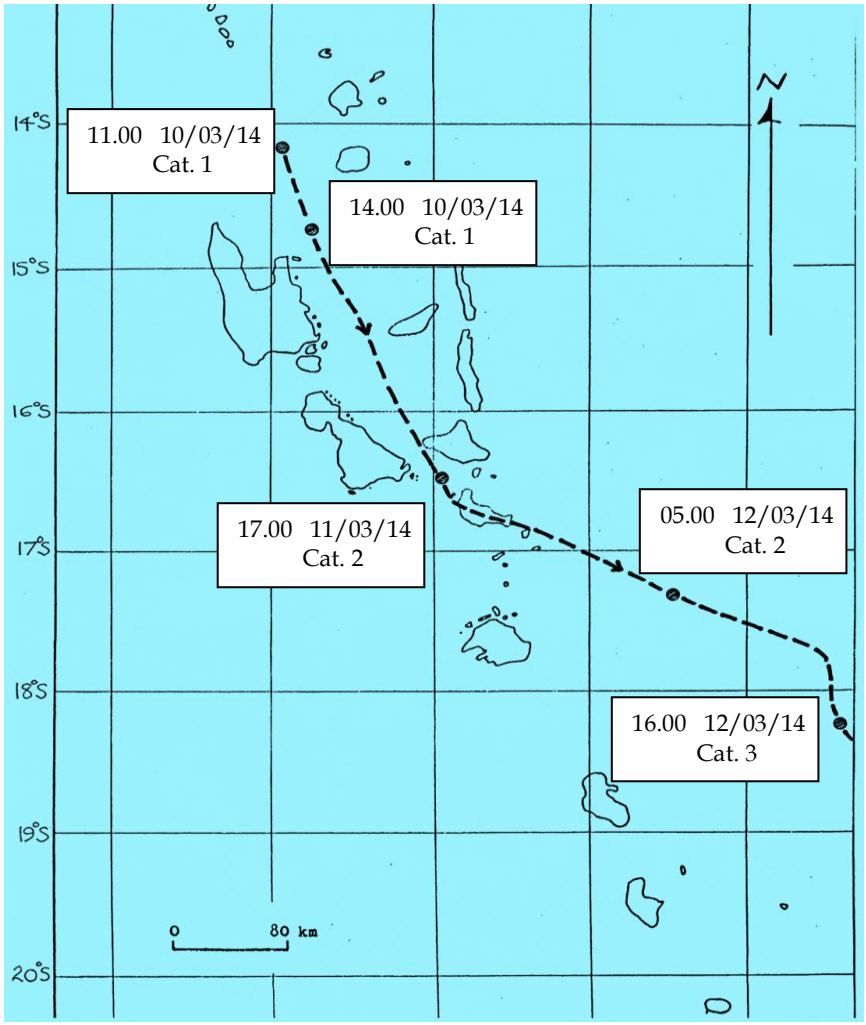
Fig. 4



In this way, communities in Whitesands face a disaster, while communities in other parts of Tanna do not.

Try and think of another disaster, like cyclone Lusi (Fig. 5). This cyclone affected Vanuatu between 10th and 12th March 2014.

Fig. 5: Track of cyclone Lusi through Vanuatu between 10-12th March 2014



Which parts of Vanuatu were most exposed to this cyclone? Why were some communities more vulnerable than others? (Think about the kind of housing and how people obtain their food.) Were some members of each vulnerable community affected more than others? Why?

Now please complete Activities **2.1** and **2.2** in your Learner Workbook

My Notes

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Concept	I understand this concept	Questions that I would still like to ask
2.1 Natural hazards and disasters. 2.2 How a natural hazard becomes a disaster. Three factors affecting the magnitude of a disaster		

My Notes …

Section 3 Distinguish between different types of hazard

After completing this section, you should be able to:

3.1 state how hazards can be either natural or human-made;
3.2 define and give examples of hydro-meteorological hazards in Vanuatu;
3.3 define and give examples of geological hazards in Vanuatu;
3.4 define and give examples of biological and other natural hazards in the Pacific;
3.5 give some examples of human-made hazards in the Pacific.

3.1 Natural and human-made hazards

In sections 1 and 2, you heard about natural hazards such as tropical cyclones, volcanic eruptions, earthquakes and fires. But hazards can also be caused by humans, and can lead to human-made disasters. Look at these two examples of fires, and say whether the disasters result from natural or human-made hazards:

80 trading 24, 2010

Fig. 6:

Bushfire in Central Queensland, Australia, December 2010, caused by strong winds and very high summer temperatures.

Chang W. Lee / The New York Times

Fig. 7:

Fire and collapse of the twin towers of the World Trade Centre in New York after the terrorist attacks of 11th September 2001.

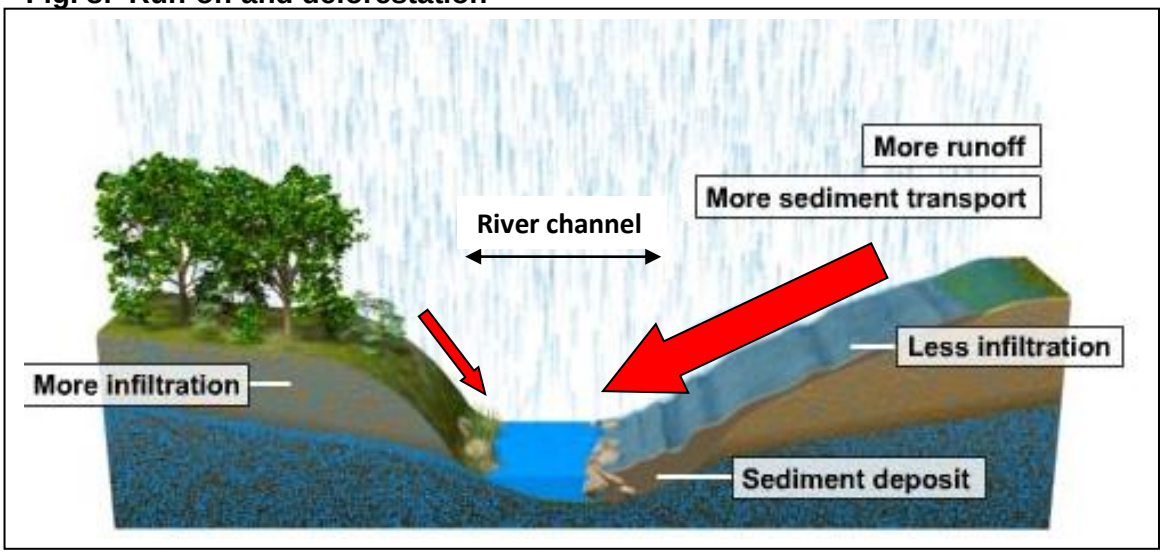
3.2 Hydro-meteorological hazards

Hydro-meteorological hazards are caused by weather and water systems (oceans, rivers and lakes), and include the following: cyclones, storms, depressions, intense rainfall events, floods, **coastal inundations**, erosion, landslides, strong winds and droughts. Hydro-meteorological hazards can result in too much water, which leads to flooding, erosion and landslides. Or they result in not enough water, which leads to drought. Climate change, which is leading to a warmer atmosphere, is likely to affect how often we get these weather-related hazards, and how severe they are.

