



# **ADAPTING TO A CHANGING CLIMATE**

## **A Community Manual**



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Conservation International is a non-profit organization founded in 1987 with program offices and partners in over 30 countries. CI's mission: "Building upon a strong foundation of science, partnership and field demonstration, CI empowers societies to responsibly and sustainably care for nature, our global biodiversity, for the well-being of humanity." In 2003, CI established the Indigenous and Traditional Peoples Program to strengthen our commitments to indigenous and traditional peoples and support their vital role in maintaining healthy ecosystems.

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# **ADAPTING TO A CHANGING CLIMATE**

## **A Community Manual**

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This document is part of a package of tools created to support the development of skilled local trainers on the basics of climate change adaptation. Other components include the Training of Trainers Course Manual and the Training Toolkit. A team of writers and designers contributed to the authorship of the products, supported by reviewers and editors, who are credited in the acknowledgment. The principal authors and contributors are:

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<b>AOSIS</b>	Alliance of Small Island States
<b>CBD</b>	Convention on Biological Diversity
<b>DRR</b>	Disaster Risk Reduction
<b>EbA</b>	Ecosystem-based Adaptation
<b>FPIC</b>	Free, Prior, and Informed Consent
<b>GEF</b>	Global Environmental Facility
<b>GHG</b>	Greenhouse Gas
<b>ILO</b>	International Labour Organization
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>LDCs</b>	Least Developed Countries
<b>LDCF</b>	Least Developed Countries Fund
<b>LMMA</b>	Locally Managed Marine Areas
<b>MPA</b>	Marine Protected Area
<b>NAPA</b>	National Adaptation Programme of Action
<b>NAP</b>	National Adaptation Plan
<b>NGO</b>	Non-governmental Organization
<b>UNDRIP</b>	United Nations Declaration on the Rights of Indigenous Peoples
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>UNPFII</b>	United Nations Permanent Forum on Indigenous Issues

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### CI staff feedback workshop, June 2012

A group of 20 CI staff members from 12 country programs and CI's US headquarters office provided technical advice on the content and structure of the training course, manual and toolkit materials during a product development workshop in June 2012. Based on their expertise in climate adaptation, science, policy and their experience working with local communities, this group provided valuable feedback and recommendations on the training materials and course content. In addition, Angela Andrade, Camila Donatti, Tiene Gunawan, Ricky Nunez, Candido Pastor, and Jeannicq Randrianarisoa provided the final technical review of the course and manual. The contributions of the CI staff technical team were essential to developing a global training tool on climate change adaptation that can be used by local trainers for local communities around the world.

The participants are listed below:\*

#### CI Staff at June 2012 workshop

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\*Divisions or field offices listed represent staff affiliations at the time of the workshop, and may have changed since June 2012.



### **Fiji Field Pilot, February 2013**

Following the technical review by CI staff, the Adapting to a Changing Climate Training of Trainers course and materials were piloted in Rakiraki, Fiji, in collaboration with CI's Fiji Program. Loraini Silvo, Marine Project Manager, organized and facilitated the pilot training with the support of CI-Fiji staff Vaseva Cerala, Operations Coordinator, and Nemani Vuniwaqa, Ra Province Field Officer.

A group of 25 local participants which included community representatives, provincial environmental officers, and NGO partners attended the training. These participants applied a wealth of experience from years of working with communities throughout Fiji, in areas that included environmental education, natural resource management, and community development to provide valuable feedback on the course. The group shared many of their own creative suggestions on how they could teach the material to communities in Fiji.

Their feedback was essential for completing the final version of this manual and toolkit, particularly their recommendations on the creation of thoughtful training activities that make new and complex topics understandable in the local context.

The names and affiliations of the participants are listed below:

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## FOREWORD

In a small island developing country where different communal lifestyles and values predominantly characterise a person's identity, we have learnt that it is critical for us to communicate, inform and educate our people about the subject of climate change in the manner they can easily relate to and understand.

We have also learnt that no matter how real climate change is, if we do not translate it well and involve our people and our communities in the formulation of respective national strategies and policies, it will be impossible to effectively address all its adverse impacts.

In this regard, the Ministry of Foreign Affairs and International Cooperation is elated to be part of the formulation of the Training of Trainers Course Manual and the Training Toolkit which addresses basic information on climate change. Importantly, we are happy to endorse the development of the Manual because it essentially represents the views of our people and our communities.

I must say that this is indeed a significant tool and having been mandated to coordinate Climate Change activities in Fiji, the Ministry of Foreign Affairs and International Cooperation recognises the invaluable efforts of Conservation International in linking and translating international and regional climate change instruments to such a user friendly manual and toolkit. I am certain that these documents are imperative in addressing the challenges that we currently face in informing and educating our communities about climate change.

I truly believe this toolkit is a timely and a very useful production.

Congratulations to the Conservation International team and all those who have worked tirelessly to see this project through.

*Vinaka Vakalevu*

Esala Nayasi

**Ministry of Foreign Affairs and International Cooperation**

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*Mr. Esala Nayasi is the Director of the Political and Treaties Division at the Fiji Ministry of Foreign Affairs and International Cooperation, which houses Fiji's Climate Change Unit.*





As the climate continues to change, it is becoming increasingly important for communities everywhere to plan and take action for climate change adaptation. It is essential for local communities to have the necessary information to fully and effectively participate in ongoing adaptation planning processes, as well as to be able to bring their knowledge and experience to these processes. Indigenous peoples and local communities have valuable strategies for adapting to changes in climate and other threats, which can contribute to climate change planning. By contributing to planning processes that are taking place at the national and international level, community leaders can identify adaptation actions that can be taken at the community level, as well as how these actions can be linked with efforts taking place at broader scales. It is equally important to recognize the role of healthy ecosystems in reducing communities' vulnerability to climate change, particularly as these ecosystems may be one of their most valuable resources. Because communities rely on different types of livelihoods that are supported by different ecosystems, communities need information on how these ecosystems may be impacted by climate change and what actions need to be taken to maintain ecosystem health.

The *Adapting to a Changing Climate Training of Trainers (ToT)* course is a community adaptation training tool which is designed to address the question: how can communities make the best use of their natural resources in order to reduce their vulnerability to climate change? The course is designed to provide participants with the information necessary to engage in planning for climate change adaptation, as well as the skills and tools to organize, design, and lead their own trainings on these topics. It also aims to highlight some of the various ways that local and traditional knowledge can contribute to communities' adaptation strategies. The six-part training manual is built on a foundation of the importance of natural resource management, and covers the relationship between people and ecosystems, the basics of climate science, international climate policy, key concepts of climate vulnerability and resilience, the ways ecosystems can help to protect human livelihoods from climate change, and planning for adaptation action. The Training of Trainers also includes sessions on training design and facilitation skills. Trainers receive the course manual, a training guide with activities and discussion questions, and a toolkit of training aids.

The course and toolkit are intended to be a global tool, which trainers can adapt for the local context of their country or region. The materials provide a global context for climate change and key issues related to adaptation, while giving trainers the flexibility to incorporate their own knowledge and experience to customize the information for a local audience. The training toolkit offers a variety of methods for presenting the material, including presentations, visual aids, and activities, and gives the trainer the flexibility to choose the learning method that works best for his or her audience. Trainers are encouraged to share local examples of both the challenges and successes that communities have had with climate change adaptation. By asking participants to share their own experiences and expertise, as well as bringing in guests presenters, the trainings can create valuable opportunities to expand local dialogue on climate change adaptation and increase the contribution of local communities to national level processes. Bringing together these multiple sources of information will allow communities to plan for and adapt to climate change in the way that is best suited to support their livelihoods and well-being .



## SESSION 1. UNDERSTANDING ECOSYSTEMS AND THE SERVICES THEY PROVIDE FOR HUMAN WELL-BEING

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### LEARNING OBJECTIVES

At the end of the session, participants should be able to:

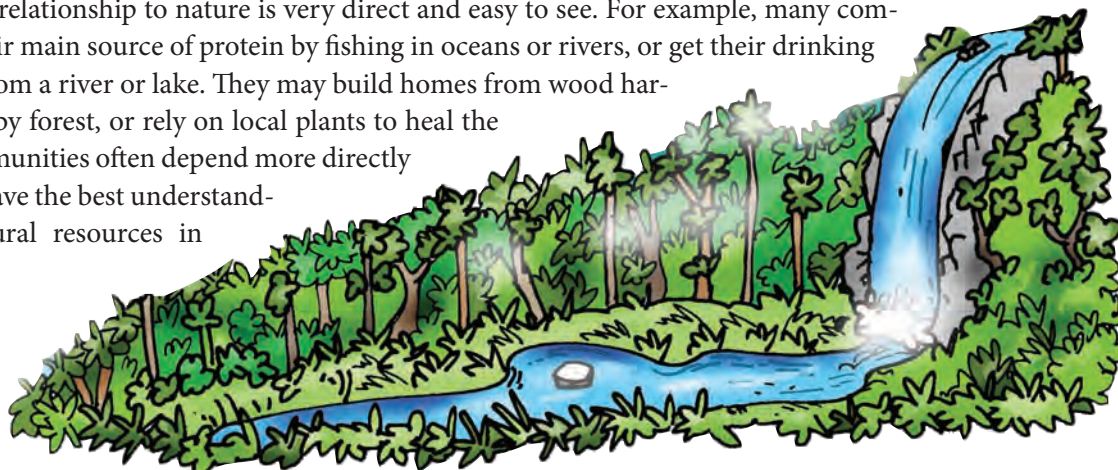
- Understand the diverse relationships between people and their environment
- Understand the different types of ecosystems and the services they provide for human well-being and livelihoods
- Understand the current threats to ecosystems from natural and human impacts,
- Understand how governments and communities are working to reduce impacts and some approaches used to protect ecosystem health and services

This session will provide an introduction to ecosystems and ecosystem services as basic background. In the following sessions, understanding ecosystems and their services will be critical for understanding the impacts of climate change on our world and how to best prepare for them.

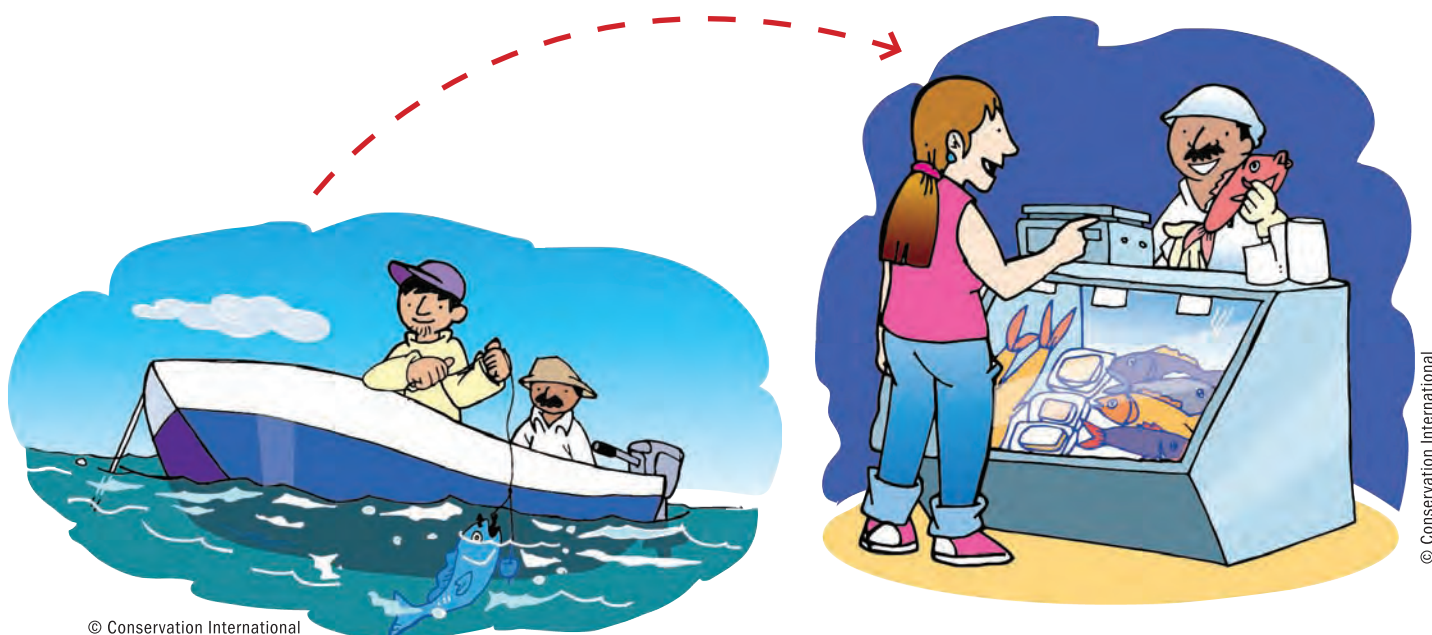
### PART 1: WHAT IS THE RELATIONSHIP BETWEEN PEOPLE AND NATURE?

Human beings have always relied on nature to provide the essentials for life, such as water, food, building materials and medicines.

Sometimes that relationship to nature is very direct and easy to see. For example, many communities get their main source of protein by fishing in oceans or rivers, or get their drinking water directly from a river or lake. They may build homes from wood harvested in a nearby forest, or rely on local plants to heal the sick. Rural communities often depend more directly on nature and have the best understanding of the natural resources in their region.



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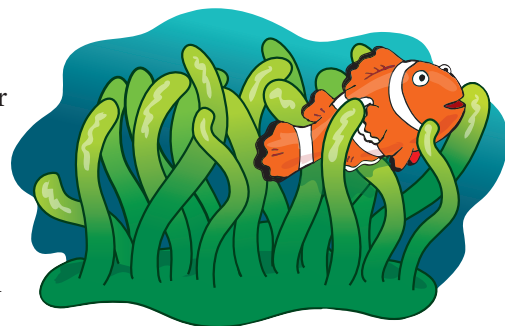


Sometimes the relationship between people and nature may be more indirect and harder to see; the natural resources may come from areas further from where people live. For example, if the fish is caught in one country, then packaged and transported to another country, the people who eat the fish do not know the area where it was taken from. Or, a coastal community that gets drinking water from a river may not be aware that the forest upstream in the mountains collects and filters (or cleans) that water to make it drinkable for them downstream. Urban communities often have more indirect relationships with nature and may not be aware of the ecosystems in other regions that provide their food, water and other resources.

A good understanding of nature and its ecosystems is necessary to prepare for the possible impacts of climate change. Ecosystems provide critical services that, if cared for well, can reduce the impacts of climate change and help communities maintain the resources they need, despite a changing climate.

## PART 2. WHAT ARE ECOSYSTEMS AND WHAT SERVICES DO THEY PROVIDE?

An ecosystem is a group of plants and animals that lives together in a specific place within a particular environment. The characteristics of the area—its soil, rocks, water—make up the environment. An ecosystem is a delicate balance in which all plants and animals have a relationship with each other and their environment. Examples of ecosystems include forests, wetlands, coral reefs, etc.



### WHAT ARE ECOSYSTEM SERVICES?

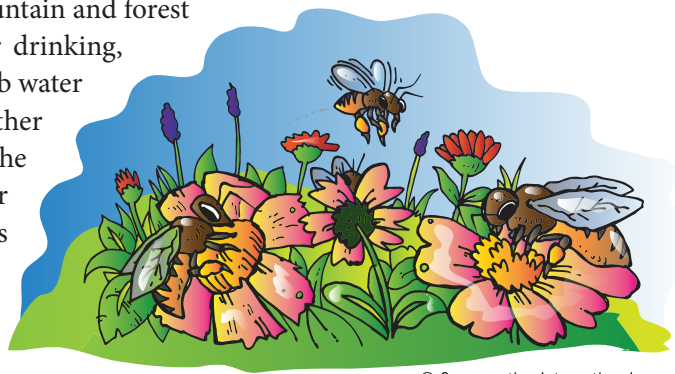
Ecosystems provide essential services for people all over the world. **Ecosystem services** are the resources and processes that nature provides that benefit people and support their **livelihoods** (their means of living and earning income). Every region of the world has different ecosystems that make it unique and provide distinct services for the communities that live there.



The following are examples of ecosystem services:

- providing food, water, timber and medicines for daily needs
- supporting economic development, such as logging, fisheries, tourism, non-timber forest products, and hydropower
- controlling floods, disease, waste, and water quality
- supporting natural processes, such as pollination, and climate control
- providing **nutrients** to soil and water systems
- providing cultural services, which are a source of beliefs, traditions and enjoyment.

Ecosystems benefit everyone in some way. Consider mountain and forest ecosystems, for example. They provide clean water for drinking, agriculture, and industry. The forest plants and soil absorb water and filter out the tiny quantities of metal, dirt and other things that people can't drink, so the water flows into the groundwater system, streams and rivers much cleaner than it arrived. The people who benefit may be indigenous peoples and local communities living in or near the forest ecosystems, or they may be city dwellers who live far from the water source but still depend on the good management of those forest ecosystems for fresh water.



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Below are some important ecosystems and their services:



### **Forests**

protect against erosion; maintain watersheds by absorbing and storing rainfall; provide habitat for insects and other wildlife that pollinate plants; maintain cloud cover, creating a cooling effect and increasing rainfall; as well as supporting drinking water and crops. Forests also provide, building materials and food supplies and sources of income from timber and non-timber forest products.



### **Wetlands** (swamps, bogs and marshes)

absorb rainfall, purify water, and regulate the flow of water to streams and rivers, thereby reducing drought and maintaining flow for hydro-electric plants. Wetlands also provide erosion control and are often rich biodiversity reservoirs.



### **Mangroves**

protect shorelines from erosion caused by rising sea level and storms, provide fish habitat, protect against flooding and keep salt water out of fresh groundwater systems.



### **Coral reefs**

protect against storm surge and maintain important fishery habitat and breeding grounds.



### **Dryland Ecosystems**

(deserts, grasslands and woodlands)

help absorb rainfall, purify water and regulate the flow of water to streams and rivers, provide habitat for insects and other wildlife that pollinate plants, keep the area cooler through plant coverage.

Ecosystem services provide a safety net for many communities. For example, when a storm destroys a town's water system, water may still be available from a local river or lake. If roads flood, temporarily making food transport to the region impossible, the community may be able to fish, hunt and gather foodstuffs from the forest to provide for themselves. These services can support a community in a time of need and give it the opportunity to recover without extreme losses.

### **WHY IS IT IMPORTANT TO CONSIDER ECOSYSTEM SERVICES AS PART OF CONSERVATION?**

The main focus of biodiversity conservation is to ensure that no plants or animals disappear or become "extinct." This conservation approach values all plants and animals as part of the world's biodiversity. Ecosystems provide the habitat that supports biodiversity.

But the value of ecosystem services goes beyond biodiversity alone. Governments, decision makers and conservationists also need to understand the value of ecosystem services' contributions to human livelihoods and development. They need to consider the value of these services when making decisions on other investments that protect communities, infrastructure and natural resources, such as sea walls, or water-powered (hydro) electric plants. Finding the best balance between protecting ecosystem services and protecting biodiversity is critical for decisions that impact the long-term sustainability of ecosystems, biodiversity, and development.





### **Grasslands**

maintain soil fertility, disperse seeds, reduce flood and drought damage, and provide erosion control to protect homes and agriculture.



### **Páramos (high altitude wetlands)**

supply fresh water for drinking, irrigation and hydro-power by storing water from melting glaciers and releasing it during the dry season.

## **PART 3. WHAT ARE THE IMPACTS AFFECTING ECOSYSTEM SERVICES?**

### **WHAT ARE THE NATURAL AND HUMAN-CAUSED IMPACTS THAT HARM ECOSYSTEMS?**

Anything that damages the ecosystem to the point where it can no longer sustain its health and provide services is a harmful impact. Economic, social and natural factors can all harm ecosystems and their services. Human impacts like over-fishing can damage a fishery and reduce its ability to maintain fish populations and provide food for communities in both the short and long-term. Similarly, poaching and over-hunting of animals for recreational purposes can harm grassland ecosystems and create an imbalance in the predator/prey relationship. Agriculture, although an important human activity, is the largest contributor to deforestation, which means that there are fewer forests to provide ecosystem services. Natural impacts like earthquakes can cause landslides that destroy entire areas of forest, removing important habitat, killing animals and polluting water with sediment.

### **WHAT CAUSES LOCAL AND REGIONAL IMPACTS?**

Many impacts to ecosystems are caused by influences that are specific to certain regions or local areas. Natural events such as volcanic eruptions, storms and earthquakes (mentioned above) can all cause major impacts to a particular area. Specific economic and social needs of human populations in a region can lead to harmful impacts as well. The need for governments and businesses to supply goods and services to a country's population can lead to the use of ecosystems and their services in ways that are not sustainable—that damages their ability to provide services for the long-term. Mining, logging, agriculture, and commercial fishing, if not regulated and well managed, can harm ecosystem health and reduce the quality of ecosystem services. Population growth and expanding human settlements and cities can also increase pressure on ecosystems.

## PART 4. WHAT ARE SOME APPROACHES AND TOOLS FOR MANAGING ECOSYSTEMS?

### HOW CAN COMMUNITIES MANAGE THE IMPACTS ON ECOSYSTEMS?

Each community has different resources, needs and ecosystems. It is important for communities to understand an ecosystem's health, what services it provides, and how those are changing over time in order to make effective decisions about managing their ecosystems. To understand what their ecosystems are and what services they provide, communities, governments and organizations often measure and map them. Mapping an ecosystem is challenging but can be done through various techniques:

- Observations on the ground
- Photographs taken from airplanes (aerial photographs)
- Satellites
- Computer modeling (to be discussed more in Session 4)
- Bringing together community members with in-depth knowledge of the ecosystem(s)
- Communicating—both outside and within the community—about the ecosystems and the critical services they provide

Communities can then create natural resource management plans that include these ecosystems and their services as resources to protect. Planning processes can help communities find ways to fulfill economic and social needs while maintaining ecosystem services, and can lead to increased resources for the community and to changes in community behavior or regional laws that protect ecosystems and their services.

**Locally Managed Marine Areas (LMMAs)** are one example of community-managed natural resources. Instead of being managed at a national level, LMMAs rely on long-standing local and traditional practices (such as seasonal bans and temporary no-take areas) to manage coastal resources. In Fiji, many LMMAs have been established, supported by a commitment from the Fijian government. These LMMAs have benefitted from strong links between community management strategies and scientific research in Fiji that explored the economic, social, and cultural value of marine resources. The findings of this research have enabled local resource managers, educators, and conservationists to build broader support for marine conservation and have helped community managers prioritize among management options.





**Community-managed forests** are another way to manage ecosystems. These have benefits not only for the forest ecosystems, but also for the people in the community. In southeast Tanzania, communities like the village of Kikole have taken over the ownership of *mpingo* forests from the government. Mpingo trees produce a type of black wood often used for making instruments and sculptures. Community management allows Kikole Village to receive payment for its timber directly instead of through the government. Because it has received international certification to show that its timber is sustainably harvested, the Kikole forest timber can be sold for a much higher price. The Mpingo Conservation Project has worked with communities to develop their own management plans and to provide training on forest monitoring.



There are several approaches and tools to manage ecosystems:

- Community/traditional rules for behavior
- Establishment and management of protected areas
- Decentralized natural resource management; assigning local rights and duties
- Planning laws (set and enforced by governments)
- Development of safeguards (e.g., set and monitored by project donors)
- Clear definition of property rights (communal, individual, etc.)
- Sustainability certification, which enables increased prices for sustainably managed and harvested products

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## IMPORTANT THINGS TO REMEMBER:

- An **ecosystem** is a natural group of plants, animals and microorganisms that lives together in a specific place, dependent on their environment to survive.
  - Ecosystems provide many basic resources and needs to support people's livelihoods.
  - **Ecosystem services** support many aspects of life, including the availability and quality of fresh water, healthy fisheries, sustainable agriculture, and protection from heavy winds, flooding, erosion and drought.
  - Managing ecosystem services requires understanding how ecosystems support livelihoods in a region, who benefits from the ecosystem services, what impacts affect those ecosystems, and the value of the services they provide.
- 

## KEY TERMS TO REMEMBER:

**Ecosystem:** a group of plants, animals (including people) and microorganisms that live together in a specific place with a particular environment that enables them to survive.

**Ecosystem services:** the resources and services provided by natural ecosystems.

**Environment:** the external surroundings in which a plant or animal lives, such as soil, rocks and water, which provides the means for life and affects behavior.

**Livelihood:** a person's means of living or earning an income to support themselves, such as fishing, farming and tourism.

**Nutrients:** a substance that provides nourishment or food, necessary for growth and life.

**Pollination:** the transfer of pollen from one part of a flower to another part of that same flower or to another flower to enable seed production and plant reproduction. Depending on the plant, insects, birds, bats and even the wind can transfer the pollen and enable the plant to create seeds.

**Rural:** relating to an area located away from cities and/or associated with farming or subsistence livelihoods.

**Urban:** relating to a city or town.

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### LEARNING OBJECTIVES

At the end of the session, participants should be able to:

- Explain the concepts of climate and weather
- Understand what climate change means and why the climate is changing
- Explain the signs of climate change
- Understand and explain the greenhouse effect and identify the main greenhouse gases
- Explain how human activities are causing climate change
- Explain how climate change affects people and nature
- Understand why we should be concerned about climate change

For people to protect themselves and their ecosystems from the threats presented by climate change, it is important to understand how the climate is changing and why. This session will cover some of the basic natural processes that make life on Earth possible, how human behavior is changing these processes, and how that is changing the climate.

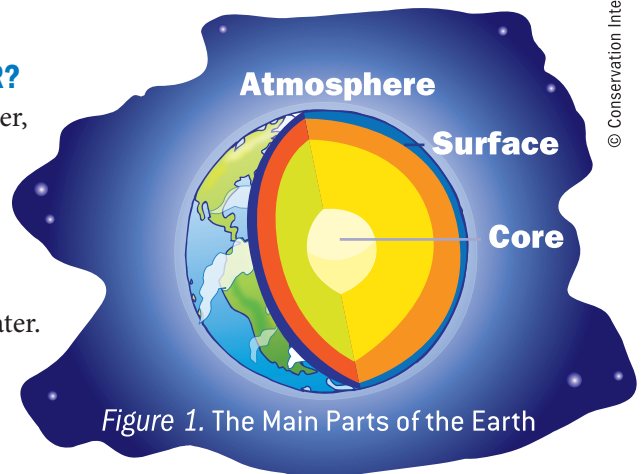
### PART 1. HOW IS THE EARTH FORMED?

The Earth is a living planet with natural processes that work together to provide a good environment for human, plant and animal life. These processes make life on Earth possible and affect our climate.

### HOW DO THE PARTS OF THE EARTH WORK TOGETHER?

The planet Earth is formed by rocks, minerals, soils, water, gases and living organisms. There are three main parts of the Earth, each made up of different materials:

- The inside, or **core**, of the Earth is composed mostly of rocks and other dense or thick materials.
- The **surface** of the Earth includes both land and water. Water in oceans, lakes and rivers covers 70 percent—almost three quarters—of the Earth's surface. The rest



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Figure 1. The Main Parts of the Earth

is land—about 30 percent, or a little less than one-third. More than 10 percent of the total land on Earth is permanently covered in ice.<sup>1</sup>

- The **atmosphere**, or air, is the area above the Earth's surface. It is made up of invisible gases such as nitrogen, oxygen, and carbon dioxide. The atmosphere begins at the surface of the Earth and extends upward into outer space in many layers. Most of the processes that affect the Earth's climate happen in the lowest layer of the atmosphere, which starts at the surface of the Earth and goes about 10 miles, or 16 kilometers, into space. This layer of the atmosphere contains the air we breathe.

All the different parts of the Earth work together to make life on Earth possible. Conditions in the atmosphere affect the Earth's surface, and in turn, the land and water of Earth's surface affect the atmosphere. For example, **photosynthesis** is a natural process in which plants on the earth's surface take in light and heat from the sun and carbon dioxide from the air, and then release oxygen into the atmosphere. This process makes plants grow and keeps our air clean.

## PART 2. WHAT IS WEATHER AND WHAT IS CLIMATE?

Climate produces the temperatures and rainfall that make life possible. Without the right temperature and rainfall, plants and trees could not grow, animals would not have food to eat, and people could not survive.

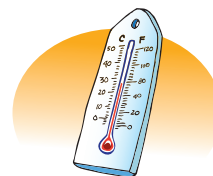
**Weather** is temperature, rainfall, or storms in a specific place on a specific day or over a short period of time, like one season. When someone says, "It is raining a lot today," or "It has been very rainy this season," they are talking about the weather. Weather measures the temperature, rainfall, wind and cloud conditions on a particular day or season. Storms are extreme weather conditions, such as heavy rain and strong winds.

**Climate** is the average weather over a long period of time. When someone says, "It always rains here for six months of the year," or "It never snows here," they are talking about the climate. When climate is measured, it is measured over several years, many decades or even centuries. It measures the average temperature, the average rainfall or snowfall, and how often storms generally happen in an area.

The climate is a very complex natural process. It is influenced by the interaction of the air, the water, and the land surface. The way the air moves through the atmosphere and the way the water moves through the ocean can all affect temperature and rainfall.

### Both climate and weather measure:

#### Temperature (Hot or Cold)



#### Precipitation (Rain or Snow)



#### Wind and Clouds



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The figure below shows how climate components work together.

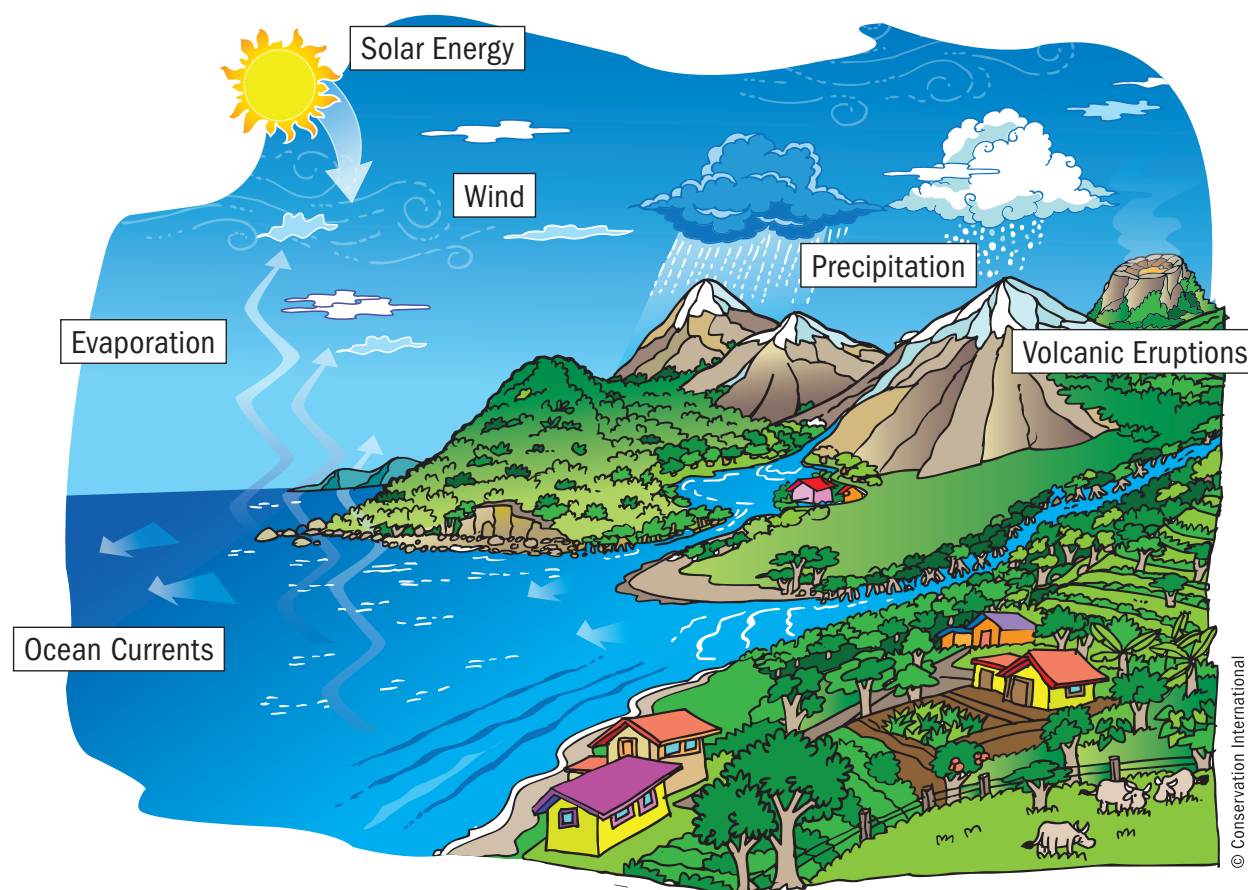


Figure 2. The Climate Components

Climate is influenced by things that happen in nature (like **volcanic eruptions**, or changes in how much energy from the sun reaches the Earth) as well as by human activities. The main natural processes that affect climate are:

### THE SUN'S ENERGY

The amount of solar (or sun) energy that reaches the Earth influences climate. If the amount of solar energy increases or decreases, it can make the Earth warmer or colder.

### GASES IN THE ATMOSPHERE

Some gases have a strong influence on climate by trapping heat in the Earth's atmosphere and making the planet warm. These gases are a natural part of the atmosphere, but, over the past 150 years, human activity has increased their amount in the atmosphere, trapping more and more heat. This results in global warming, an increase of the average temperature of the planet, and contributes to climate change.

### OCEAN CURRENTS

The oceans are a critical part of the climate system because of their ability to absorb gases from the atmosphere and move heat around the world. Ocean water is always moving. When the wind blows, it moves water over the ocean's surface in regular patterns, called currents. Colder water, which is heavier

than warmer water, sinks to the bottom of the ocean at the Earth's poles. Water also moves up from the colder, deeper parts of the ocean to the warmer surface. These movements affect the temperature of the surface of the ocean. The movement of ocean water also moves heat around the globe, so ocean currents have a big impact on climate change.

Other natural processes that affect climate are:

### **VOLCANIC ERUPTIONS**

When volcanoes erupt they release gas and tiny particles that get into the upper parts of the atmosphere and can affect the Earth's temperatures. The particles reflect the sun's energy away from the Earth and have a cooling effect on the climate—this usually only lasts a few years at most.<sup>2</sup>

### **SNOW AND ICE**

Because snow and ice are light in color, they reflect solar energy back to the atmosphere, which keeps Earth cooler. As Earth's climate warms and snow and ice melt, less solar energy is reflected back, which causes even more warming.

### **CLIMATE VARIABILITY: NATURAL CHANGES TO CLIMATE**

Just as one day may be wetter or hotter than another, one year may be wetter or hotter than the last; even decades can vary one from another. These differences are not always caused by climate change. Many things determine this variation.

Some key factors include the rotation of the Earth and the way the heat from the sun interacts with the land and water on the Earth. These changes can happen in cycles. For example, temperatures are generally higher at mid-day than in mornings or evenings because the Earth is more exposed to the sun at this time.

El Niño and La Niña are other examples of natural cycles that affect the climate. They happen every 3-7 years and last for a year or two. Scientists are still trying to understand exactly what causes these cycles, but they know it is related to temperature changes in the Pacific Ocean, as well as ocean currents and wind patterns.

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**El Niño** and **La Niña** are names given to cycles of temporary changes in the winds and water movement that occur between the east and west sides of the Pacific Ocean. In El Niño, which happens every three to five years, the winds and ocean currents in the tropical Pacific Ocean reverse, moving west to east, and warmer water builds up in the eastern Pacific Ocean. In La Niña, the opposite happens—the winds over the tropical Pacific move east to west but are stronger than usual, bringing colder water to the eastern Pacific Ocean. These changes can affect weather all over the world, including increased rainfall or extreme drought, which in turn affects food production. El Niño and La Niña are not caused by climate change, but when they happen, they can cause climate change effects to be more severe, making it difficult to adapt.