River flooding

After heavy rain in the middle of an island, rivers increase in speed and volume, and they overflow their channels on to the land on either side. River flooding can bring long-term benefits to the low-lying land next to the rivers, since the floods deposit mud and other sediment which can improve soil fertility. However, the short-term impacts of flooding are mostly destructive, because people may drown or lose their homes and possessions, and animals may perish. The dangers of flooding and soil erosion increase when people cut down the forests on hillsides, so that the rain water does not infiltrate, or go into, the ground below. It simply runs off down the slopes, picks up loose soil on the way, and quickly increases the volume of the river.

Fig. 8: Run-off and deforestation



The Comet Programme, 2010, Pierce, C., 2014

Look at Fig. 8 above, and answer these questions with the help of your trainer:

- What do the big arrows show?
- What are the three ways in which rain water gets into the river?
- Why is there less run-off on the left-hand side of the diagram?
- What has happened to the river channel on the right-hand side of the diagram?

Coastal inundations and coastal erosion

Today, most people in Vanuatu live close to the coasts of their islands, where the land is lower and flatter. Therefore, they are more vulnerable to any form of coastal change, including king tides, ocean currents, sea-level rise, storm surges, tsunamis - all of which can lead to an increase in coastal inundations and erosion. The problem is made worse when people build houses right on the shoreline, when mangroves are removed, or when beach sand and coral are extracted in order to build houses. Climate change makes these problems worse as it leads to warmer sea-surface and air temperatures. The warmer the water, the more it expands in volume, so causing sea level rise. Sea level rise is also caused by the melting of ice sheets in polar regions.

Sea levels and beaches around the world are always changing, for these reasons:

- Each day, there are two high tides and two low tides, caused by the pull of the moon on the earth's oceans.
- There are El Niño and La Niña seasons in the Pacific. During an El Niño period, sea-levels can rise by up to 20-30 cm (ABM and CSIRO, 2011).

Fig. 9:

Low tide on Efate

Pierce, C., 2010

- Long term changes or **inter-annual** changes in atmospheric temperature will cause expansion of the ocean water (when it is warmer) and contraction of the ocean water (when it is cooler). This leads to higher and lower sea levels.
- Due to plate tectonics, land masses can rise or sink. If an island is sinking, the sea level on all sides of the island appears to rise. If an island is being uplifted, as is the case with many islands in Vanuatu, the sea level appears to fall.

Fig. 10:

The different levels of land on Lelepa Island, North Efate, represented coral reefs that have been uplifted during the past. The oldest raised reef is at the top.

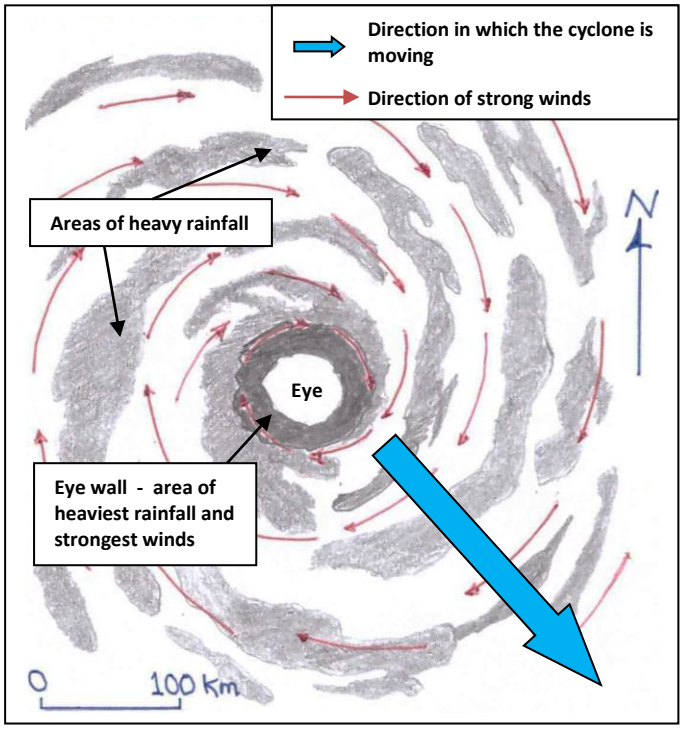
Pierce, C., 2007

- There are seasonal changes in ocean currents, waves, wind and rain, and this can cause sandy shores to change.
- Extreme waves caused by storms or tsunamis change sea levels for a short time and have big effects on shorelines.
- Coral reefs around tropical Pacific islands protect the beaches, and dead coral fragments make up most of the sand on these beaches. If reef systems die or change, for example in a severe cyclone, this affects the supply of coral sediment to the beaches, and also affects the way in which the reef blocks wave energy (SPC/GIZ, 2013).

Tropical cyclones

These are centres of **low atmospheric pressure** that may form over the oceans when sea temperatures rise over 27° C. Air is drawn into the area of low pressure and starts rising upwards. More air is drawn in, and the winds start **spiraling** around this low pressure centre, picking up more moisture from the sea. In the southern hemisphere, winds spiral in a clockwise direction. Around the centre, or **"eye"** of the cyclone, the **water vapour** in the rising air condenses to give dense cloud and heavy rainfall. Now the low pressure centre starts to move, generally in a southerly direction. As long as it remains over the warm ocean, there is always energy to feed the system.

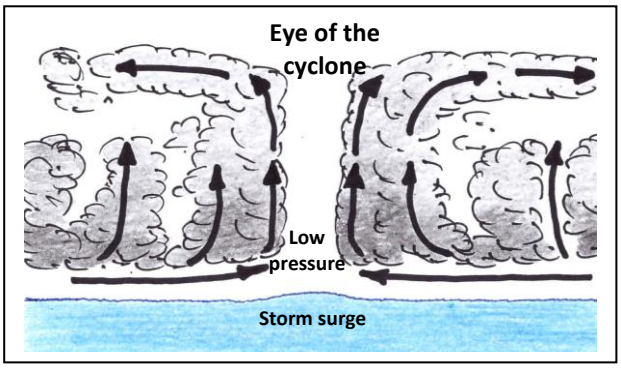
Fig. 11: Map of a tropical cyclone in the southern hemisphere



Pierce, C., 2014

The amount of water in the system builds up, and wind and rain become stronger. The system becomes a tropical cyclone. Under the eye, the level of the sea rises up to give a **"storm surge"**. The strong winds, heavy rainfall and storm surge can bring great damage to islands in the path, or **"track"** of the cyclone.