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### PART 3. WHAT IS CLIMATE CHANGE AND HOW DO WE KNOW IT IS HAPPENING?

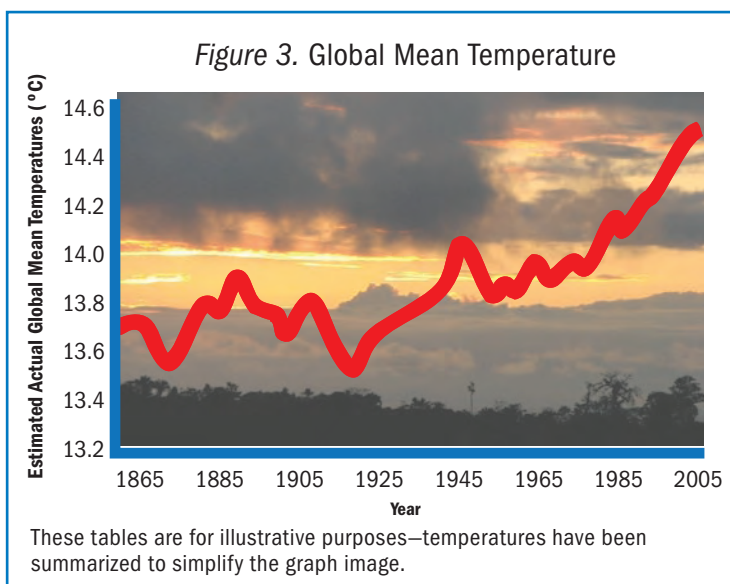
Climate change is the change of the normal weather patterns around the world over an extended period of time, typically decades or longer. As Earth's average temperature has slowly increased over the last 100 years, the term '**global warming**' is often used when discussing climate change.

Remember that 'average' means that scientists are looking at changes in temperature all over the planet. In some places, the temperature is getting warmer; in other places, it may actually be getting cooler—climate change is not happening in the same way everywhere. But overall, the Earth is getting warmer.

Signs of climate change are being seen in various ways: Scientists are observing and measuring changes in weather patterns, and people all around the world are experiencing these changes. Changes are happening much faster than in the past. The major signs of global climate change are:

#### INCREASING GLOBAL TEMPERATURES

- Global warming: The average global temperature has increased steadily during the last 100 years—about .74 degrees Celsius (1.3 degrees Fahrenheit).<sup>3</sup>
- Temperature increases have occurred in all regions around the world.
- Changes in ocean and land surface temperatures have caused changes in rainfall patterns worldwide.
- In many places, the rainy seasons are changing. Rain is falling at different times and for shorter or longer periods than in the past.
- While some regions of the world are receiving less rainfall and suffering from longer and more droughts, other regions are experiencing much higher levels of rainfall.
- Globally, areas experiencing drought—periods of extremely dry weather—have increased since the 1970s.<sup>4</sup>



#### DECREASING SNOW COVER AND MELTING ICE AT THE POLES

- At the Earth's **poles** (the most southern and northern parts of the planet) the climate is traditionally very cold, and ice covers the Earth's surface and parts of the sea. These areas of ice, called **glaciers**, are melting because of global warming.
- Glaciers are also found on very high mountains. These, too are melting because of warmer temperatures.



The glacier on Mount Kilimanjaro is over 12,000 years old, but the ice of this mountain glacier has almost disappeared. Some scientists think it could be gone by 2020.<sup>5</sup>

### CHANGING PATTERNS OF EXTREME WEATHER EVENTS

- Over the past 50 years, very hot days and nights are happening more often, and very cold days and nights are happening less often.
- Periods of high temperature (heat waves) have become longer and hotter over most land areas.
- Big storms with heavy winds and rain are happening more often, causing more damage.

### CHANGING OCEAN LEVELS ARE IMPACTING PEOPLE AND ECOSYSTEMS

The height of ocean's surface is called the 'sea level.'

- Sea levels are rising because warmer ocean temperatures cause the oceans to expand. In addition, warmer air temperatures are melting ice in the mountains and at the north and south poles, adding more water to the oceans.
- In the last 100 years, the average global sea level has risen about 6 inches, or 15 centimeters.<sup>6</sup>
- Rising sea levels are threatening communities in coastal areas and on islands, causing flooding and washing away coastal land.
- Higher sea levels bring salt water into rivers and other freshwater sources, affecting the quality of water supplies.

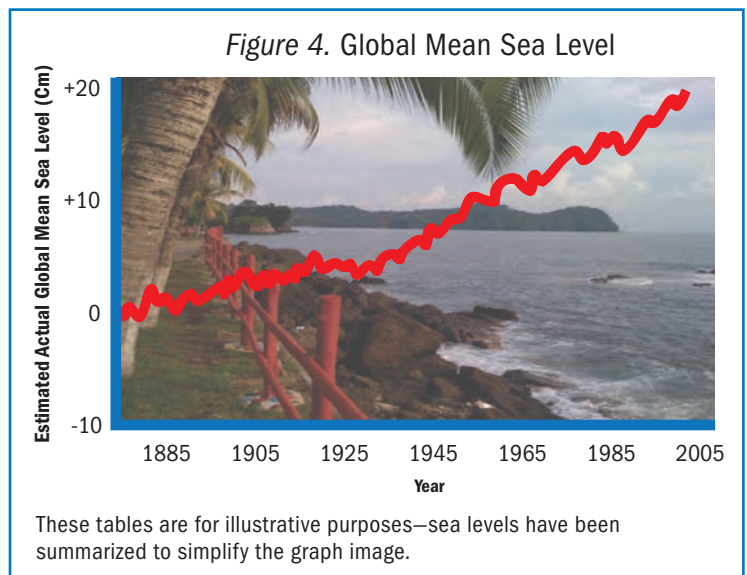
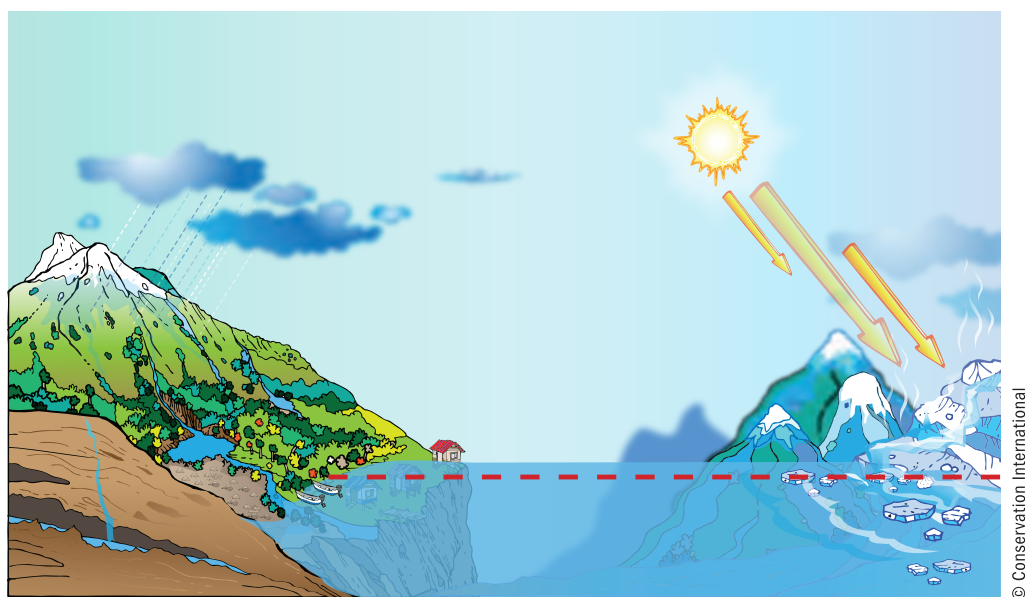


Figure 5. Rising Sea Levels



Illustration of normal sea level



Melting glaciers and warmer water temperatures cause sea levels to rise.

#### PART 4. HOW DOES NATURE REGULATE CLIMATE?

Most of the increase in global average temperature is due to the increase of certain gases in the atmosphere. The atmosphere is made up of many different gases—called **Greenhouse Gases** or GHGs for short—which occur from natural processes and are also produced by human activities. At their natural levels, these gases help regulate the temperature of the Earth and keep it at the right level. Producing too much of some of these gases can cause a change in natural processes that in turn causes the climate to change.

## WHAT IS THE GREENHOUSE EFFECT?

A **greenhouse** is a building made of clear glass or clear plastic walls and roof. This clear glass lets in light and heat from the sun and traps it inside the building, so plants can stay warm inside and grow during cold weather. The Earth's atmosphere acts like a greenhouse—trapping the light and warmth from the sun. This is why the process of warming the Earth is called the '**Greenhouse Effect**.'



The greenhouse effect is a natural process. It is how the atmosphere keeps the Earth warm. The atmosphere is formed by a layer of invisible gases that hold the sun's warmth in the atmosphere. Without those gases, the Earth would be a frozen planet; no life could survive. Both greenhouse gases and the greenhouse effect are good for the Earth in the right amounts. The right amount of GHGs allows the Earth to be just the right temperature to support life. But when human activities add more and more greenhouse gases to the atmosphere, the natural process is disturbed. More heat is trapped, and the Earth gets warmer.

This works just like a blanket: When you are in bed and feel cold, you cover your body with a blanket. The blanket traps the warmth of your body and keeps the air around you warm, so your body stays warm. With one blanket, some of the warmth stays close to you, and some of the warm air escapes. If you are still cold, you add more blankets. But if you add too many blankets, you get too hot because all the warm air is trapped, and your body gets warmer and warmer.

This is what is happening to the Earth right now. As more and more gases are sent into the atmosphere, they act like a thick blanket and trap too much heat close to the Earth, making the Earth get warmer.



*Figure 6. The Greenhouse Effect*

The greenhouse gases that make up the atmosphere have the capacity to retain solar energy (the warmth from the sun) and keep the Earth warm enough to make life possible.



*Figure 7. Human Impacts on the Greenhouse Effect*  
But, when there is a higher quantity of these gases in the atmosphere, the atmosphere retains more and more solar energy, and the earth gets warmer.



## WHAT ARE THE GREENHOUSE GASES AND HOW DO THEY AFFECT CLIMATE CHANGE?

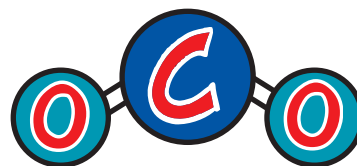
There are many greenhouse gases in the atmosphere. The most important one is **carbon dioxide** ( $\text{CO}_2$ ). This gas is produced when the substance carbon—found in all things on Earth—joins with the oxygen in the air. Trees and other plants take  $\text{CO}_2$  out of the atmosphere and store it. This reduces the amount of  $\text{CO}_2$  in the atmosphere. When plants die, or are burned, however, they emit that stored  $\text{CO}_2$  back into the atmosphere. Additionally, human activities, such as burning wood and driving cars, emit  $\text{CO}_2$  into the atmosphere.

The **carbon cycle** is the process by which carbon flows in and out of the atmosphere. This flow of carbon in the carbon cycle is one way nature regulates climate.

Carbon moves and flows through the carbon cycle in many different ways: for example, it is stored in trees, plants or other living things, then used and released as  $\text{CO}_2$  into the atmosphere by plants, trees, animals and humans through respiration or breathing. When a tree is cut down or burned, it also releases  $\text{CO}_2$  into the atmosphere. Oceans also play an important role in the carbon cycle by storing carbon.

### WHAT IS $\text{CO}_2$ ?

$\text{CO}_2$  is the result of joining carbon (**C**) with oxygen (**O**). It takes 1 part of carbon joining with 2 parts of oxygen to form the gas  $\text{CO}_2$ .



**C** The red **C** refers to the carbon stored in trees, plants, animals, and fuels.

This symbol refers to the gas carbon dioxide.

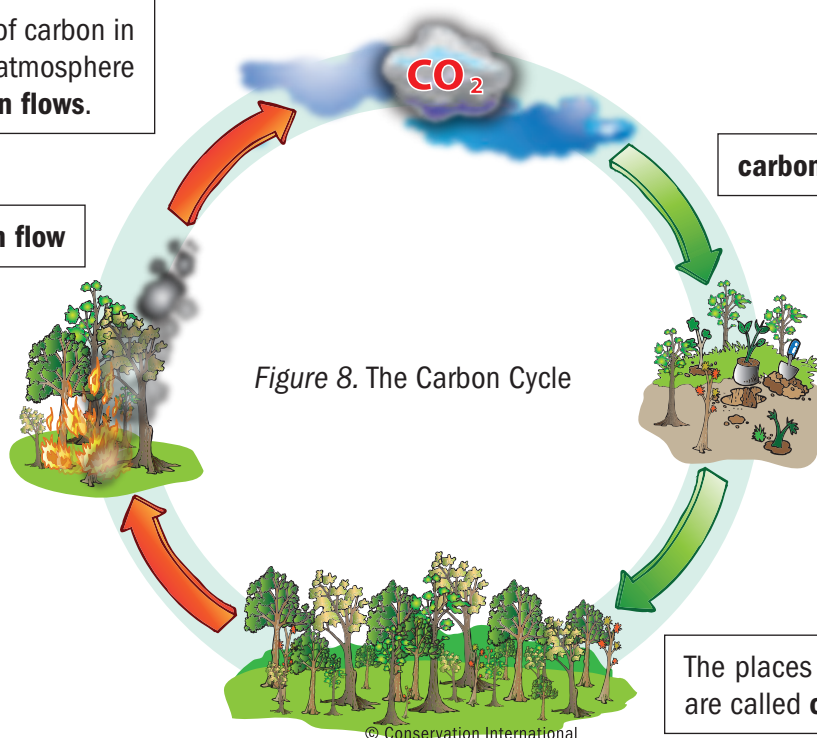


The movements of carbon in and out of the atmosphere are called **carbon flows**.

carbon flow

carbon flow

Figure 8. The Carbon Cycle



The places where carbon is stored are called **carbon reservoirs**.

The natural process of carbon moving or flowing between the different places where it is used and stored (reservoirs) is called the **carbon cycle**.

When there is too much carbon dioxide in the atmosphere, or too few trees to absorb it, this causes an imbalance to Earth's natural cycles. The release of  $\text{CO}_2$  into the atmosphere through human activities is the greatest GHG contributor to climate change. Most efforts to stop climate change focus on reducing the amount of  $\text{CO}_2$  we emit in the atmosphere.

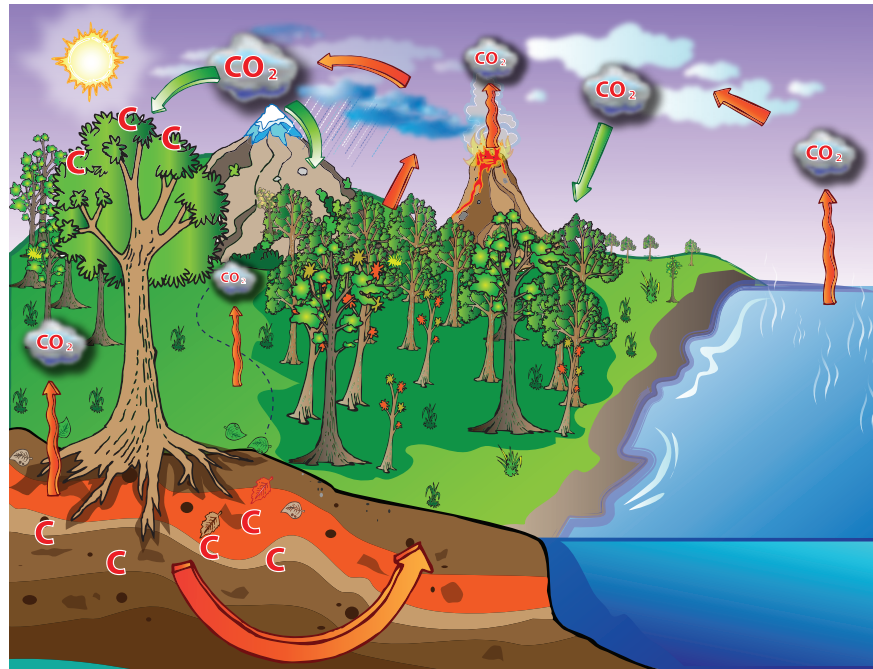
Other important greenhouse gases include:

- **Methane ( $\text{CH}_4$ )**: comes from animal droppings and wetlands, as well as human activities such as rice cultivation
- **Nitrous oxide ( $\text{N}_2\text{O}$ )**: comes from fertilizers and also from burning plants.

## PART 5. HOW DO HUMAN ACTIVITIES CAUSE CLIMATE CHANGE?

The main reason the climate is changing is that human activities are disturbing the balance of Earth's natural processes and cycles—like the greenhouse effect and the carbon cycle—by putting more and more  $\text{CO}_2$  emissions into the atmosphere.

Almost every single human activity releases some  $\text{CO}_2$  into the air, but some activities—such as burning fossil fuels in industry, the use of motor vehicles, deforestation and fires—release large amounts:



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Figure 9. The Natural Carbon Cycle

Carbon flows in and out of the atmosphere through natural processes and is stored in reservoirs.



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Figure 10. Human Impacts on the Carbon Cycle

Human activities can produce more  $\text{CO}_2$  in the atmosphere (industry and fires) and can also reduce the amount of  $\text{CO}_2$  pulled out of the air and stored (cutting down forests). This disturbs the natural process of the carbon cycle.



## BURNING OF FOSSIL FUELS (PETROLEUM, NATURAL GAS)

Motor vehicles and manufacturing industries use large amounts of fossil fuels (oil, natural gas and coal). Electricity is also often produced by burning fossil fuels. These fuels all contain high amounts of carbon that turns into carbon dioxide and goes straight to the atmosphere when the fuel is burned.

## DEFORESTATION AND LAND-USE CHANGE

Changes in the way land is used affects the amount of greenhouse gases in the atmosphere. Deforestation—cutting down or burning of forests for commercial timber, agriculture, or livestock grazing—causes 20 to 25 percent of GHG emissions. Changing natural ecosystems into areas for agriculture or pasture often changes an area of high carbon storage, such as a forest, into a low storage area, such as a pasture, reducing the amount of CO<sub>2</sub> pulled out of the atmosphere.

**Fossil fuel** is the term for fuel that is formed inside the earth over a long time from decaying plants and other organisms. Examples are oil, coal, and natural gas.

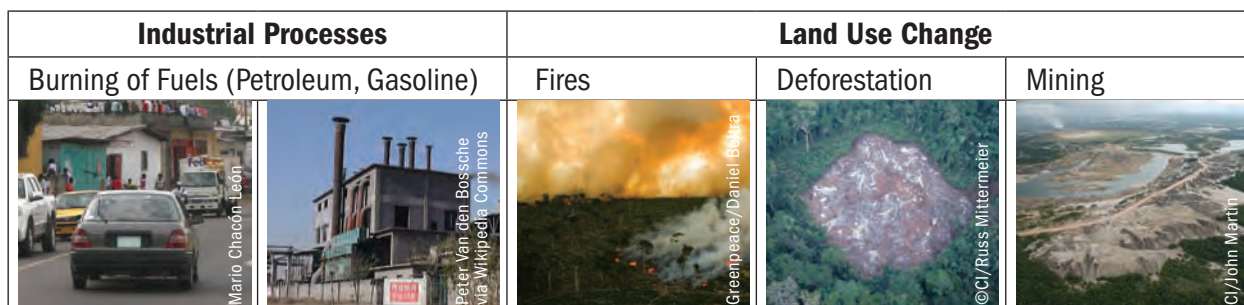
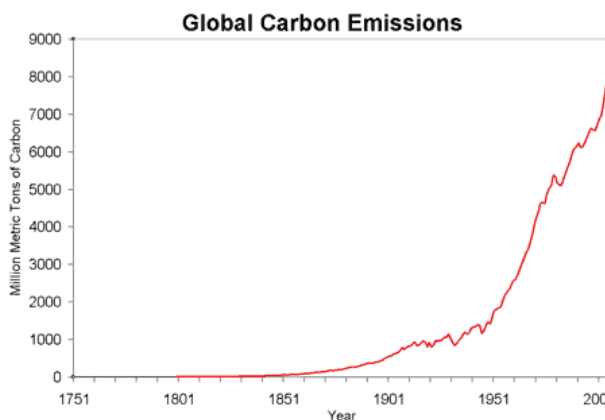


Figure 11. Industrial Processes and Land Use Change Cause CO<sub>2</sub> Emissions and Reduce Carbon Storage

Reducing the amount of fossil fuels used in industry and motor vehicles and stopping deforestation will reduce the amount of carbon that is sent into the atmosphere. Planting trees or reforesting areas that have already been cleared will add new trees to remove and store more carbon from the air. These activities can help restore the balance of the Earth's natural processes and stop climate change.

The **Industrial Revolution** is called a turning point in human history. It began in the late 1700s with the invention of machines that replaced human manual labor. By the mid 1800s, the use of machines was increasing rapidly. These machines were powered by coal and other fossil fuels. The Industrial Revolution brought many benefits to people's daily lives, but it also dramatically changed the impact of human activities on the world. With mass production and the increased use of fossil fuels, more greenhouse gases were released into the atmosphere. The invention of electricity and motor vehicles increased greenhouse gas emission even more. Technology must be used in a sustainable way to avoid increasing the effects of climate change.



## PART 6. HOW DOES CLIMATE CHANGE AFFECT THE EARTH AND OUR LIVES?

Climate change is already affecting the land, the forests, water resources, ocean levels, animal behavior, crop production, and many other things on Earth and will continue to do so for years to come. If we want to survive on this Earth in the future, we need to stop activities that are causing climate change and learn to adapt to new ways of doing things.

### IMPACTS OF CLIMATE CHANGE ON THE NATURAL WORLD

Nature and ecosystems rely on having the right amount of heat, water, wind and currents to survive and provide ecosystem services. Ecosystems need dependable seasons to stay healthy and maintain the services they provide. If it is too hot for too long, plants die, animals go thirsty and eventually entire forests, grasslands, lakes, and rivers will be affected. If there is no rain for a long period, plants and animals will suffer. If the rain comes too quickly, it can flood an area and kill plants and animals. Over time, if seasons become shorter or longer, some plants and animals will survive while others will die. For example, a forest in an area that is getting hotter and drier may stay a forest, but it might have different trees and animals that can survive better in the new, warmer and dryer climate. Below are some of the impacts that climate change will have on the ecosystems and the natural world:

- **Drought**—Forest fires, water scarcity
- Floods – Erosion, water contamination
- Heat waves and cold spells—Disruption of pollination cycles, pest outbreaks, damage to animals and plant life
- Less predictable seasons—Disruption of pollination cycles, disruption of mating cycles, changing plant and animal life able to survive in the ecosystem
- **Ocean acidification**—Oceans become more acidic as they absorb excess CO<sub>2</sub> from the atmosphere, making it hard for marine organisms with shells to survive. Since coral reefs are formed by these types of organisms, ocean acidification destroys both the habitat and food supply provided by the coral reef ecosystem.

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It is difficult to predict exactly how much of an impact **ocean acidification** will have in the long-term, but scientists have already noticed some of its negative effects: too much acidity can make it hard for marine creatures such as clams and oysters to grow shells. Ocean acidification also affects the tiny creatures (phytoplankton and zooplankton) eaten by some whales and fish, which can impact the whole food chain, reducing the amount of fish available for people to eat and sell. Ocean acidification makes it hard for coral reefs to grow their skeletons, and thereby reduces their ability to provide food and habitat to many other marine species, which will also reduce the availability of fish to eat and sell. This can also have a negative impact on tourism as a source of income, as the variety and number of fish found in the reefs will decrease.

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### IMPACTS OF CLIMATE CHANGE ON PEOPLE

When ecosystem services are harmed by climate change, so are people, who may not be able to get the services they need from those ecosystems. Floods, drought and extreme heat or cold also damage agriculture, homes and businesses, and cause health problems and death in human populations. Climate change can also create new opportunities in some areas. Warmer temperatures or increased rainfall may bring longer growing seasons and higher crop yields that improve the food supply. Climate change affects different parts of the world in different ways.

Below are some of the regional impacts of global change forecast by the Intergovernmental Panel on Climate Change (IPCC)<sup>7</sup>:

- **North America:** Decreasing snowpack in the western mountains; 5-20 percent increase in yields of rain-fed agriculture in some regions; increased frequency, intensity and duration of heat waves in cities that currently experience them.
- **Latin America:** Gradual replacement of tropical forest by savannah in eastern Amazonia; risk of significant biodiversity loss through species extinction in many tropical areas; significant changes in water availability for human consumption, agriculture and energy generation; rising mountain temperatures causing glaciers to melt glaciers and threatening water supplies.
- **Europe:** Increased risk of inland flash floods; more frequent coastal flooding and increased erosion from storms and sea level rise; glacial melting in mountains; reduced snow cover and winter tourism; extensive species losses; reduction of crop productivity in southern Europe.
- **Africa:** Increased scarcity of water that will affect between 75 and 250 million people by 2020; reduced yields from rain-fed agriculture up to 50 percent in some regions by 2020; severely compromised agricultural production, including access to food.
- **Asia:** Decreased availability of fresh water in central, south, east and southeast Asia by the 2050s; increased risk of flooding to coastal areas; increased death rate from disease associated with floods and droughts in some regions.
- **Australia and Pacific Islands:** Increased risk of death to coral reef organisms (called coral bleaching); increased risk of flooding in some regions; possible increased pasture productivity.

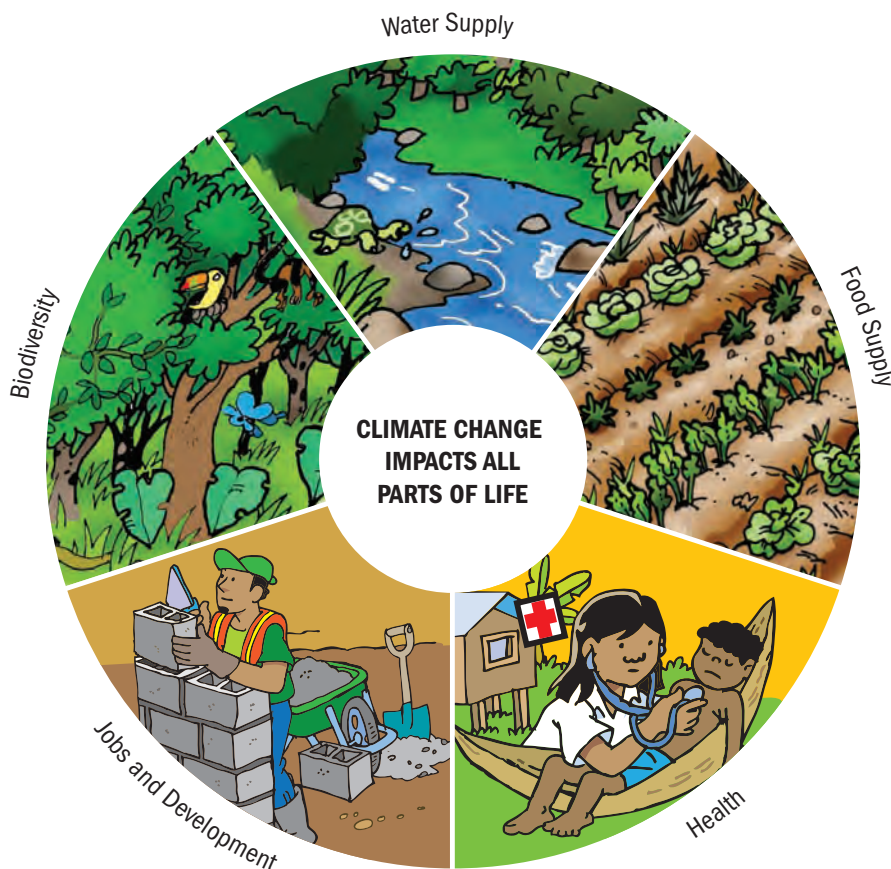


Figure 12. The Impacts of Climate Change

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## IMPORTANT THINGS TO REMEMBER:

- The Earth is a living planet formed by rocks, minerals, soils, water, gases and living organisms.
  - Climate is a complex process that is determined by how the sun, atmosphere, land, water and winds work together.
  - Climate change is the change of normal weather patterns around the world over a long period of time. The average temperature of the Earth is getting warmer.
  - The climate is changing faster than in the past. Climate change is not happening in the same way everywhere.
  - Scientists are observing and measuring climate change, and people are experiencing the effects of climate change now.
  - Climate change impacts all parts of life.
  - Greenhouse gases and the greenhouse effect are both part of natural processes that support life on Earth by keeping it warm.
  - CO<sub>2</sub> is the most important GHG: When there is too much CO<sub>2</sub> in the atmosphere, the Earth gets warmer and the climate changes.
  - Human activities can cause climate change by adding too much CO<sub>2</sub> to the atmosphere and upsetting the natural carbon cycle.
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## KEY TERMS TO REMEMBER:

**Atmosphere:** The atmosphere is the part of Earth that begins at the surface and extends upward into outer space in many layers. It is composed of a mixture of gases. Most processes that affect life on Earth happen in the lowest layer of the atmosphere, nearest to the Earth's surface.

**Carbon:** One of the most common elements in the universe, found in all living things.

**Climate:** The "average weather" or weather conditions that happen over a long period of time.

**Climate change:** The change of the normal weather patterns around the world over a long period of time.

**Climate variability:** Natural changes within the climate system that often occur in cycles or in particular areas over seasonal or longer time periods.

**Earth's poles:** Areas at the far north and far south of the Earth. Also called the "polar regions."

**Evaporation:** The process in which water is heated and changes from a liquid into a gas. The sun heats water in lakes, rivers or oceans, causing it to evaporate or turn into a gas called water vapor.

**Fossil fuel:** Fuel such as oil or coal that is formed inside the earth from decaying plants and other organisms over a long time.

**Glacier:** Layers of permanent ice found in very cold areas, either on land (i.e. in the polar regions) or on mountains at high elevations. Sometimes glaciers extend into the ocean.

**Global warming:** The increase in the average temperature of the Earth's atmosphere.

**Greenhouse effect:** The process of how the atmosphere keeps the Earth warm.

**Greenhouse gases:** The gases that help regulate the Earth's temperature, keeping it warm.

**Land-use change:** Changes in the way a land area is used, for example, changing a forest to a farm, or changing farms to pasture, or returning pasture to forest by re-planting trees.

**Ocean currents:** Movement of the ocean's surface water. Water is moved mainly by wind in regular, consistent patterns.

**Ocean acidification:** The change to the ocean water caused when increasing amounts of carbon dioxide (CO<sub>2</sub>) are absorbed from the atmosphere. This combines with the water (H<sub>2</sub>O) and increases the amount of carbonic acid in the ocean.

**Photosynthesis:** Natural process in which plants take in the light and heat from the sun and carbon dioxide from the air, and release oxygen to make plants grow and keep our air clean.

**Precipitation:** Rain, snow, or hail (ice) that forms from the moisture in the atmosphere and falls to the ground.

**Sea level:** The height of the ocean's surface

**Volcanic eruptions:** Volcanoes are mountains formed over openings in the Earth's surface by melted rock that flows out of the Earth's surface and hardens. When a volcano erupts, melted rock, called lava, flows out of the mountain, and ash and gases are forced into the atmosphere.

**Weather:** The temperature, rainfall, or storms in a specific place on a specific day or over a very short period of time, like one season.





## SESSION 3. CLIMATE CHANGE POLICIES AND ACTION: WORKING TO SOLVE THE PROBLEM OF CLIMATE CHANGE

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### LEARNING OBJECTIVES

At the end of the session, participants should be able to:

- Understand how international agreements on climate can support local efforts to adapt to climate change
- Understand how countries are working together to make policies and take action on climate change at the United Nations Framework Convention on Climate Change (UNFCCC)
- Understand some of the ways indigenous, international and local organizations are working on climate change
- Define mitigation and some of the ways climate change can be slowed
- Define adaptation and describe some ways communities are adapting to the impacts of climate change
- Understand how funding to help communities adapt to climate change is being distributed by international organizations

This session will cover some of the ways countries are working together in international organizations to solve the problem of climate change. This information is important because some of the decisions made in these international organizations can help communities lessen climate change and lessen the ways that it will affect them and their ecosystems.

### PART 1. CLIMATE CHANGE POLICIES: WHAT IS THE INTERNATIONAL COMMUNITY DOING TO SOLVE THE PROBLEM OF CLIMATE CHANGE?

Climate change is caused by emissions from many countries, and its impacts will be felt by many countries.

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A **policy** is a guiding principle that directs decision-making and planning to achieve specific results. For example, governments around the world are making national policies to reduce greenhouse gas emissions as a way to slow down climate change. To achieve this policy, the country may plan to reduce its use of fossil fuels in industry.

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Thus, it is a global problem, and the most effective solutions will come from countries working together for a common cause.

Countries around the world have also formed international organizations to work together on international policies for many important issues, including climate change. The organization that leads international policy-making is the **United Nations (UN)**, which includes 193 countries—almost every country in the world.



In 1994, countries within the UN committed to work together within the **United Nations Framework Convention on Climate**

**Change (UNFCCC)** to create climate change policies. Nearly every country in the UN is also a member of the UNFCCC. The UNFCCC holds important meetings each year. Every country that is part of the UNFCCC sends **delegates**—people to represent their country's concerns—who participate in making decisions on climate change.

Non-governmental organizations (NGOs), private businesses, and groups with special interest, such as indigenous peoples' organizations,

also attend UNFCCC meetings as **observers**

to make their opinions heard and to influence decisions. **But only the government delegations make the decisions at the UNFCCC.**

The UNFCCC is working on two important aspects of climate change policy right now:

- Policies to help countries stop or slow down climate change (**mitigation**)
- Policies to help countries adjust to the current and future impacts of climate change in their countries (**adaptation**)

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Within the UNFCCC, countries around the world discuss and take action on solutions for climate change. Within the UNFCCC, governments

1. Learn and share information on greenhouse gas emissions, national policies and best practices
  2. Set up and introduce national strategies for slowing greenhouse gas emissions<sup>1</sup>
  3. Share information and research on how to adapt to the impacts of climate change such as sea level rise, droughts and flooding<sup>2</sup>
  4. Help countries make plans to adapt to climate change, and provide funds and technologies to developing countries to carry out these plans
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These policies help governments create plans, encourage research, and provide countries with funds and technologies to put these policies and solutions in place.

When people take action to **mitigate**, they are contributing to a global effort to stop or slow down climate change. When they take action to **adapt**, they are working to solve the local impacts of climate change and to prepare for future impacts climate change may have on their community.

## WHAT PROGRESS HAS BEEN MADE IN THE INTERNATIONAL NEGOTIATIONS?

The most important agreement made by the UNFCCC is the **Kyoto Protocol**. In this agreement, 37 industrialized countries promised to reduce greenhouse gas **emissions** and to look for new ways to create energy that cause less CO<sub>2</sub> emissions. These countries also agreed to transfer technology and funds to help developing countries to mitigate climate change, and to help them adapt to the current and future impacts of climate change.

Countries promised, or made commitments, to take these actions in a specific period of time—a **commitment period**. The Kyoto Protocol's first commitment period was 2008 to 2012. The second commitment period is 2013 to 2020. There are several important issues under discussion for the next commitment period:

- Reducing the amount of CO<sub>2</sub> and other gases released into the atmosphere
- Stopping deforestation
- Improving forest management and forest conservation
- Improving agricultural practice
- Protecting communities from rising sea levels
- Creating national adaptation plans
- Supporting developing countries that are facing impacts too serious for adaptation to be effective—such as the possible relocation of populations of small island nations threatened by sea level rise.
- Finding ways to provide expertise, technology and funding to pay for these actions.

## HOW DO NATIONAL GOVERNMENTS ENGAGE IN INTERNATIONAL CLIMATE POLICY?

Every country has its own unique environmental, social, and economic situation and must consider the ways that climate change will specifically impact its own people when it negotiates in the UNFCCC. With so many different countries involved, it is a challenge for them all to agree. **But in the UNFCCC, every country must agree in order for a decision to be made.**

Even though each country has its own views and concerns, some countries share similar interests and often work together to reach a final decision that is in their best interest. (See box to the right.)