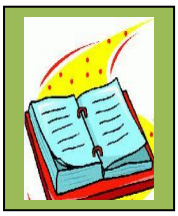
Fig. 12: Cross-section through a tropical cyclone



Pierce, C., 2014

Tropical cyclones are divided into categories, with category 1 being the least severe and category 5 the most dangerous.

When the tropical cyclone moves over land or cooler water, there is not enough energy to feed the system and the cyclone dies away.



Before we leave the topic of tropical cyclones, discuss with your trainer the meaning of the following words:

low atmospheric pressure
spiraling
water vapour
eye
storm surge
cyclone track

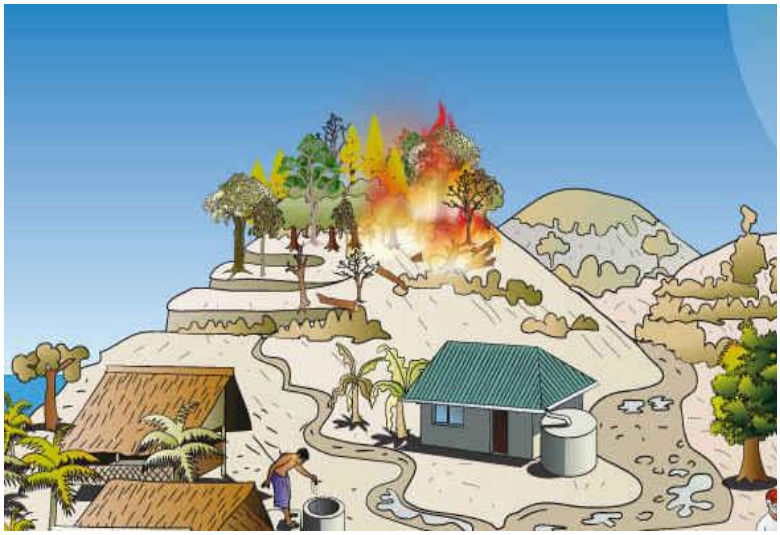
Drought

A drought is a long period with no rain, during a time when rain is expected. When there is a drought, less water is stored under the ground. There is not enough water for drinking, sanitation or watering the plants. A drought does not happen suddenly, but emerges gradually over time. Early warnings are not always issued.

The consequences of a long drought vary from place to place. Crops always suffer, leading to food shortages that continue after the drought has ended. On small islands, there will be a lack of fresh drinking water, and the fresh water can turn **brackish**. On larger islands, there may be bush fires. With climate change, it is expected that there will be more and longer periods of drought in Vanuatu, because the rainfall is likely to come in short severe events rather than being spread throughout the year. Higher temperatures will also result in greater evaporation of water from the soil and from vegetation.

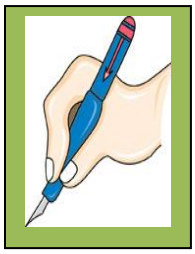
Fig. 13:

Picture of drought in a Pacific island.



SPC & GIZ , *A visual guide*, 2014

Vanuatu's worst drought on record was in 1993.



Now please complete Activities **3.1, 3.2a** and **3.2b** in your Learner Workbook

My Notes:

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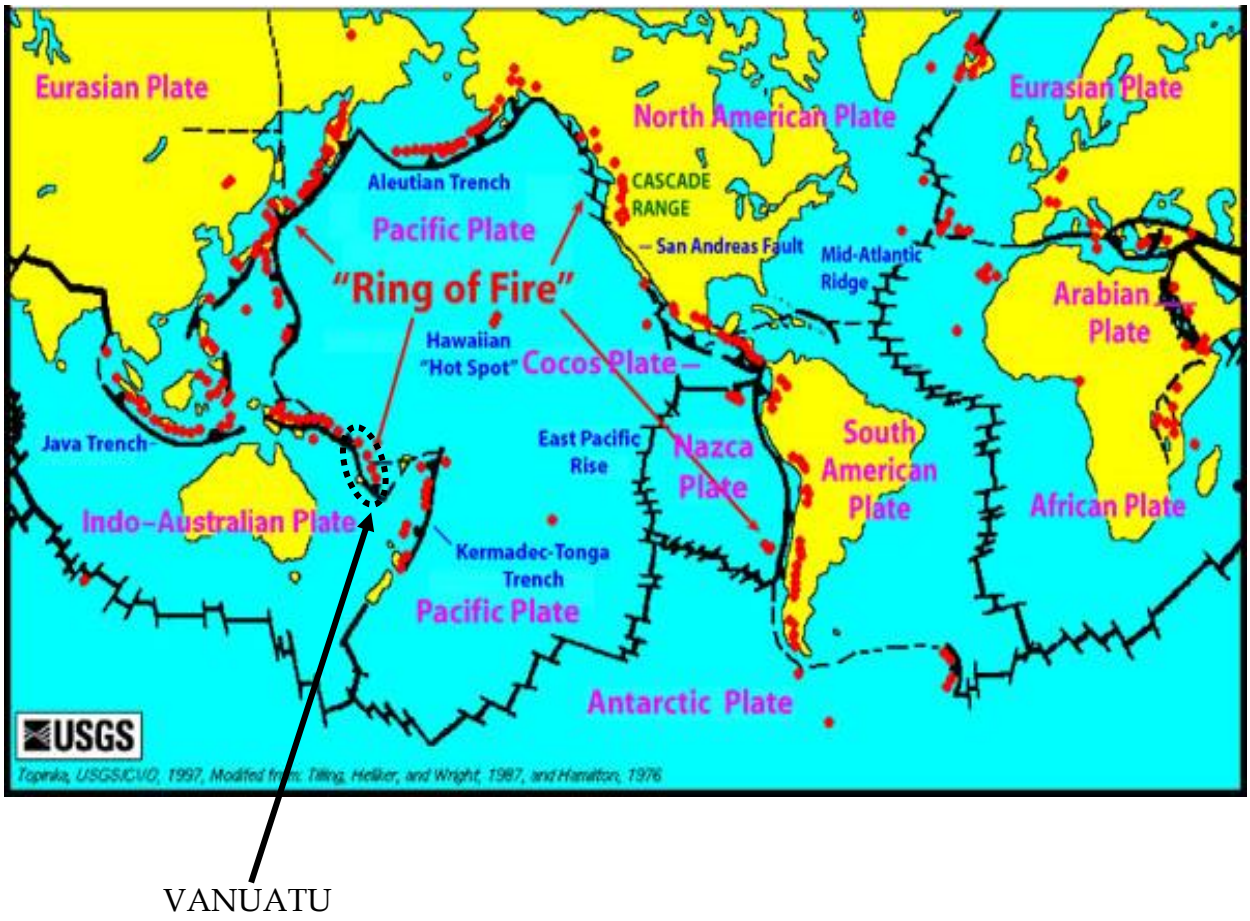
Concept	I understand this concept	Questions that I would still like to ask
3.1 Natural and human-made hazards 3.2 Hydro-meteorological hazards in Vanuatu		

3.3 Geological hazards

Geological hazards are caused by plate tectonics and the release of magma from under the earth's surface.

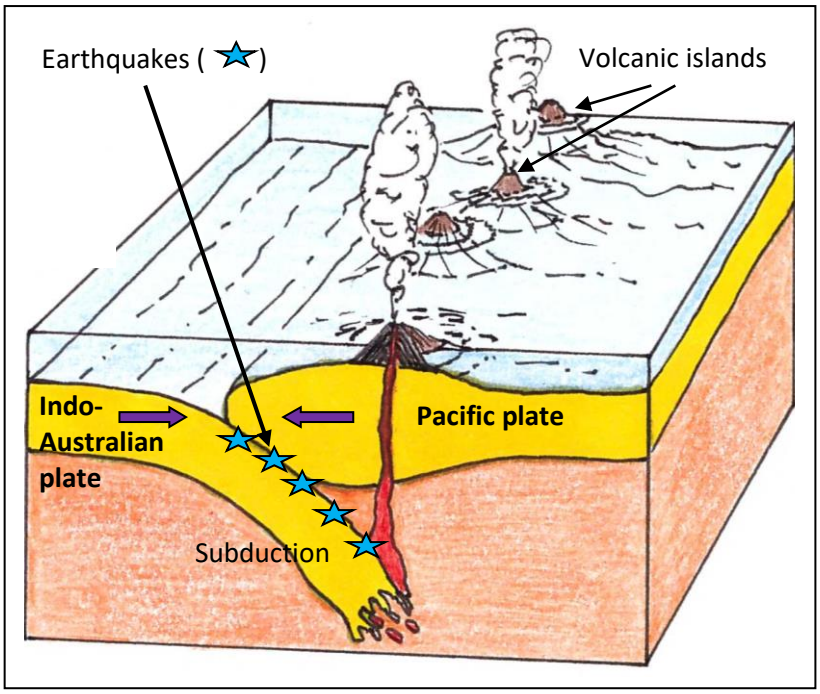
Vanuatu is situated along the Pacific "Ring of Fire" (Fig. 14) - a line right around the Pacific Ocean where tectonic plates are meeting together, with volcanoes and earthquakes.

Fig. 14: Active volcanoes, tectonic plates, and the Pacific "Ring of Fire"



USGS/Topinka, 1997

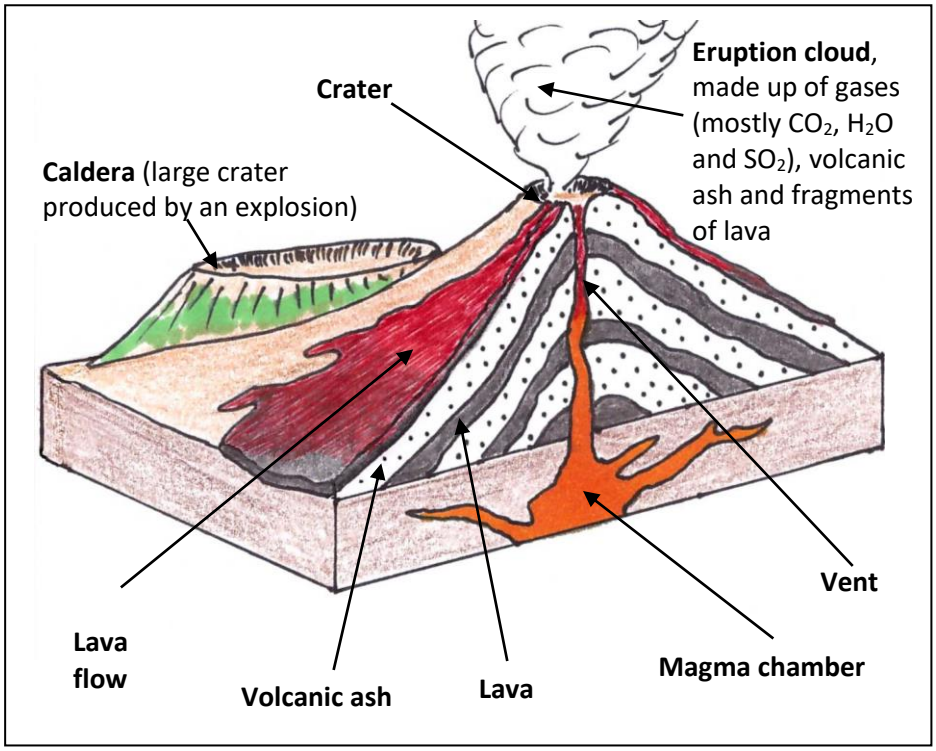
Fig. 15: Formation of the volcanic islands of Vanuatu



Pierce, C., 2014

The islands of Vanuatu have been formed where the Indo-Australian plate is pushing against the Pacific plate. The Indo-Australian plate is **subducted**, or pushed downwards, under the Pacific plate. As the two plates meet and grind against each other, stress builds up. The sudden release of stress causes an earthquake. As the Indo-Australian plate reaches great depths, it melts, and the extra magma produced rises up to produce volcanoes. This type of plate boundary, where two plates are meeting together, is called a **convergent** margin.