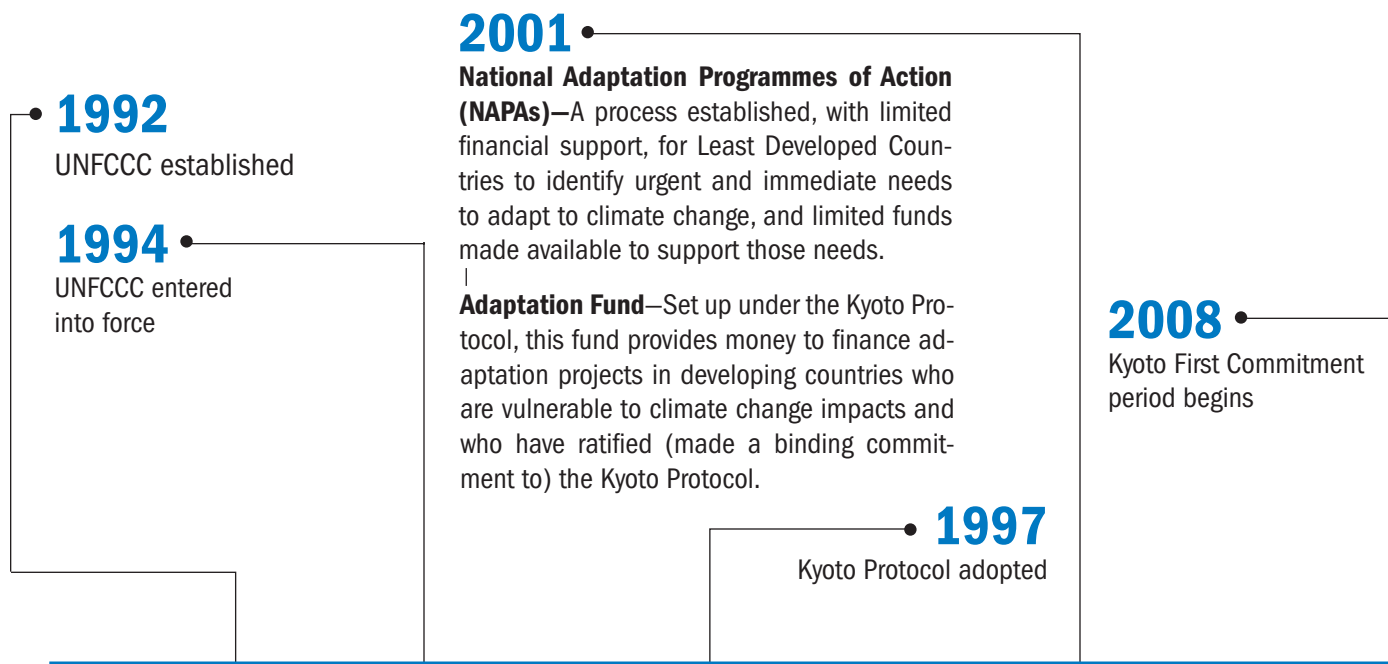
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### GROUPS OF COUNTRIES WITH COMMON INTERESTS WORKING ON CLIMATE CHANGE:

- Many small island nations work together through the Alliance of Small Island States (AOSIS).
  - Forty-nine of the poorest countries who are also very vulnerable to climate change impacts—called the Least Developed Countries (LDCs)—work together to promote higher mitigation goals to stop or lessen climate change, and increased resources for adaptation.
  - A number of developing countries have formed a loose coalition called the Group of 77 that frequently works with China to promote common interests.
  - The European Union negotiates as a group.
  - Several developed countries, including the US, Canada, Australia, New Zealand, Russia, and Japan, work together in the Umbrella Group.
  - The Rainforest Coalition, a group of 33 developing countries with tropical rainforests, works to address the impact of carbon emissions from deforestation.
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Figure 13. Timeline of Important Actions at the UNFCCC



**2006**

**Nairobi Work Programme**—Provides a platform for countries and organizations to share the work they are doing on adaptation; focuses on impacts, vulnerability and adaptation to climate change. Established at the UNFCCC meeting in Nairobi, Kenya.



**2007**

**Bali Action Plan**—Creates a new negotiating process to make decisions about what will be in the next major agreement after the Kyoto Protocol. Adopted at the UNFCCC meeting in Bali, Indonesia.

The concerns often shared by developing countries include:

- concerns about the rising impacts of climate change
- threat of climate change to their economies
- need for significant mitigation action by developed countries
- support for adaptation to climate change.



**2009**

**Copenhagen Accord**—Puts forth important points for a future agreement and outlines basic commitments to reduce emissions and long-term funding plans to stop climate change. Committed to by countries with major economies and recognized but not adopted by the UNFCCC in Copenhagen, Denmark.  
**Adaptation Fund Operationalized**



**2012**

Kyoto First Commitment period ends, Doha Climate Gateway

**2020**

Kyoto Second Commitment period ends



**2010**

**Cancun Agreements**—Historic agreements that address comprehensive international action on climate change, including Loss and Damage and **National Adaptation Plans** (NAPs), which are more flexible and have a longer-term view on adaptation planning than the NAPAs. Adopted at the UNFCCC meeting in Cancun, Mexico.



**2011**

**Durban Platform**—Agreement by all countries in the UNFCCC to work toward an international agreement with commitments by both developed and developing countries with a tentative deadline of 2015. Enhances the Bali Action Plan and Cancun Agreements.

The concerns shared by developed countries often include:

- the impact of climate mitigation on their economies and trade relationships
- how to obtain and distribute funding for adaptation.

Those concerns change over time, so a country's position in the negotiation can also change. In the UNFCCC, decisions are made based on continual discussion and negotiation. Developing and developed countries

know that they need to work harder to come to agreement. Developed countries have agreed that they must take action on climate change and support developing countries. However, exactly how that will be done is still being discussed.

### WHAT ARE GOVERNMENTS DOING IN THEIR OWN COUNTRIES?

Governments around the world are making new national policies that will lessen climate change and also allow their countries to grow and be strong economically. While much remains to be done, many developed countries are working to reduce their emissions and lessen the impacts of climate change. Developing countries are working on **development** plans that do not increase greenhouse gases and help prepare for the impacts of climate change. Many countries are assessing the potential impacts of climate change on their land and people and starting adaptation actions.

### HOW ARE INDIGENOUS PEOPLES CONTRIBUTING TO INTERNATIONAL POLICY ON CLIMATE CHANGE?

Indigenous peoples' organizations around the world send representatives to the UNFCCC and other climate meetings to influence decisions. They work to ensure the rights of indigenous peoples—as defined in the **United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)** and other international agreements—are respected in decisions on climate change. Some countries' official delegates to the UNFCCC include indigenous peoples' representatives.

Indigenous peoples also participate in the **United Nations Permanent Forum on Indigenous Issues (UNPFII)**. (A **forum** is a place where people discuss specific issues.) This forum has the mandate from the United Nations to discuss economic and social development, culture, the environment, education, health and human rights as they relate to indigenous peoples.

Indigenous peoples and local communities also make important contributions to climate change policies and planning in their own countries and communities by sharing their traditional practice and their knowledge of the land, forests and nature. They also help manage forests, fisheries and other natural resources and ecosystems, so that these remain healthy over a long time.

### WHAT OTHER INTERNATIONAL POLICY EFFORTS ARE IMPORTANT FOR CLIMATE CHANGE ADAPTATION?

Although the UNFCCC is the most important group making policies on climate change and adaptation, several other conventions or groups are important as well:

- The **UN Convention on Biological Diversity (CBD)** works to conserve biological diversity (plant and animal species) to ensure both long-term and equitable benefits. As species and ecosystems can easily be harmed by climate change, this agenda is relevant to adaptation.



Ms. Simona Gómez Lopez, indigenous representative from Mexico, speaks at COP 16 in Cancun.

- The UN **Convention to Combat Desertification (CCD)** attempts to reverse and stop land desertification (process of land turning into desert, by becoming drier and losing plant and animal life) and reduce the economic and environmental impacts of drought. As droughts caused by climate change may speed up desertification, this issue is relevant to adaptation.
- The **Ramsar Convention** works to conserve wetlands and promote their use in a way that keeps their long-term economic, scientific and cultural benefits.
- **Global Facility for Disaster Reduction and Recovery (GFDRR)** is a group of countries and organizations that works to bring strategies for reducing the risk of disaster and adapting to climate change together with development plans.

## PART 2. MITIGATION AND ADAPTATION ACTION: HOW CAN INTERNATIONAL POLICY HELP TO REDUCE CLIMATE CHANGE?

### WHAT IS MITIGATION AND MITIGATION ACTION?

Climate change mitigation is the process of reducing greenhouse gas (GHG) emissions caused by industrial activities, forestry and agricultural activities. Reducing GHGs in the atmosphere will require looking at every aspect of a country's economy to reduce human activities that cause climate change.

For example, vehicle manufacturers are working to design cars that use less fuel or that can run on electricity. These cars will emit less CO<sub>2</sub> and help reduce the amount of GHGs in the atmosphere. Sustainably managed forests help reduce deforestation and increase amount of CO<sub>2</sub> pulled out of the atmosphere.

Some examples of mitigation actions are:

#### From the Energy Sector:



More efficient electrical equipment like solar panels to provide electricity

#### From the Transportation Sector:



Fewer cars and more public transportation, cars that use biofuel or electricity instead of gas

Figure 14. Mitigation Actions in Different Parts of Daily Life



## From the Forestry and Agricultural Sectors:



Reforestation—planting new trees



Avoiding deforestation, or cutting of trees



Improved management of forests



Improved crop and pasture management to increase carbon storage in the soil

Figure 14. Mitigation Actions in Different Parts of Daily Life

## WHAT IS ADAPTATION AND ADAPTATION ACTION?

### WHAT IS ADAPTATION?

**Adaptation** is changing the way of doing something because of new conditions. As the climate is changing, plants, animals and people will need to adapt to new weather conditions, rising sea levels and other impacts from climate change.

Imagine people who live in cities or villages right next to the ocean. If the sea level rises too much, flooding will increase, and houses and streets will be under water. One way to adapt is to build houses on poles, so the water can run underneath them, or to move buildings to higher ground. This is a way of **adapting** to sea level rise and more flooding.

Some examples of adaptation actions are:

### **From the Energy Sector:**



Restoring wetlands in mountain areas to provide water to run electric plants

### **From the Transportation Sector:**



Building roads on higher ground and with protective barriers (mangroves, sea walls, levees) to avoid flooding and erosion.

### **From the Fisheries Sector:**



Reducing pollution of coral ecosystems to make them healthier and better able to survive temperature increases in sea water.

### **From the Fresh Water Sector:**



Restoring key watershed ecosystems to protect the water supply for communities and biodiversity.



#### From the Forestry Sector:



Creating plans to manage forests that include removal of invasive species and fire management.

#### From the Agriculture Sector:



Protecting and restoring wetlands to provide water and keep air temperature cooler for crops. Planting shrubs and trees along with crops to create shade and keep moisture in the soil.

Figure 15. Adaptation actions by sector

### WHAT ARE COUNTRIES DOING ABOUT ADAPTATION?

Climate change is already affecting people, and there will be more impacts in the future. Scientists and communities in many regions in the world are observing earlier melting of snow in the spring, higher sea levels, higher temperatures and changes in rainfall patterns. These changes affect how people live.

Governments of the Least Developed Countries most affected by climate change have made plans called **National Adaptation Programmes of Action (NAPA)** to help them adapt to these changes. These plans identify ways of living, and ecosystems in their communities that are the most at risk and develop actions to increase the community's ability to deal with, or adapt to, climate change. For example, in Bangladesh (a low-lying coastal country in south Asia) mangroves were restored to protect communities from flooding due to sea level rise.

At the UNFCCC in 2010, countries around the world agreed to support Least Developed Countries in creating **National Adaptation Plans**. Although similar to NAPAs, National Adaptation Plans have the benefit of looking at impacts from climate change and adaptation over a longer time period to improve adaptation action. (See Cancun Agreement on page 31.)

### PART 3. WHAT RESOURCES ARE AVAILABLE FROM THE INTERNATIONAL COMMUNITY TO SUPPORT ADAPTATION?

Resources to support adaptation and help countries deal with the impacts of climate change are available through several sources. The **Global Environment Facility (GEF)** is an independent financial organization made up of 182 countries who work with international institutions, non-governmental organizations (NGOs), and businesses on environmental issues, including climate change.

The GEF is the organization officially responsible for carrying out decisions made by the UNFCCC. The GEF collects money promised by developed countries to create financial mechanisms called funds that

transfer money to developing countries' governments or organizations working in those countries. The GEF has several funds that support climate adaptation in developing countries:

- The Least Developed Countries Fund
- The Special Climate Change Fund
- The Adaptation Fund—created as part of the Kyoto Protocol. It consists of taxes on mitigation projects that the GEF collects and gives as grants to developing countries for adaptation projects

The GEF also has a Small Grants Program that can provide resources for adaptation action in communities.

Adaptation funding is also available through grants from other sources, such as developed country governments, private companies and NGOs.

Adaptation has become more important in the UNFCCC, as climate change impacts become more and more likely to interfere with human development and well-being. The UNFCCC is working to ensure funding is available to help communities adapt to climate change and to share lessons learned from adaptation action across the world. While this international negotiation process may result in funding, technical resources and information, protecting communities and adapting will require more than international support. It requires concern, action and the long-term support from national and local governments and from the communities themselves.

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## **IMPORTANT THINGS TO REMEMBER:**

- The United Nations Framework Convention on Climate Change (UNFCCC) is the international organization that brings countries together to make policies about climate change.
  - Only country governments can make decisions about policies at the UNFCCC, but many other organizations attend meetings to observe and influence decisions.
  - Countries with similar interests often work together to promote policies that are in their best interests.
  - Countries implement UNFCCC climate change policies and also develop their own national plans to address climate change.
  - Indigenous peoples' organizations, NGOs and businesses work to influence decisions at the UNFCCC.
  - Under the Kyoto Protocol, developed countries agreed to reduce GHG emissions and to help developing countries mitigate and adapt to climate change.
  - Mitigation actions help stop or lessen climate change.
  - Adaptation actions help countries adjust to current or future changes caused by climate change.
  - Funding, mainly from developed countries, is available through the Global Environmental Facility (GEF) and other sources to help mitigation and adaptation action in developing countries.
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## KEY TERMS TO REMEMBER:

**Adaptation:** A change in the way of doing something. In the case of climate change, it involves addressing and adjusting to climate impacts. Because the climate is changing, plants, animals and people need to adapt to new conditions.

**Delegates:** People who represent a government or organization and have the authority to speak or vote for that organization.

**Convention:** A formal agreement (or treaty) between the people or groups who have signed it. It serves as a foundation for further discussions and treaties on specific issues.

**Ecosystem:** A group of plants, animals and microorganisms that live together in a specific place in a particular environment that enables them to survive.

**Ecosystem services:** Benefits people obtain from ecosystems such as food, water and timber; services that control climate, floods, disease, waste, and water quality; cultural services that are a source of spiritual benefits and also enjoyment.

**Environment:** The external surroundings in which a plant or animal lives (for example soil, rocks and water) that affects its behavior and ability to live.

**Emission:** A substance discharged into the air. In climate change, the term refers to Greenhouse Gases sent into the atmosphere.

**Forum:** A place for open discussion on specific issues.

**Fossil Fuel:** Fuel such as oil or coal that is formed inside the earth over a long time from decaying plants and other organisms.

**Funds:** A financial mechanism to provide resources for activities to achieve goals. For example, the Adaptation Fund provides money to governments to pay for adaptation activities. Money is contributed to a fund by donations, pledges from country governments, taxes, or other sources.

**Mitigation:** The process of stopping or lessening climate change by reducing greenhouse gas (GHG) emissions that come from industrial activities, forestry and agricultural activities.

**Observers:** People who attend meetings or conventions to understand what is being discussed and to influence decision-makers, but who cannot negotiate or vote on proposed actions. Observers to the UNFCCC represent businesses, NGOs, indigenous peoples, and other organizations.

**Policy:** A guiding principle that directs decision-making and planning to achieve specific results.

**Protocol:** An agreement that outlines specific obligations or actions that countries need to take to implement the objectives of the convention.<sup>3</sup>

**Sustainable Development:** Development that meets the needs of the present while still preserving resources for future generations.



## SESSION 4. CLIMATE CHANGE ADAPTATION: UNDERSTANDING CLIMATE VULNERABILITY AND CLIMATE RESILIENCE

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### LEARNING OBJECTIVES

At the end of the session, participants should be able to:

- Understand adaptation and why communities need to think about adaptation
- Understand how climate change can impact communities
- Understand climate vulnerability and what makes a community vulnerable
- Define the exposure, sensitivity and adaptive capacity—three conditions that influence a community's vulnerability to climate change
- Understand the difference between resilience-based approaches and vulnerability-based approaches to adaptation
- Define the difference between local and external knowledge
- Explain how external and local knowledge can work together to help communities adapt to climate change
- Identify tools and approaches that communities can use to protect themselves from climate impacts

This session explains the concepts of climate vulnerability and climate resilience, and how understanding these concepts can help communities adapt to climate change. It explains what makes a community more likely to be harmed by the impacts of climate change and how communities can strengthen their ability to adapt. It also describes the type of knowledge, information and tools that help communities strengthen their ability to adapt to climate change.

### PART 1. WHY DO WE NEED TO CHANGE OUR BEHAVIORS AND ADAPT?

Even if all greenhouse gas emissions could be stopped immediately, climate change would continue for many years because CO<sub>2</sub> and other greenhouse gases stay in the atmosphere and the oceans for a very long time.

Climate change mitigation is very important. Reducing CO<sub>2</sub> and other greenhouse gas emissions in the atmosphere will gradually reduce the change to the Earth's climate. It will take a long time for the climate to return to normal, so until then, both people and ecosystems must adapt to a changing climate.