Fig. 16: Diagram of a volcano



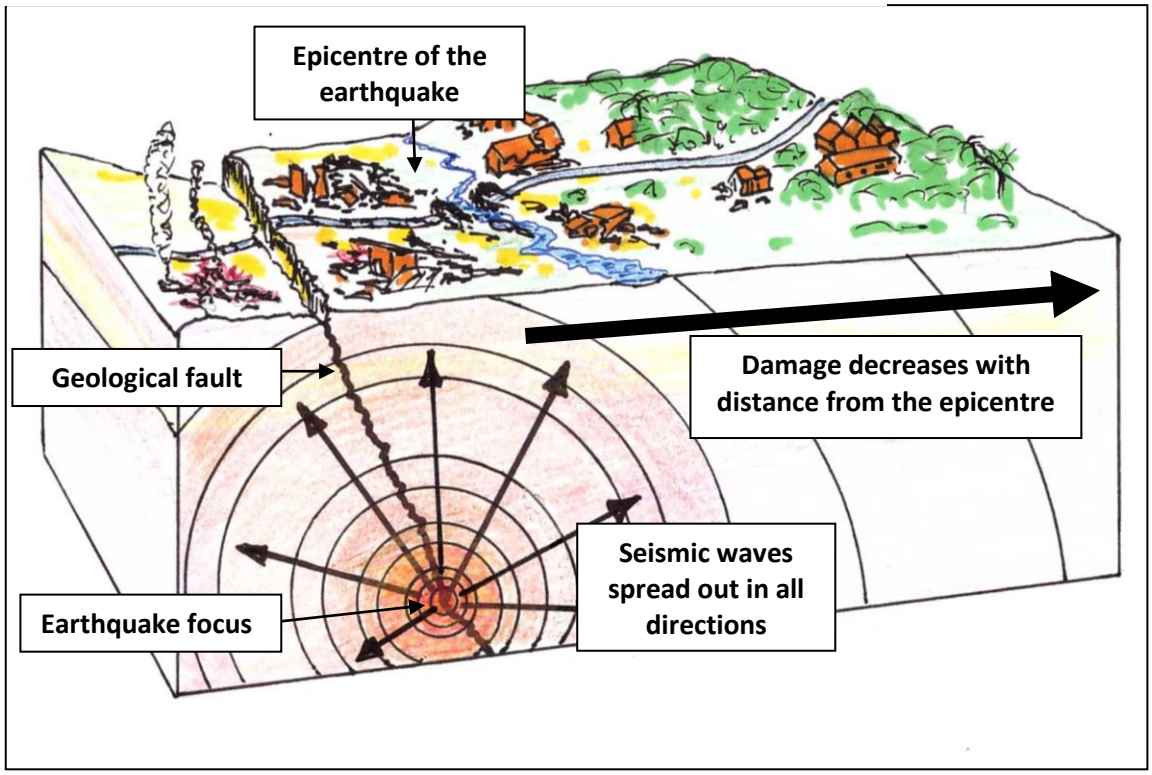
Pierce, C., 2014

Many volcanoes are composed of layers of lava and volcanic ash. Some, like Yasur on Tanna, consist only of volcanic ash.

Volcanoes are very dangerous because they emit poisonous gases, red-hot lava has temperatures of over 1000 ^{o}C, and volcanic ash can fall down over large areas, destroying food gardens, polluting water supplies breaking roofs and making it difficult for humans to breathe.

Earthquakes are vibrations in the ground that occur when rocks suddenly slip or move. Waves of energy spread out immediately in all directions from the place where the disturbance started, or the **earthquake focus**. The point directly above the focus is called the **epicentre** of the earthquake. The waves of energy, or seismic waves, can travel at speeds of up to 7 km in just one second!

Fig. 17: Earthquakes and seismic waves



Pierce, C., 2014

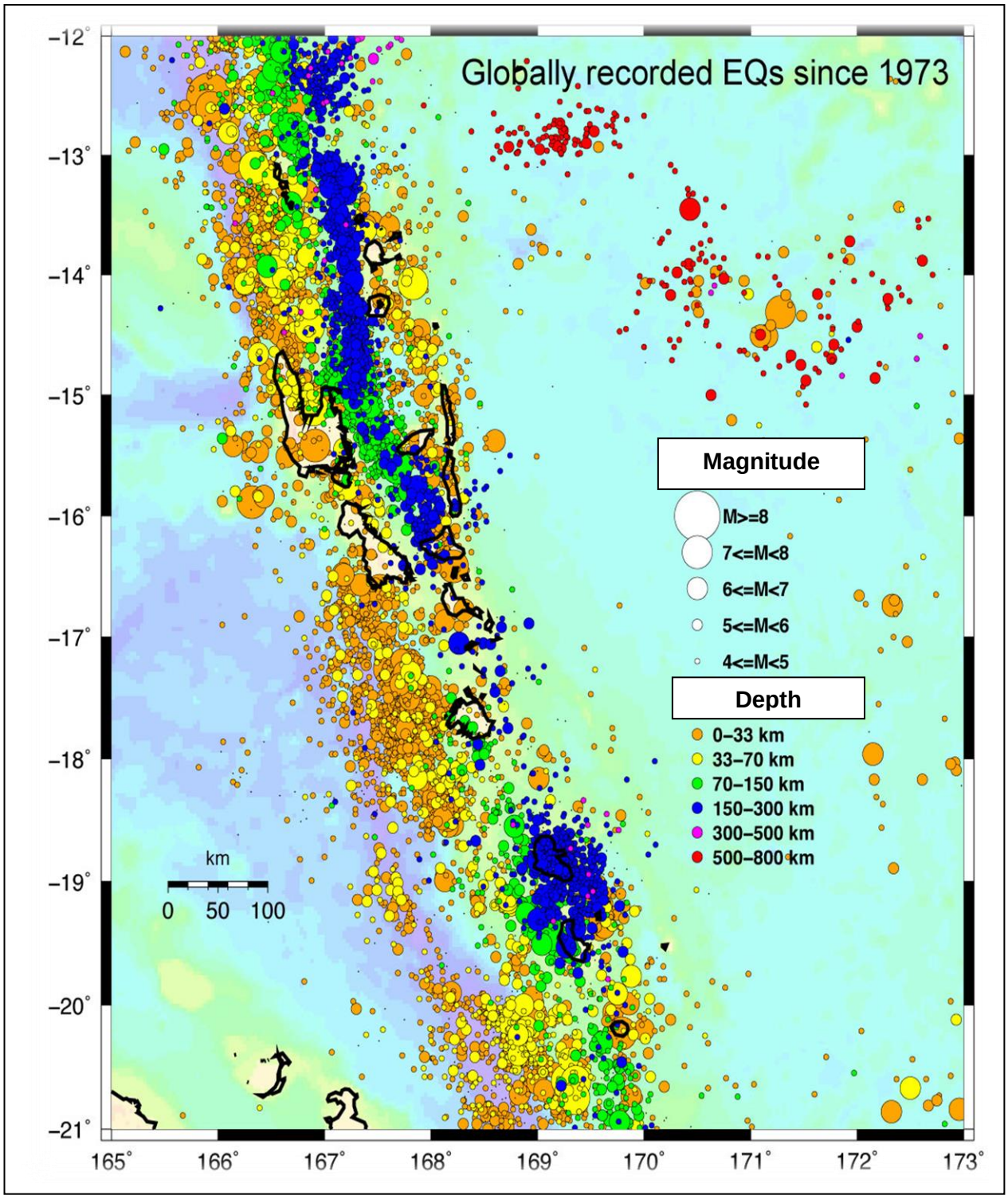
Earthquakes are measured on the Richter scale on a magnitude, or strength, of between 1 and 10. For each number that you go up on the scale, the vibrations are ten times bigger than those of the previous one. Vanuatu experiences earthquakes every day, but we only feel those of magnitude 5 and over. The greater the magnitude, the more dangerous the earthquake becomes. However, it is not only the size of the earthquake that is important, but also the length of time that it lasts.