Adaptation is a change in the way of doing something. Adapting to a changing climate means that people, communities, businesses and governments will have to make changes to their activities to adjust to changes happening now and that will continue to happen until the Earth's natural processes that control climate are no longer affected by excess GHGs in the atmosphere.

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Many aspects of daily life are affected by climate change. Some changes are happening slowly; others are happening more quickly. Many areas of the world with colder climates are already noticing that sea ice is melting and less snow is falling. Closer to the equator, more powerful storms and longer periods of hotter weather are causing stronger floods and droughts. When changes in climate happen over a long period of time, people and ecosystems have enough time to adapt naturally. However, when climate change happens too fast, people, animals and plants cannot adapt naturally, so people will need to make decisions to change their behavior so that they can reduce the harm that climate change can cause them and the resources on which they depend.

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Although individuals can adjust their own behavior to new conditions, adaptation will be more effective on a larger scale if people work together within their communities and countries, and if countries work together.

Communities have important contributions to make to national and international decision-making about adapting to climate change. Including their knowledge and priorities is very important for successful adaptation action.

## **PART 2. HOW DOES CLIMATE CHANGE IMPACT COMMUNITIES?**

Communities have a long history of surviving in areas where the climate conditions are difficult and change often. They have learned over time to prepare and respond to changes from year to year in how they manage their crops, build their homes and live their lives.

But as climate change happens more quickly, changes to the natural world are happening faster and becoming harder to predict. To prepare, communities with strong, direct relationships with natural resources must understand how the climate is changing in their area and in the nearby mountains, lakes and oceans on which they depend.

### **CLIMATE CHANGE RISKS AND OPPORTUNITIES**

When people know that rains come at a certain time, where and when to expect storms, how hot it gets in the dry season, or how high the river usually rises in a storm, they know how to plan their farming, hunting and other livelihood activities. They know how weather patterns affect their lives. People know from experience that there may be differences in the weather each year. They have experience in how to adapt to minor changes in climate or weather. But when changes become more significant and unpredictable, it becomes more and more difficult to continue the same approaches to livelihood activities. Climate change is creating risks to community livelihoods and to the ecosystems that support them.

For example, in India the southwest monsoon typically begins at the start of June on the western coast and covers the country by mid-July, so communities plant according to this cycle. They are prepared to deal with slight changes in the weather that season, but if climate change causes the monsoon rains to come very early, or very late, then planning becomes very difficult. Crops may fail if they are not planted at the right time, or farmers may miss the time to plant altogether if they are away from the community at seasonal jobs. Communities are more likely to be harmed if the changes are unpredictable or unforeseen from year to year.

Climate change can also make natural hazards worse. A natural hazard is a danger caused by nature, such as an earthquake, a flood, or a severe storm that causes harm to people. Most communities have experienced natural hazards and have learned ways to prevent or lessen the harm that they can cause, although sometimes a natural hazard such as a hurricane or drought is so severe that harm cannot be avoided. Climate change will increase the severity and frequency of natural hazards in many regions and make it more difficult for communities to protect themselves and recover.

Climate change can also create new opportunities. Fish populations may move closer to a community, providing a new food source. In cooler climates, increasing temperatures may provide a better growing season for agriculture and less need for heating. Climate risks and opportunities will depend on the region and its climate and resources.

Tuna fisheries are one of the most studied ecosystems in terms of climate change. Scientists are working to understand how this species—which many people depend on for food and income—will change and move under new climate conditions. So far, studies suggest that tuna fisheries in the Pacific Ocean will not remain in the same locations as they are traditionally found. Over time, tuna will increase in the western area of the Pacific, and decrease in the east. This will present new fishing opportunities in Papua New Guinea and other areas. But, in the eastern Pacific where the marine ecosystem may no longer support tuna, people will no longer be able to depend on this fish for income or food. New livelihood options will have to be developed as part of climate change adaptation in these communities.

Remember that any significant change in the natural environment requires people to adapt. Even a positive change requires some adjustment. So adaptation planning is important whether climate change brings people new risks or new opportunities.





Climate Risks		Climate opportunities	
 Photo by Gila Brand	 © Cl/Jan Schöpper	 © Cat Holloway	 © Cat Holloway
Rivers may dry up.	Flooding may become more common.	Fish populations may come closer to land.	Temperatures may increase, providing a better climate for agriculture.

Figure 16. Climate Risks and Opportunities

### PART 3. WHAT ARE CLIMATE VULNERABILITY AND CLIMATE RESILIENCE?

Both ecosystems and communities can be vulnerable to climate change. Communities need to understand how they can be harmed by climate change and how they can protect themselves from harm and recover when harm cannot be avoided.



## WHAT IS CLIMATE VULNERABILITY?

People, communities and the ecosystem services they depend upon can all be vulnerable to climate change. Climate vulnerability is a term used to describe how much an ecosystem or a community can be harmed by the impacts of climate change. Climate vulnerability is defined by three main factors that make a community or ecosystem vulnerable: **climate exposure**, **climate sensitivity**, and **adaptive capacity**.

**Climate Exposure** refers to how likely it is that harmful climate impacts will happen in a particular region. This includes climate hazards, such as storms or floods, as well as other changes such as less rainfall or hotter temperatures. Storms, drought and flooding all occur from time to time, but when they occur more often or are more severe, the community's exposure to potential harm is increased. Climate exposure can be measured by collecting information about the region's history and past weather conditions such as temperature, rainfall, flooding and droughts, to see how the weather is changing over time. It can also help to use climate models (described below), which predict how the climate is likely to change in the future.

**Climate Sensitivity** describes how seriously climate change will harm a community—how much impact it will have on natural resources, specific livelihoods, or infrastructure (roads, houses, communication systems). If a community depends completely on farming or fishing for food and income and builds its houses at ground level, it is very sensitive, or likely to suffer damage from an unusually strong storm that destroys crops and fishing grounds and floods houses. Sensitivity can be determined by gathering information about how much a community depends on specific natural resources and ecosystems and how likely they are to be damaged by climate hazards.



**Adaptive Capacity** is a community's ability to cope with and recover from the impact of climate hazards and climate variability and to adapt to future climate impacts. Adaptive capacity is affected by the way a community is managed and the skills and knowledge available to that community. A community that is well organized, with strong skills, access to traditional and scientific knowledge and financial resources, and that manages its natural resources well and has a variety of ways to produce food and income has a strong adaptive capacity. It will be better able to recover from a strong storm or decreased rainfall than a community without these resources. Adaptive capacity can be determined by gathering information on community governance, resource management and livelihood systems, the resources it has, the health of its ecosystems, and how well it has recovered in the past from natural hazards and times of stress.



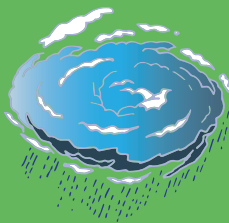
Table: Examples of Exposure, Sensitivity and Adaptive Capacity

<b>Exposure</b>	Sea level rise, number of hot days, annual rainfall, drought
<b>Sensitivity</b>	Drought tolerance of crops, level of flood-proofing of buildings, diversity of crops
<b>Adaptive Capacity</b>	Amounts of household savings, level of education, access to communications technology

To better understand the three factors defining vulnerability (exposure, sensitivity and adaptive capacity), consider the following scenario:

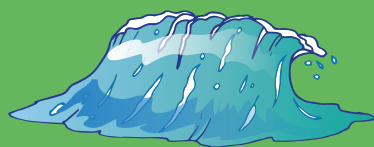
If a community is exposed to large decreases in rainfall but has a healthy watershed and a good reservoir for storing water, the lack of rainfall might not cause serious problems. Thus, even though the community is exposed to water shortages, it has less sensitivity to them, so it is less vulnerable. Its ability to manage its watershed is part of its adaptive capacity, so it will be able to recover quickly from damages. Another community without water reserves or a healthy watershed might have less exposure to decreased rainfall, but will still experience serious harm to important crops. Their sensitivity to any decrease in rainfall is higher which makes them more vulnerable to harm. Their vulnerability is increased because their adaptive capacity is weak—they do not have a way to manage their natural resources effectively. See the following page for an illustrated example.





**Exposure:** cyclones

**Exposure:** sea level rise

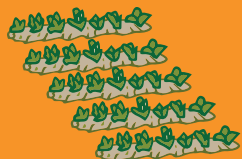


**Exposure:** storm surges

**Higher Sensitivity:** Houses at ground-level are **more likely to be harmed** flooding.



**Higher Sensitivity:** This community depends on only one type of crop for food and income.



**a more vulnerable community**

**Higher sensitivity:** This community does not have healthy natural resources to protect them from or help them recover from climate impacts.



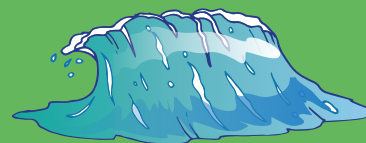
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**Exposure:** cyclones

**Exposure:** sea level rise



**Exposure:** storm surges

**Higher Adaptive Capacity:**  
This community has more than one source of food and income.



**Higher Adaptive Capacity:** Having access to stored water makes it easier for a community to recover when a climate event impacts the water supply.

**Lower Sensitivity:** Houses on stilts are less likely to be harmed by flooding.



**Higher Adaptive Capacity:**  
This community has well-managed natural resources, which can help them to recover from climate impacts.



## WHAT OTHER CONDITIONS AFFECT VULNERABILITY?

Non-climate factors can also affect how vulnerable a community is to climate change. Social and economic conditions, and the community's general strengths and weaknesses, all affect its vulnerability as shown by the examples below:

- Lack of important services such as health care, transportation, strong community leadership, and strong government reduces a community's adaptive capacity, making it more vulnerable.
- Lack of secure water and food supplies also increase vulnerability. If a community depends on one resource for food and income, it is more vulnerable than a community that has several livelihood options. For example, a fishing community is already vulnerable to loss of food and income if the health of their fishing grounds is weakened by pollution or overfishing. The marine ecosystem that supports the fisheries is more vulnerable to a change in climate, making the community more vulnerable.
- Lack of funding for adaptation planning and action can reduce a community's adaptive capacity and make it more vulnerable.

Although communities in many parts of the world are vulnerable to climate change, communities in developing countries are often the most vulnerable because they have less money and fewer resources for planning and protection. They often have limited sources of income, food, or shelter. This means they have low adaptive capacity. Communities that are vulnerable to climate change are often communities that were already struggling to maintain their standard of living and vulnerable without climate change. Their adaptive capacity is already low, and the increased threat of climate change lowers it even further.

It is also important to understand that all of the individuals in the same community are not equally vulnerable. For example, children and older people may be more sensitive to disease, are less mobile and generally require more assistance than others in times of crisis. The sensitivity and adaptive capacity of individual members of a community is not the same and adaptation plans and actions need to take this into consideration.

Examples of communities that are vulnerable to climate change include:

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**Kiribati**, an island nation in the Pacific Ocean, is made up entirely of small, low-lying islands. Most of the land is very close to sea level, so the country has high exposure to the impacts of rising sea levels. The ocean waters are slowly covering their island lands. This also increases the country's sensitivity to strong storms or the tsunamis, or large waves that can be caused by earthquakes. Also, the cost of investing in protective barriers such as mangrove reforestation or sea walls is very high, which weakens the country's adaptive capacity. Communities in Kiribati are considered to be some of the most vulnerable in the world to the impacts of climate change.

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The **Mbororo people of Western Chad**, in West Africa are nomadic—they move across the region from place to place with their livestock and rely on watering holes and water from Lake Chad. This makes them very sensitive to changes in water availability. They are also increasingly exposed to rising temperatures and reduced rainfall, which are reducing the size of Lake Chad and causing watering holes to dry up. The Mbororo have a weakened adaptive capacity, as they have no alternative water sources or other sources of income other than the sale of their livestock.

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## WHAT IS CLIMATE RESILIENCE?

Climate resilience is the ability of a community or ecosystem to recover quickly from a climate hazard and return to normal functioning. Understanding climate vulnerability requires understanding future climate events (**exposure**) and their impact on specific local activities (**sensitivity**). Understanding a community's climate resilience requires understanding the overall strengths and weakness of the community's structure and resources that help it to recover from any hazard or problem, including those caused by climate change, and maintain its structure and livelihoods. Climate resilience is about understanding how prepared a community is generally, for many different hazards, so it does not require specific information about climate impacts on a region. Understanding how to increase resilience is important for communities that do not have access to reliable information about expected changes in climate or where changes are becoming more unpredictable.



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However, if a community understands how it is vulnerable to climate change, it can plan actions or seek help to strengthen any weaknesses in its resilience (its ability to recover and return to normal functioning as a community).

A community that is healthy, with strong institutions, healthy ecosystems and well-maintained infrastructure is more resilient to any impact, whether it is the result of a changing climate or a change in social or economic conditions. In the case of climate resilience, a community with strong leadership, effective resource management, and access to food and water reserves has a higher resilience than one that does not have these resources and strengths and skills.<sup>1</sup>

The example of Andavadoaka, Madagascar, at the bottom of the page, illustrates how understanding vulnerability helped communities work with local authorities to increase their resilience.

## PART 4. VULNERABILITY-BASED PLANNING OR RESILIENCE-BASED PLANNING FOR CLIMATE CHANGE?

To increase its adaptive capacity and resilience, a community must:

- Understand how it is vulnerable to climate change
- Improve its access to resources
- Strengthen the skills needed to plan and adapt

Communities can better understand their climate vulnerability by combining local knowledge with information and resources on climate change from the international community. In this way, they can make adaptation plans for key aspects of livelihood and well being, such as fresh water, fisheries, agriculture, forestry and public health.

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### CASE STUDY: ANDAVADOAKA, MADAGASCAR



*Andavadoaka is a town located in south-western Madagascar, an island nation off the east coast of Africa. The community is located on the coast in a*

*sheltered bay surrounded by a coral reef that is part of one of the largest and most diverse reef systems in the Western Indian Ocean. Traditional fishing is the main livelihood in the area. Agricultural options are limited because soil is poor and there is not much rainfall. In recent years, fishermen have relied on catching octopus, sea cucumbers, and shells to sell internationally and for local demand. As a result, these resources from the sea are starting to decline.*

**Exposure:** Andavadoaka is exposed to cyclones—strong storms with heavy winds and flooding. Cyclone frequency and strength as well as flooding are likely to increase with climate change, as are seawater temperatures and sea level. Increased sea water temperature causes the organisms forming the coral reefs to die, affecting the productivity of the ecosystem and the fisheries it supports. Coral

## HOW DOES A COMMUNITY ADAPT WHEN THEY DO NOT HAVE ENOUGH INFORMATION ABOUT CLIMATE IMPACTS?

There are two approaches to climate change planning: vulnerability-based and resilience-based. A **vulnerability-based approach** requires information on current and/or future impacts from climate change to identify how a community is vulnerable. Often, however, a community doesn't have information about how its climate is changing or will change in the future. This is especially true in developing countries where there are not many weather stations, and governments often don't have money to invest in the tools and knowledge that would predict climate change. In these cases, communities can still prepare for climate hazards using resilience-based planning.

	Stronger Vulnerability Focus	Stronger Resilience Focus
<b>Characteristics of Planning Context</b>	High level of understanding of future climate and impacts	Low level of understanding of future climate and impacts
	High level of access to knowledge relevant to vulnerability	Low level of access to knowledge relevant to vulnerability
	Low level of existing viability	High level of existing variability
	High certainty	Low certainty
<b>Approach</b>	More focused on reducing sensitivity	More focused on improving adaptive capacity

reefs also protect the coastline from waves. Sea level rise is also likely to affect the freshwater supplies of the areas.

**Sensitivity:** People in the community rely almost completely on the sea and traditional fishing for food and income—primarily the octopus industry. Andavadoaka is difficult to reach—particularly during the storm season when roads cannot be used. There is little communication and no electricity. People move up and down the coast fishing along the whole reef system.

**Adaptive Capacity:** Because people in Andavadoaka spend all their time on activities for daily survival, they have little time to plan for the future. People in Andavadoaka are poor, with three-fourths of their income spent on food.

Education is low, and only half the community speaks the national language. Local governance and traditional beliefs are strong. Access to resources is regulated by a traditional system that is highly respected. People have a good understanding of the reef ecosystem and the importance of reefs for protection from storms, but they are not always aware of how their activities affect the health of the ecosystems.

**Building Resilience:** To increase the community's resilience, several marine protected areas (MPAs) were formed. These MPAs help the community manage its fisheries and marine resources better and will reduce biodiversity loss and prevent further reef damage. A healthier reef will recover from storm damage and other climate impacts more rapidly. The impact of the MPAs on the community's resilience to climate change is being monitored and observed.

## WHAT IS A VULNERABILITY-BASED APPROACH TO ADAPTATION PLANNING?

A vulnerability-based approach focuses on understanding how a community's resources and livelihoods are vulnerable to current and future impacts of climate change. It looks at a community's exposure, sensitivity and adaptive capacity. It identifies the specific impacts a community may face, and the management skills and livelihood resources the community has—or doesn't have—to deal with these impacts.

In a vulnerability-based approach to adaptation planning, the community asks the question, *'What are the livelihood activities and natural resources most likely to be harmed by climate events and climate change, and what should be done to protect them?'*

An example of a community taking a vulnerability-based approach comes from the Verde Island Passage in the Philippines:

In the **Verde Island Passage**, communities worked with scientists and the government to do vulnerability assessments. These showed that climate change could impact the community's fisheries, so the community developed fishing regulations and **marine protected areas (MPAs)** to better manage their use of the fisheries and protect them. They established sustainable fishing certificates, implementing no-take zones during certain seasons, and established programs to increase the population of certain important fish species by growing newly hatched fish. They looked at several impacts, including pollution and overfishing, that made their fisheries more sensitive and focused on climate impacts as a major element of the planning process.



## WHAT IS A RESILIENCE-BASED APPROACH TO PLANNING?

A **resilience-based approach** to adaptation planning examines the strengths and weaknesses of the community that will determine how well it can protect itself and recover from the impacts of climate change. The resilience-based approach builds on the characteristics of a community that are strong and will enable it to recover, and tries to strengthen those characteristics that are weak.