Fig. 18:

An earthquake of magnitude 7.3 on 3rd January 2002 damaged all bridges in South Efate. This bridge over the River Teouma dropped by one metre.

Pierce, C., 2002

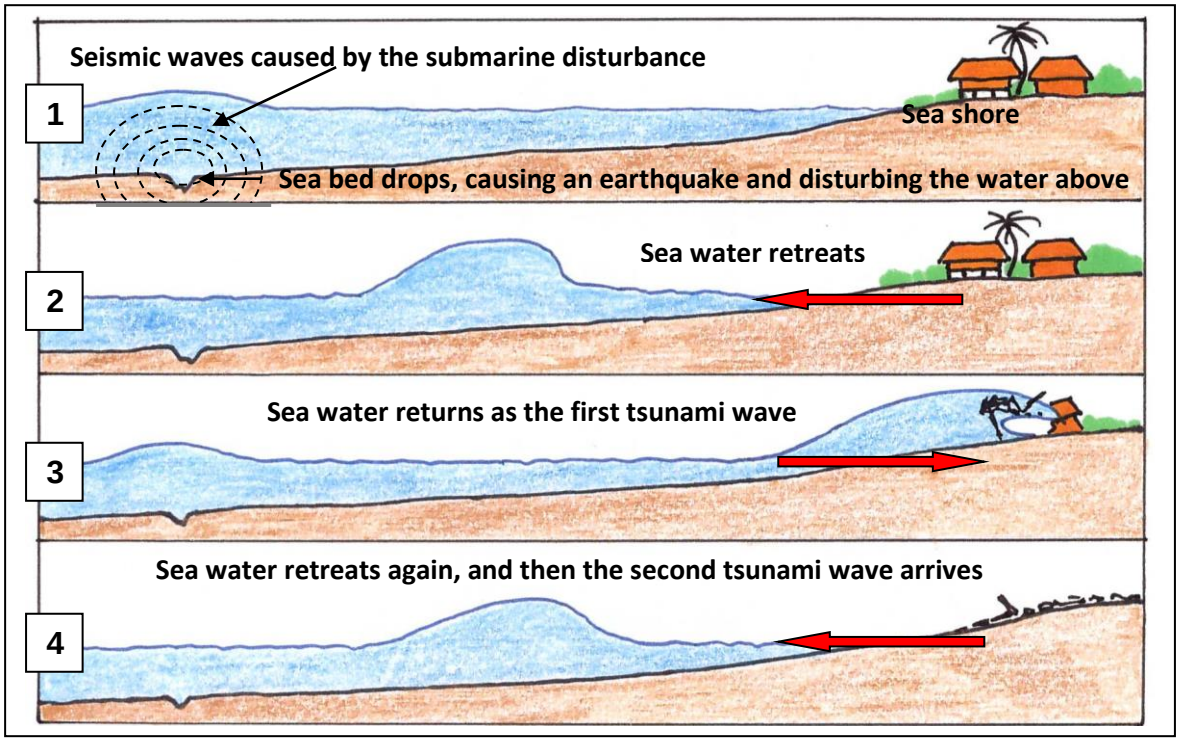
Fig. 19: Earthquakes recorded in Vanuatu since 1973



Look at this map. What does it tell you about the number of earthquakes that Vanuatu has experienced since 1973? Where are the shallowest earthquakes? Where are the deepest ones? Where are most of the strongest ones?

Tsunamis are huge ocean waves produced when plate movements cause parts of the sea floor to suddenly move or drop down (Fig. 20). The sudden movement also produces seismic waves, so that a tsunami is usually associated with an earthquake. As the tsunami waves reach shallow water, they increase in height and pick up everything in their path as they move inland.

Fig. 20: Formation of tsunami waves



Pierce, C., 2014

It is important to remember that tsunamis consist of several huge ocean waves, one after the other, and all moving very rapidly. The quickest way to escape a tsunami is to run to higher ground (Fig. 21).

Fig. 21: Escaping from a tsunami

Morgan, B., 2014

After the Tohoku earthquake of 9.0 magnitude affected the east coast of Japan on 11th March 2011, tsunami waves reached a maximum height of 40 metres in Sendai province. According to the Japanese National Police Agency, the earthquake and tsunami resulted in 15,885 known deaths, and caused the total collapse of 127,290 buildings. 4.4 million households in north-east Japan were left without electricity and 1.5 million households were left without water.

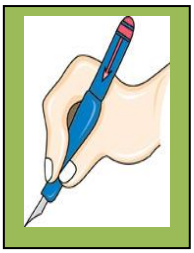
Fig. 22:

Tsunami waves start to engulf a road in Miyako city, Iwate, Japan, after the Tohoku earthquake of 11th March 2011

The Mainichi Newspapers, 2011

To conclude this topic of geological hazards, discuss with your trainer the meaning of the following words:

subduction	**Ring of Fire**	**convergent margin**
crater	**volcanic ash**	**lava flow**
earthquake focus	**epicentre**	**seismic waves**
Richter scale	**tsunami**	



Now please complete Activities **3.3a, 3.3b** and **3.3c** 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 Geological hazards		

3.4 Biological and other natural hazards

Biological hazards include outbreaks of diseases that affect humans, as well as those affecting plants and/or animals. In the Pacific islands, humans suffer from malaria, dengue, typhoid, ciguatera poisoning, etc. - diseases that are transmitted through mosquitoes, water and food.

Changes in climate, especially hotter temperatures and increased humidity, are likely to result in a wider spread of vector-borne diseases such as malaria and dengue fever because more and more mosquito-breeding sites will flourish in the warmer conditions. We must learn to be more responsible for cleaning up our rubbish and removing sites where stagnant water can accumulate.

Tompkins, A., VECTRI, 2014

Fig. 23:

Warmer, wetter climates will encourage more and more mosquito-breeding sites

Plants and animals are affected by pests and diseases, and this impacts upon agricultural and fish production.

One example is taro leaf blight (***Phytophthora colocasiae)***, which caused extensive damage to Samoa's taro crop during the 1990s. One year after the disease was introduced, it had caused a 95% reduction in the supply of taro to the public market in that country (Hunter, D., 1998).

Fig. 24: Taro leaf blight

Land Resources Division, SPC, 2014

Other examples are the fire ant (Fig. 25) and the cocoa pod borer (Fig. 26) in Vanuatu. The fire ant ***(Wasmannia auropunctata)*** is an agricultural pest that also causes great discomfort to humans through its sting. It first reached the Banks islands in the 1990s and is gradually spreading southwards to other islands. The cocoa pod borer ***(Conopomorpha cramerella)*** is a serious pest affecting cocoa. It makes the processing of cocoa pods difficult and spoils cocoa bean quality.

Fig. 25: Fire ant

DAFF, Queensland Gov., 2013

Fig. 26: Cocoa pod borer

DAFF, Queensland Gov., 2013

Invasions of non-native species of plant and animal are an important type of biological hazard in the Pacific islands, since these species spread quickly and overpower the native species. One example is the mile-a-minute vine, which was introduced into Vanuatu and Fiji by US armed forces in World War II to serve as camouflage for tanks and other equipment. It has now become a major weed that covers bush, forest and gardens in all islands. Another weed that overpowers the grass in cattle plantations is ***Lantana camara***.

Fig. 27: Mile-a-minute

Land Resources Division, SPC, 2010

Other forms of natural hazard include forest fires that start because of lightning or very dry, hot conditions.

3.5 Human-made hazards

Hazards can also be caused by humans, and can lead to human-made disasters. People can deliberately cause a hazard, or people can accidently make mistakes, or a human-made system or infrastructure can fail.

Fig. 28

Two sentenced for fire which destroyed historic Vanuatu Courthouse

Updated at 4:12 pm on 15 December 2008

Vanuatu's Supreme Court has sentenced the two young men accused of burning down the colonial-era Courthouse in Port Vila last year to over six years prison each.

The historic hardwood courthouse, which was built during the colonial rule of France and Great Britain, was razed to the ground on June 27th last year.

The estimated cost of the damage is around 16 million US dollars, most of which covers the value of the content of the documents that went up in flames.

Fire also destroyed the nearby building of the Department of Geology and Mines with an estimated cost in damage of over 8 million USD.

Radio New Zealand International, 15th December 2008

Now please complete Activities **3.4** and **3.5** in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
3.4 Biological hazards 3.5 Human-made hazards		

Section 4 Identify community responsibility for reducing disaster risks

After completing this section, you should be able to:

4.1 explain the natural causes and human actions that may have led to some recent disaster events;

4.2 explain how the reduction of disaster risks often depends on whether the hazards are slow-onset or fast-onset;

4.3 explain the need for communities and individuals to take responsibility for trying to reduce disaster risks and increase community resilience.

4.1 Disasters result from both natural causes and human actions

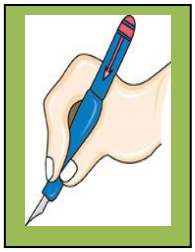
Many people believe that disasters are "acts of God" that are natural and strike at random. But often the effects of a natural hazard are made worse because of human actions, or the lack of human actions. For example, if people cut down all the forest and bush on the steep slopes behind their village, and then a cyclone arrives with strong winds and very heavy rainfall, most of the water will run straight down the slopes and cause flooding and even landslides. Another example is if there is a tsunami warning, and many people in a coastal village take no notice; those who stay in their homes or go down to the sea to watch it arrive will probably drown, while those who run to high ground will survive. Yet another example is when a school or clinic is built on flat land next to a river: after heavy rain, the buildings may be flooded or washed away. So although we cannot stop most natural hazards from happening, we can take certain actions to reduce the risk of them becoming disasters.

4.2 Reduction of risks from slow-onset and fast-onset hazards

Natural hazards such as earthquakes and tsunamis are **fast-onset**, meaning that they arrive very quickly, with little or no warning. Others like cyclones, droughts and sea-level rise are **slow-onset**, meaning that they may take days, weeks or years to arrive, and there are clear signs to show that they are coming.

With **fast-onset** hazards, people have very little time to prepare for the impacts, and must take immediate action in order to avoid danger. Of course, there are certain steps that can be taken beforehand, just in case the hazard comes. An evacuation route to higher ground can be prepared, and each family can make up a bag of basic needs such as torches, batteries, tinned food, medicines, fresh water, mosquito nets, spare clothes and valuable documents, ready for a quick get-away.

Slow-onset hazards give people much more time to prepare. As soon as the first cyclone warnings are given, they can clean up and remove loose objects from around their homes, secure roofs and windows, and prepare an emergency kit of medicines, fresh water, tinned food, valuable documents and spare clothing; they can also seek shelter in stronger buildings. With slower onset hazards such as droughts, they have time to dig deeper wells, repair water tanks, clean gutters, plant drought-resistant crops and preserve food. And with the slowest onset hazards that result from climate change - sea level rise, higher temperatures, changing rainfall patterns and more extreme weather events - it is possible to undertake long-term adaptation activities such as the relocation of whole villages and the breeding of new varieties of food crops and livestock. In this way, the negative impacts of slower-onset hazards can be greatly reduced.



Now please complete Activities 4.1a, 4.1b and 4.2 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 Disasters are usually the result of natural causes and human actions 4.2 Fast-onset and slow-onset hazards and the reduction of disaster risks		

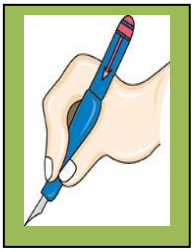
4.3 Taking responsibility for disaster risk reduction

As we saw in section 2 (pages 18-19), the **vulnerability** of a community refers to the extent to which it is unable to cope with, or manage, a natural hazard event that it faces. Today, it is recognized that a hazard can become a disaster when a community has not built up enough **resilience,** and its vulnerability is high. This is often because of poverty, inequality and lack of knowledge. So to reduce this vulnerability, there must be more educational programmes about natural disasters, better early warning systems, proper building regulations, flood protection systems and improved land-use practices.

All of us - individuals, communities, private companies, national and provincial governments, non-government organisations, schools, health centres, traditional leaders and religious organisations - need to take more responsibility for learning about natural hazards and for implementing measures that can be taken to reduce their impacts.