The resilience-based approach asks the question, *'What are the characteristics of a community that will help that community be strong given any kind of climate event or change?'*

When a community uses a resilience-based approach instead of a vulnerability-based approach, they do not need as much information about what is likely to happen from climate change in the future (their exposure). Instead they look more at how different climate events could impact them (their sensitivity) and how well they will be able to strengthen the resources that will increase their resilience against the impacts of climate change. This approach is useful when there is not enough usable information about how climate will change in the future.

One approach to resilience-based planning is diversification—making sure that the community does not rely on only one source for food or income (such as growing coffee or fishing). A community that is totally

dependent on a single crop is more sensitive to harm from a new threat (such as a pest or big storm) than a community that relies on two or more crops. A community is more resilient when it has several sources of food and income.

An example of resilience-based adaptation planning is occurring in South Africa:



Communities in the **Suid Bokkeveld in the Northern Cape Province of South Africa** have created a cooperative to manage and sell their Rooibos tea. They are working with a local NGO, the government and universities to create adaptive management plans so that their wild, organic tea will grow sustainably even though they are experiencing less rain and increasing temperatures. The communities did not know how much their rainfall was decreasing from year to year. To protect their tea crops from possible decreases

in the water supply and other climate hazards, the communities are planting windbreaks to protect crops from soil erosion and wind damage, and removing invasive plants which use a lot of the water supply. This frees water for their crops during times of low rainfall.

Communities may find that focusing on both vulnerability and resilience works best. As more information becomes available to a community, the approach they take to adaptation can change. For example, the communities in the Suid Bokkeveld, South Africa, discussed above, began recording weather information so that they would know more about what is happening on their lands. They increased their understanding of the patterns of droughts and how droughts could affect their crops more severely due to climate change. They also share the information they gather with other members of the cooperative to create potential adaptation strategies. The community is combining both a focus on vulnerability with a focus on building resilience.

## **PART 5. WHAT TYPES OF KNOWLEDGE AND TOOLS ARE IMPORTANT FOR COMMUNITIES WHO WANT TO ADAPT?**

Knowledge, information and tools can help decision makers in government and communities plan for and adapt to climate change. Both local knowledge (knowledge from inside the community) and external knowledge (knowledge from outside the community) have benefits and limitations. Effective adaptation planning should ideally make use of both types of knowledge to meet the needs of communities and decision-makers.

### **LOCAL KNOWLEDGE**

**Local knowledge** comes from within the community. It can come from local communities, indigenous peoples and local scientists:

- **Traditional knowledge**—Indigenous peoples living in tropical forests, coastal fishing areas and other ecosystems have their own wisdom, practices and traditions for managing natural resources that allow them to survive. This traditional knowledge has been learned over time and passed on from generation to generation.



- **Shared Experience**—Sharing successes and failures of different adaptation actions is very important for adaptation. The best solutions may not always be delivered in formal training.
- **Local scientific research**—Scientific research done in the region itself, or information from the region collected by the government is often more directly related to the community than research done outside the region. Local government officials often have access to the best weather information for their town, state or region. Local universities often do the best job combining science with traditional knowledge to understand how climate is changing in their region.

People living in tropical forests, coastal fishing areas, and other ecosystems have their own cultures, goals, and interests. Indigenous peoples and local communities have local knowledge, practices and traditions for managing the natural resources that allow them to survive. Indigenous peoples and other communities who depend on the forests or on fishing grounds are skilled at adapting to changes in natural conditions.

Below are three adaptation actions that indigenous peoples and local communities have taken in South America, the Asia-Pacific and Africa using local knowledge:

1. The Aymara peoples of Bolivia have problems getting enough water for their needs. They have developed a new way to collect water in the mountains by placing small dams along the mountain rivers. These dams have helped supply water for human needs, and also for livestock, especially in times of drought.<sup>5</sup>
2. In 1997, the gardens of many people in Papua New Guinea failed due to droughts and freezing weather, so the people used a number of traditional survival techniques. These included eating ‘emergency foods’ such as the part of banana plants closest to the ground, self-sown pueraria tubers and wild yam tubers.
3. In Burkina Faso, a country in Africa where drought has been increasing, farmers dig holes during the dry season to collect leaves, dead plants and manure. This decaying matter attracts termites, and when the rainy season begins, water collects in the tunnels that the termites create. This stores water and improves the soil for farming.<sup>6</sup>

## EXTERNAL KNOWLEDGE

**External knowledge** is knowledge that comes from outside the community. Examples of external knowledge include:

- scientific studies conducted in other regions
- information from experts or advisors from other countries, regions or communities.

External knowledge provides important information—data on expected changes to the climate, what impacts a community should expect, and what livelihood approaches will be most vulnerable to climate change.

External knowledge can be necessary to solve a specific problem, but this outside knowledge needs to be brought together with local knowledge in order to be useful to the community.

## HOW CAN LOCAL AND EXTERNAL KNOWLEDGE WORK TOGETHER?

External knowledge must be applied carefully in local communities. External information is important because it can show communities changes they may not have seen before, and it can help them understand what those changes mean for their well-being.

However, many times outside solutions are unsuccessful if local knowledge about the area is not also considered and respected. Even if the solution seems to be perfectly suited, it may not be successful if people

in the community do not participate in making the decisions and agree that the activities will meet their own needs and priorities.

Communities, scientists and governments need to work together, share information and create new ideas to observe and learn about how changes in climate will affect communities. Local knowledge combined with external knowledge and good planning can increase adaptive capacity and help communities be more resilient to the impacts of climate change. It is important that communities have access to information from outside of their communities. This information can allow them to look at changes they may not have seen before and discuss what these changes mean for their well-being.

There are many examples where external and local knowledge have been used together for adaptation planning and action:

- Scientists from universities, the Colombian government, and conservation NGOs worked with community members to understand the current and potential future impacts of changing rainfall and temperature on the availability of fresh water in the mountains and for the capital city of Bogota. After studying local knowledge and the best available climate models, they made an improved management plan for protected areas to restore the high mountain ecosystems that collect and absorb water and are necessary for a healthy watershed. Healthier grasslands and forests help protect and strengthen the watershed, even though it is being impacted by climate change. Thus it is better able to provide the freshwater flow needed for other ecosystems and human development.
- In Ethiopia, farmers use their radios to get seasonal updates on the timing and intensity of the rainy season. These updates are based on climate models and regional weather information from experts and help the farmers to determine when to plant and which crops to plant depending on how much rain they think will fall that season.
- In the Bagamoyo-Pangani and Menai Bay Seascapes of Tanzania in eastern Africa, outside experts worked with a coastal community to improve the health of their ecosystems and improve their resilience by improving coastal governance and restoring and building up natural resources. They restored coastal dunes, mangroves, wetlands and increased plants along rivers. These changes provided the community with diverse income and food options by strengthening fisheries and protecting the coast, thus improving their socioeconomic health as well as making them more resilient to the impacts of temperature changes.

Bogota Conservation Corridor  
reforestation project



CI/Olaf Zerbock

Ethiopia



© Robin Moore/ILCP

Menai Bay, Tanzania



© Robin Moore/ILCP

- In East Africa, scientists from Kenya's national weather department are working with a family of traditional "rainmakers" in western Kenya to make weather forecasts for local farmers that combine both satellite technology and traditional forecasting methods. The forecasts are broadcast over the radio in the local Luhya language.<sup>2</sup>

## TOOLS THAT HELP TO UNDERSTAND VULNERABILITY AND RESILIENCE

Many different tools and approaches can help increase a community's adaptive capacity. Some of the most important include climate monitoring, climate models, early warning systems and vulnerability assessments (a tool that will be discussed more in Session 6).

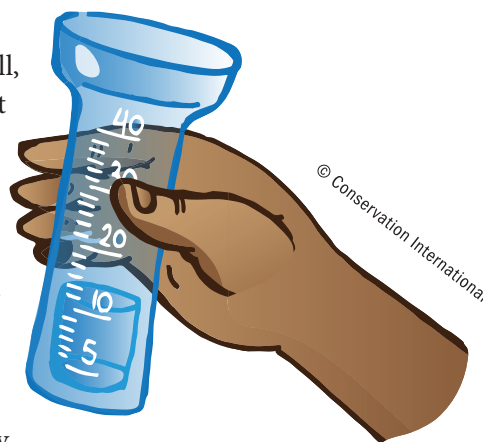


A senior rainmaker in the Nganyi community instructs an apprentice on a forecasting method.

### Climate Monitoring

Climate monitoring is observing different aspects of climate (rainfall, temperature, storms) to understand a community's past and current exposure to climate hazards.

Cultures all over the world have been monitoring and keeping track of climate information (rain, temperature, storms and sea level) for a very long time. In the last 60 years, scientists and many communities have been monitoring information about climate change, especially temperature and rainfall. Scientists are working on systems to collect this information that are consistent, reliable, and accurate, and can be used all around the world. Some climate monitoring is done by satellites, machines that circle around the Earth in space and collect information about large areas of the Earth. Some information comes from measuring devices in the ocean (called buoys) that record the temperature and height of the sea, as well as its currents. There are also monitoring stations in key locations, such as a famous CO<sub>2</sub> monitoring station in Mauna Loa, Hawaii, in the Pacific Ocean. Scientists began measuring the amount of CO<sub>2</sub> in the atmosphere there in 1958.



Some communities monitor their local climate by setting up rain gauges and thermometers and recording daily readings, both for their own use and to share with the scientific community.

Scientists share data to bring together historical climate information for the entire planet. This data helps us understand what our climate was like in the past, how it is changing now, and what it will look like in the future.

### Climate Models

Climate models are used to predict future exposure to climate change. Scientists take the data they collect on the atmosphere, greenhouse gases, oceans, land and ice and put it into computers to create different pictures, or climate models, showing what will happen to the climate in the future.

Different models are based on different predictions of how much greenhouse gas (GHG) emissions there will be and temperature changes caused by the levels of GHG in the atmosphere. Climate models show how rain patterns, temperature, sea level and storms might change in the future and how these changes will impact people and the environment.

Some of the more complicated models can take a long time to complete—models predicting climate scenarios for the next 30 - 50 years can take up to a year to run on large and costly computers. There are only a few specialized research centers in the world that create these models, and it is challenging to get the best models to countries, regions, and especially communities to use in their decision-making processes.

Climate models are useful for governments and groups involved in water management, farming and fisheries management to help them make adaptation plans for climate change and to understand the changes they are already seeing. One agricultural group, for example, uses climate models to predict regional yield for five crops: rice, wheat, maize, soybeans and groundnuts.

The quality of climate models is always improving, but these tools do have limitations. A climate model is an estimate of what is likely to happen in the future, but it does not predict exactly what will happen. To use models in adaptation planning, it is necessary to have a good record of the weather, scientific expertise and, in many cases, access to sophisticated computer equipment. One of the goals of the international climate policy discussions is to ensure that climate monitoring and models are available to more countries and communities around the world.

### **Early Warning Systems**

Just like a weather forecast will provide information about expected rainfall, storms, or very high temperatures, early warning systems inform people of likely flooding, heavy winds, and other weather events, so that they can prepare. In the case of climate change, early warning systems can warn communities about expected drought, increased exposure to malaria, forest fires, storms and floods. Information on expected weather patterns and rainfall helps farmers decide what crops to plant and helps communities know if they need to invest in mosquito nets and additional medicine, or in fire prevention. Early warning systems can be an important tool in climate adaptation by alerting communities and giving them enough time to put their planning into action.

### **Vulnerability Assessments**

A vulnerability assessment is a tool that helps a community analyze its adaptive capacity, identify potential risks from hazards (i.e. sensitivity), and develop plans to reduce their vulnerability to these risks. Climate vulnerability assessments are becoming more common, and involve both local and external knowledge to help communities determine their vulnerability to climate change and design a plan to reduce this vulnerability. Vulnerability assessments will be discussed in more detail in Session 6.



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## **IMPORTANT THINGS TO REMEMBER:**

- The climate is changing, and communities must be able to adapt to both the negative impacts and new opportunities that these changes bring.
  - Communities should try to understand their vulnerability to climate change by assessing their exposure, sensitivity and adaptive capacity.
  - Communities that are strong and manage their resources well are more resilient to climate change.
  - Communities can improve their resilience to climate change by diversifying livelihoods strategies, and protecting and strengthening the health of their natural resources.
  - With enough information on likely climate impacts in their region, communities can take a vulnerability-based approach to adaptation
  - With limited information on potential climate change impacts in their region, communities can take a resilience-based approach to climate adaptation
  - Local knowledge should be used together with external knowledge to help a community prepare for climate change.
  - There are a variety of tools available to communities to help them do adaptation planning and action.
-

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## KEY TERMS TO REMEMBER:

**Adaptive Capacity:** The ability to adjust to current and future changes caused by climate change and to acquire the skills and manage the resources needed to recover from the impacts of climate change.

**Climate Exposure:** The likelihood that naturally occurring climate events (such as storms or floods), or changes to climate conditions (such as less rainfall, or hotter temperatures) will harm a community's natural resources, livelihoods and infrastructure (roads, houses, communications systems).

**Climate Hazard:** Climate events that cause damage or harm to a community or its surrounding environment, including hurricanes, cyclones, drought, and extreme flooding.

**Climate Models:** Computer studies that predict future exposure to climate change. Scientists take the data they collect on the atmosphere, greenhouse gases, oceans, land and ice and put it into computers to create different scenarios or pictures, showing what will happen to the climate in the future.

**Climate Monitoring:** Observing different aspects of climate (rainfall, temperature, storms) to understand a community's past and current exposure to climate hazards.

**Climate Resilience:** The ability of a community and its natural resources to recover from the damage or harm suffered because of climate hazards or climate variability and to return to normal functioning.

**Climate Risk:** The risk that climate and/or weather will negatively affect human life.<sup>3</sup>

**Climate Sensitivity:** How much a community depends on natural resources, particularly livelihoods and infrastructure systems that are likely to be harmed by climate events and climate change.

**Climate Vulnerability:** The degree to which climate changes can cause harm to a community or ecosystem.

**Disaster:** A hazard can become a disaster when it seriously disrupts a community's ability to lead their daily lives, causing major human, economic and environmental loss.

**Early Warning System:** Systems that alert communities to prepare for a climate hazard or event.

**External Knowledge:** Knowledge that comes from outside a system or community.

**Local Knowledge:** Knowledge that comes from inside a system or community.

**Resilience-based approach:** Examines the strengths and weaknesses of the community that will determine how well it can protect itself and recover from the impacts of climate change.

**Traditional Knowledge:** The wisdom, knowledge and practices of indigenous peoples and local communities gained over time through experience and orally passed on from generation to generation.

**Vulnerability-based approach:** focuses on understanding how a community's resources and livelihoods can be harmed by current and future impacts of climate change. It looks at a community's exposure, sensitivity and adaptive capacity.





## SESSION 5. MAINTAINING HEALTHY ECOSYSTEMS TO ADAPT LIVELIHOODS TO CLIMATE CHANGE

### LEARNING OBJECTIVES

At the end of the session, participants should be able to:

- Understand how ecosystems and their services help communities build resilience and adapt to climate change
- Understand how ecosystem services support different livelihoods
- Understand how ecosystem services are impacted by climate change
- Explain how ecosystem services support three important livelihoods—fisheries, agriculture and pastoralism
- Discuss examples of adaptation strategies for fisheries, agriculture and pastoralism
- Understand how people can improve the resilience of ecosystems and their livelihood services to protect themselves from climate change impacts.

This session builds on the information from Session 1 (on the importance of ecosystems and ecosystem services) and the information from Session 4 (on how communities and ecosystems are vulnerable to climate change). It brings these two ideas together to show how ecosystems support people and livelihoods and how adaptation plans can be made to protect ecosystems and their services.

### PART 1. HOW CAN ECOSYSTEM SERVICES HELP PEOPLE ADAPT TO CLIMATE CHANGE?

**Ecosystem services** are the resources and processes provided by natural ecosystems that support human livelihoods, safeguard biodiversity and help control climate. Healthy ecosystems are essential to life on earth. Whether it is a wetland that absorbs and filters fresh water for crops, or coral reefs that provide habitats for fish populations, ecosystems provide essential services to keep humans, plants and animals alive and healthy and are a key part of adaptation efforts.

Ecosystem services can also protect communities from the impacts of climate change and reduce their vulnerability, especially in rural places where people depend closely on nature.

Not all of the ecosystem services described in Session 1 will be relevant to local adaptation. Communities must identify the specific ecosystem services that they depend upon to decrease their **sensitivity** to climate change and increase their **adaptive capacity**.



Healthy ecosystems can reduce the **sensitivity** of communities by:

- **Maintaining the health of other ecosystem services:** Climate change hazards may severely harm the quality of some ecosystem services, but other ecosystems can supply this service. For example, planting shade trees in coffee plantations may help to keep moisture in soil and maintain coffee yields through times of drought;
- **Protecting resources from exposure to climate events:** Some ecosystems protect property from the impacts of climate change. For example, plants next to a river may reduce and delay flooding, so that people downstream have more time to prepare.

Healthy ecosystems can also increase the **adaptive capacity** of communities:

- **Providing options for human well-being:** Ecosystems provide a diverse range of services. Protecting this diversity improves the likelihood that people will have alternative food, fresh water and other services available if a climate hazard affects a community's main water system or food source.

Keeping ecosystems healthy reduces the stress on natural resources and makes sure that the ecosystem can continue to provide its basic services, even if other resources fail. For example, if rains arrive during big storms and not seasonally, as expected, a community with an intact forest that absorbs and filters the water for rivers and streams may have a better chance of avoiding drought, flood, and erosion damage than one in which there are no healthy forests to clean and maintain the water flow.

The following examples show how services provided by specific ecosystems may reduce community vulnerability to climate change.