And this is where **you**, as students in a rural training centre, have a key role. You can take back your learning to your village or community and help it to become more resilient to natural disasters and climate change. For example, you have already found out that dangers of flooding and landslides are increased when all the bush and forest is removed from sloping ground, so that you can encourage actions such as tree-planting on such slopes. You are also aware that Vanuatu's National Disaster Management Office has published clear guidance on how to prepare for earthquakes, tsunamis, volcanic eruptions, landslides and flooding, and that this knowledge must be shared with all members of your community. You should also be mindful that the vulnerability of different members of your community varies according to gender, age, health, wealth, education, social status and location.

In terms of climate change, you already know that we must expect warmer temperatures and more extreme weather events in the years to come, and that one outcome of this is likely to be a rise in sea level. In later units of this course, you will learn more about how to reduce the impacts of climate change, and you will also find out about measures we can take to adapt our living conditions to these changes.



Now please complete Activity **4.3** in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
4.3 Our responsibility to try to reduce disaster risks and increase community resilience		

Section 5 Identify hazard risks in a local community

After completing this section, you should be able to:

5.1 identify the areas in a local community that are at risk from natural and human-made hazards;

5.2 explain the areas, assets and people in a local community that are at risk from natural and human-made hazards.

5.1 Description and map of a local community

To help you better understand and apply your knowledge of natural hazard risks, you are going to produce a "risk map" of your local community. You should form working groups of 3 or 4 trainees and choose a local community or neighbourhood that you know well.

You should then carry out these three tasks:

1. Describe the selected community, indicating its total population, number of males and females, number of households, a brief description of its location, and a summary of how people make their living. Then draw a map of this community on a large piece of paper that will later be put up on the wall.
2. List the existing hazards and past disasters and describe their impacts on the community's people, infrastructures and environment. You should also discuss whether these impacts have become more or less severe.
3. Draw hazard zones on to the map of your community.

Full details of these tasks appear in your Learner Workbook.

5.2 Explanation of the areas, assets and people in this community that are at different levels of risk from natural hazards

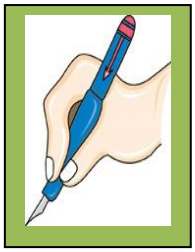
When you have completed your map, you should now prepare a short report in which you identify and explain the areas, assets and people in the community that are at different levels of risk from natural hazards.

Full details of this tasks appear in your Learner Workbook.

Fig. 29 shows a risk map drawn by a group of learners at the Fisher Young RTC on Vanua Lava. They visited the village of Kwanglav and produced this map. Notice how the map shows steep slopes, gentle slopes, flat land and the zones at risk from tsunamis and coastal erosion.

Fig. 29: A sketch map of Kwanglav village, Vanua Lava.

Cliffe Mosaiah, 2015



Now please complete Activities **5.1** and **5.2** in your Learner Workbook

My Notes:

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Concept	I understand this concept	Questions that I would still like to ask
5.1 Map and description of a local community 5.2 Areas, assets and people in the local community at different levels of risk from natural hazards		

Glossary

Atmospheric pressure	The weight of the atmosphere as it pushes down on a surface or person.
Biological hazards	Hazards that are caused by living things - diseases, pests and invasive species of plant and animal.
Brackish water	Water that has more salinity than fresh water, but not as much as sea water. It occurs when sea water mixes with fresh water.
Coastal inundations	Flooding of coastal areas by the sea due to high tides, storms or a rise in sea levels.
Convergent margin	A line along which two tectonic plates are meeting together.
Crater	A roughly circular opening at the top of a volcano from which lava, materials and gases are ejected.
Cyclone track	Path followed by a cyclone as it moves over the earth's surface.
Disaster	When the impacts of a natural hazard are greater than the community's ability to respond and get back to normal.
Disaster risk	Impacts on life, property and the environment that could happen if a hazard strikes a community.
Drought	Long period with no rain.
Earthquake	Vibrations in the ground that occur when rocks suddenly slip or move.
Emergency	A situation generated by the occurrence of an event that requires immediate attention. Also, a loss or difficulty that a community is able to handle using its own resources.
Epicentre	Point on the earth's surface directly above the earthquake focus.
Eruption cloud	Material and gases emitted from a volcano during an eruption.
Exposure to a hazard	Length of time that a community experiences a hazard, or distance of a community from the place where the hazard is greatest, or level of intensity of a hazard that a community experiences.
Eye of a cyclone	Centre of cyclone, with lowest atmospheric pressure and a storm surge.
Fast-onset hazards	Hazards that are quick to arrive, with little or no warning - earthquakes, tsunamis in the immediate area, landslides, etc.
Focus	Point where an earthquake starts.
Human-made hazards	Hazards caused by humans, either deliberately or accidentally.
Hydro-meteorological hazard	Hazard caused by weather and water systems - cyclone, storm, depression, intense rainfall event, flood, coastal inundation, erosion, strong winds, drought.

Inter-annual	From one year to another.
Invasive species	Species of plant or animal that spread into other areas and overpower the plant or animal life there.
Lava flow	Outpouring of molten material from underground on to the earth's surface - both on land and on the sea bed.
Natural hazard	Something natural that may cause disruption or damage to life, property and/or the environment.
Resilience	The ability of a person, household or community to prepare for, cope with, and recover from hazards and disasters.
Richter scale	Scale that measures the magnitude, or strength of an earthquake on a scale of 1 to 10.
Ring of Fire	Zone around the Pacific Ocean along which there are many volcanoes and frequent earthquakes.
Risk map	Map that shows the places in a community that are at the greatest risk from natural hazards, e.g. earthquakes, tsunamis, cyclones, landslides, coastal erosion, …..
Seismic waves	Waves of energy that spread out in all directions from the place where an earthquake starts.
Slow-onset hazards	Hazards that take a long time to arrive, with plenty of warning - cyclones, droughts, sea level rise, etc.
Storm surge	Raised sea level that is associated with the eye of a cyclone, or with a severe storm or strong winds
Subduction	When two tectonic plates meet, and one is pushed downwards under the other.
Tectonic plate	Large section of the earth's crust that can move very slowly against other sections of the crust. A plate "floats" on semi-molten material below.
Tsunami	A series of huge ocean waves produced when plate movements cause parts of the sea floor to suddenly move or drop.
Volcanic ash	Fine material thrown into the atmosphere during a volcanic eruption.
Vulnerability	The extent to which a community cannot cope with the impacts of a hazard.
Water vapour	Water in the form of a gas. It is invisible.

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Illustrations

Fig. number	Source
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1.	Vanuatu Daily Post, Issue 4118, 18 March 2014, *Landslide tragedy claims five lives.*
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17.	Pierce, C., 2014, *Earthquakes and seismic waves.*
18.	Pierce, C., 2002, *Bridge over the River Teouma.*

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