### Terrestrial Ecosystems:

#### • Forests

- Protect humans, infrastructure (roads, houses), agriculture, and other resources from erosion and landslides
- Ensure water availability by absorbing and storing rainfall and regulating water flow
- Maintain water quality by filtering sediment and pollutants
- Keep crops healthy by providing habitat for insects and other wildlife that pollinate plants
- Protect communities by reducing and slowing flood peaks
- Provide diverse sources of livelihood and food for communities
- Protect humans and ecosystems from extreme heat by maintaining a cloud cover, which cools the air and increases rainfall

#### • Grasslands

- Keep soils fertile (for agriculture)
- Maintain crop yields and biodiversity by spreading seeds
- Maintain water quality and provide erosion control

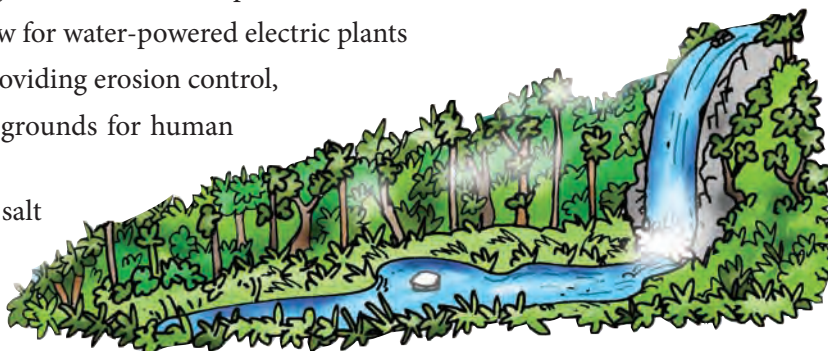


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### Freshwater ecosystems:

- **Wetlands (swamps, bogs and marshes)**

- Protect communities from coastal flooding caused by storm waves and heavy rainfall
- Keep water quality high by filtering out dirt, and other pollutants
- Store ground water to maintain flow for water-powered electric plants
- Protect coasts and coral reefs by providing erosion control,
- Provide fish habitat and breeding grounds for human livelihoods
- Protect water supply by keeping salt water out of fresh groundwater systems
- Provide habitat for biodiversity, keeping natural resources strong.



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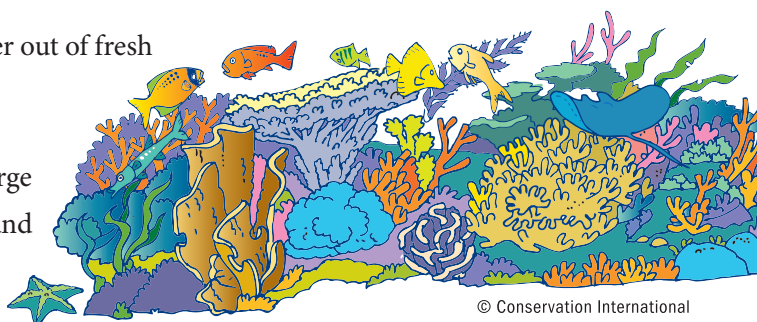
### Marine (Saltwater) Ecosystems:

- **Mangroves**

- Protect shorelines from erosion caused by sea level rise and storms
- Provide fish habitat and breeding grounds for human food and livelihood
- Protect against flooding
- Protect water supply by keeping salt water out of fresh groundwater systems.

- **Coral Reefs**

- Protect against flooding due to storm surge
- Provide important fishery habitat and breeding grounds
- Provide income as tourist destinations.



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## PART 2. HOW DO ECOSYSTEMS AND ECOSYSTEM SERVICES SUPPORT HUMAN LIVELIHOODS?

Ecosystems and their services support many human livelihoods—fisheries, agriculture and pastoralism are three of the most important. The following section explores how specific ecosystem services impact these livelihood options, how they are impacted by climate change, and what adaptation action communities can take to protect the ecosystem services that support their livelihoods. Case study examples discuss how communities are adapting behaviors to protect fisheries, agriculture and pastoralism.

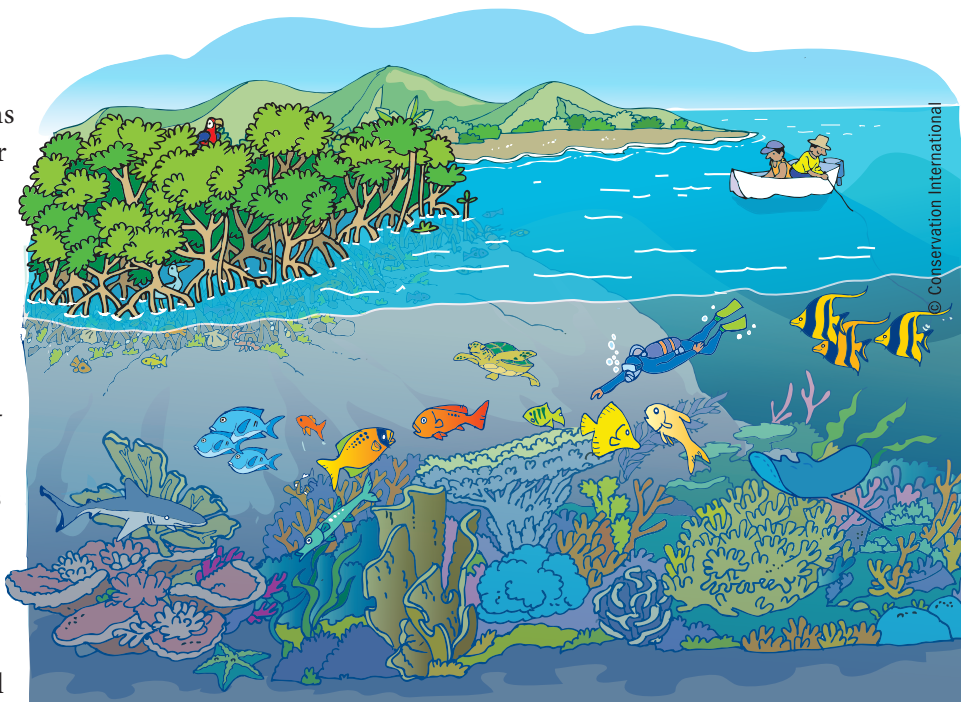
### FISHERIES

#### HOW DO ECOSYSTEMS SUPPORT FISHERIES?

Fisheries provide food, tourism and cultural resources for many communities. Several important ecosystems, both land and water, keep fisheries healthy:

- Marine ecosystems (coral reefs, mangroves, sea grass beds and salt marshes)—provide habitat, breeding grounds, and food for finfish, shellfish, small organisms and marine mammals.

- Freshwater ecosystems (wetlands)—keep water clean, regulate water flow and control erosion, provide breeding grounds for fish that require fresh water or brackish (mixed salt and fresh water) habitats to breed.
- Terrestrial ecosystems (coastal and upland forests)—provide erosion control that keeps soil and runoff from collecting in river and coastal fish habitats, maintain water quality and water flows that support freshwater and marine fish populations.



## HOW DOES CLIMATE CHANGE IMPACT ECOSYSTEM SERVICES THAT SUPPORT FISHERIES?

Climate change impacts many of the ecosystem services which keep fisheries healthy:

- Increasing sea surface temperatures can weaken and kill coral reefs (coral bleaching), which in turn destroys this habitat and food sources for many important fish.
- Rising sea temperature may also cause entire fish species to move to a different area, making them unavailable as a food and income source for communities who traditionally depend on them. The warmer temperatures may, however, provide a new opportunity for fishing in other communities.
- Increased temperatures and changing rainfall can damage or kill mangroves, sea grass and plants in salt marshes as well as forests, reducing the ability of these ecosystems to provide habitats and other services that support healthy fisheries.
- Sea level rise is a gradual climate change impact that affects coastal fisheries. In some places the sea is rising faster than the mangrove ecosystem can move towards the land. Or the mangroves are blocked from moving inland by roads, houses, or commercial fishponds. In these cases the mangrove ecosystem will not be able to provide the services that support fisheries.
- In the longer term, **ocean acidification**, (a change in the chemistry or make-up of sea water when the ocean absorbs excess CO<sub>2</sub> from the atmosphere) and sea level rise could cause entire ecosystems, such as coral reefs, to collapse, severely reducing fisheries' habitat. These effects will probably be felt first in the far northern or the far southern areas of the planet. But now is the time to change human activities and create plans to adapt to the changes that are already happening—before they cause severe impacts.

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Vulnerability of specific fish populations to climate change is difficult to predict. To know the vulnerability of a specific species we must know how much habitat change affects its normal breeding behaviors (sensitivity), and how much it can adapt to changes before it can no longer survive in its usual locations (adaptive capacity). Both local knowledge and scientific research are needed to understand how changing conditions affect specific fish populations.

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## WHAT ARE SOME EXAMPLES OF ADAPTATION STRATEGIES FOR FISHERIES?

Adaptation in fisheries can be difficult because it is harder to reduce the sensitivity of fish and their habitats to changing conditions than it is for species that live on land. However, good management of marine ecosystems can maintain the productivity of fisheries in a changing climate. Healthy ecosystems are more resilient to both climate and non-climate related impacts. The following strategies give fisheries the best chance of continued productivity and reduce the risk of losing this important source of livelihood:

1. Manage and protect key habitats at critical times in the life cycle of fish species (particularly breeding grounds and habitats for younger fish).
2. Reduce human pollution, such as sediments, pesticide and agricultural fertilizers that damage ocean and river ecosystems.
3. Reduce pressure on fish populations by developing alternatives to overfishing.
4. Introduce Marine Protected Areas (MPAs) and Locally Managed Marine Areas (LMMAs) to restore and protect key habitats that have been damaged or changed by human activity.

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In the Pacific Islands, freshwater aquaculture (fish farming) is being proposed as an adaptation action for fishing communities along the coast. These communities are likely to become vulnerable to climate change as tuna populations become unavailable. Aquaculture will help these communities protect their livelihoods and reduce pressure on the natural fish stocks. However, aquaculture (both freshwater and marine) must be established in a way that doesn't harm the health and functioning of ecosystems. It must be located in a place where it will support fish farming over the long term and not cause damage to the surrounding area.

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These actions will help keep fisheries healthy in general and will also help them stay resilient in the face of climate change.

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### Traditional Knowledge and LMMAs

In Fiji, Locally Managed Marine Areas (LMMAs) have already begun to include climate change concerns within training and monitoring activities. The approach is being used to raise awareness and adopt locally-based adaptation options against sea level rise, warming temperatures, and extreme weather patterns. These options include temporary “**tabu**” or no-take zones and locally developed resource management plans which have resulted in increased fish catch in the surrounding areas and healthier coral reefs.

“Tabu” areas were traditionally set aside for 100 days as a sign of respect when the chief of a village died. Today, communities are setting aside small areas of their fishing grounds as tabu areas for longer periods of time, leading to an increase in the fish catch of the open areas. Traditions such as formal declarations, marking the closed areas, and notifying others who use the fishing grounds are still practiced for these no-take zones.<sup>1</sup>





## CASE STUDY: FISHERIES ADAPTATION IN THE PHILIPPINES



*The Verde Island Passage in the Philippines is part of an area that is considered the center of the world's*

*marine biodiversity. The coastal marine ecosystems here support the livelihood and well-being of over 7 million people.*

**Exposure:** The Verde Island Passage is already experiencing impacts from climate change: increased sea surface temperature, rising sea level, increased storms and increased erosion and sediment from heavy rainfall.

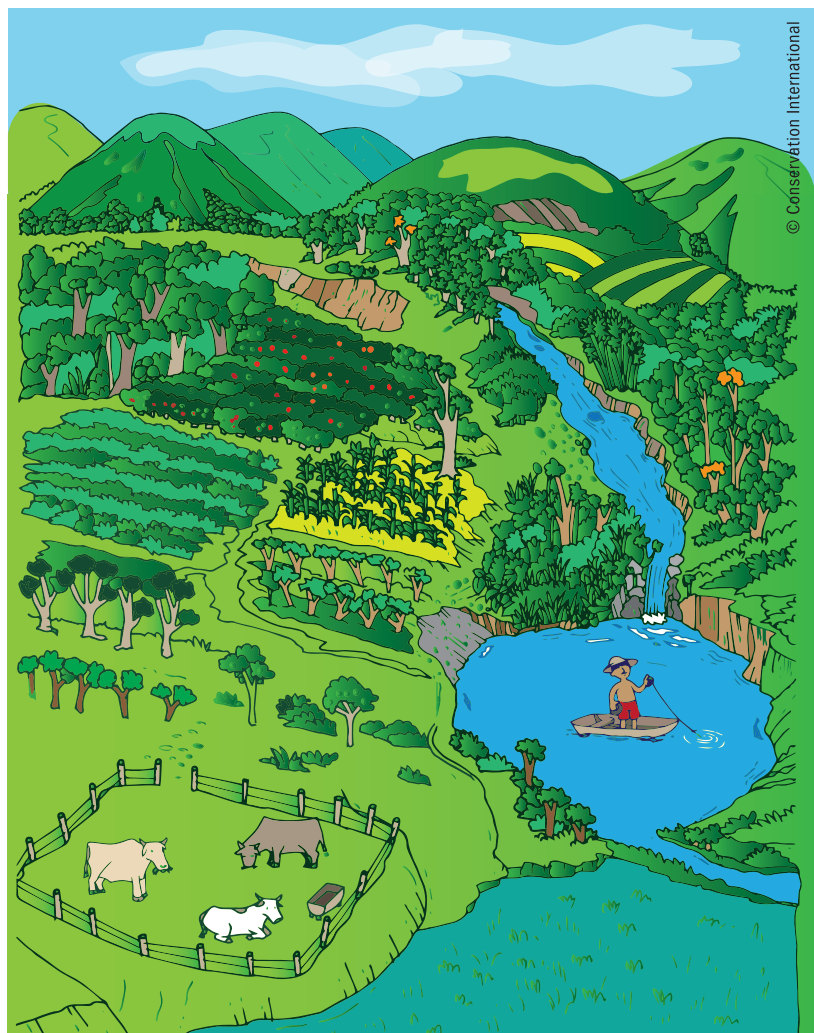
**Sensitivity:** A vulnerability assessment conducted by the community, scientists and the government identified ecological and human impacts to several ecosystems due to climate change. First, the fish themselves, including their eggs, were threatened

## AGRICULTURE

### HOW DO ECOSYSTEMS SUPPORT AGRICULTURE?

Agriculture provides basic food and income for many communities. On a large scale, agriculture produces much of the food for the world's population. Ecosystems play a critical role in adaptation strategies for agriculture. Healthy crops require a healthy watershed, healthy soil with rich nutrients, and good management of ecosystems to reduce the risk of damage from flooding or drought. Several ecosystems contribute their ecosystem services to healthy agriculture:

- Freshwater ecosystems (including wetlands): support the watershed, regulate the flow of fresh water to protect crops from flooding and droughts, control erosion, and bring nutrients to the soil for healthier crops.



because rising temperatures and storms affected mangrove, coral and sea grass ecosystem habitats. The fishing and tourism infrastructure (boats, docks) were also sensitive to damage by increased storms. Traditional hunting areas were being affected as forest was lost to sea level rise and flooding.

**Adaptation Actions:** Several adaptation actions were developed:

- Marine protected areas were established (Improved Adaptive Capacity)
- Mangroves systems were rehabilitated to protect against sea level rise, storm surge and to keep salt water out of freshwater systems (Reduced Sensitivity)

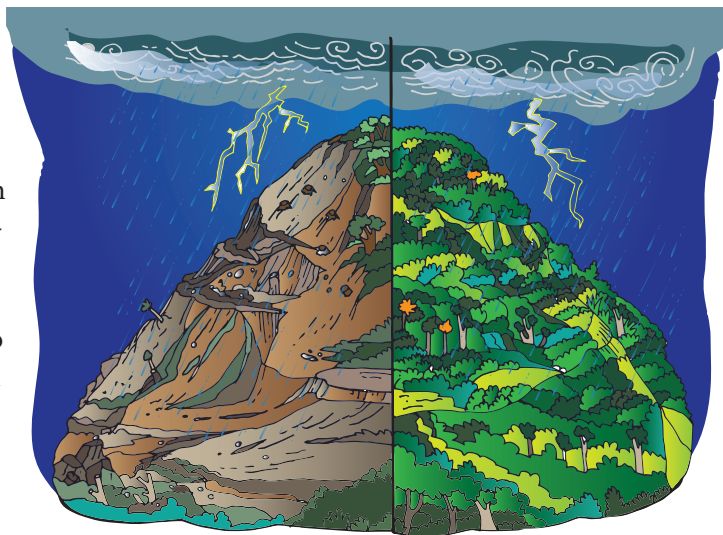
- Aquaculture (fish farming) practices were established using practices that are good for the long-term health of the environment. These include low-density finfish pens and no-chemical shrimp ponds (Reduced Sensitivity)
- Best management practices for fishing on coral reefs, seagrass beds and mangrove forests were established (Increased Adaptive Capacity)
- New markets were opened up for fishing communities (raising and selling sea cucumbers) and new livelihoods were created through eco-tourism by building elevated bamboo walkways in the rehabilitated mangrove ecosystems.) (Improved Adaptive Capacity)

- Terrestrial ecosystems (coastal and upland forests)—create a healthy watershed, delivering water and nutrients to crops, provide erosion control and windbreaks, provide habitat for pollinating insects, birds and mammals.
- Coastal ecosystems—protect crops from storms and sea level rise, keep salt water out of ground and surface water.

## HOW DOES CLIMATE CHANGE IMPACT ECOSYSTEM SERVICES THAT SUPPORT AGRICULTURE?

Ecosystem services that support agriculture are exposed to climate hazards such as floods, droughts, extreme heat and freezing events in different parts of the world. When climate change increases the severity of these events, ecosystem services and agricultural livelihoods also become more sensitive to impacts:

- Freshwater ecosystems, such as wetlands and lakes, can dry up, limiting or destroying water availability and the flow of water and nutrients to agriculture.
- Rising temperatures and changing rainfall patterns can cause drought and impact traditional planting cycles for staple crops such as rice, maize and cassava.
- Rising temperature and changing rainfall can also increase the spread of diseases to crops, and increase insect infestations and forest fires.
- Loss of forest can cause increased erosion, reduce the quality and availability of fresh water, and destroy habitat for pollinators, affecting crop yields.
- Flooding or drought can affect the availability of freshwater, introduce saltwater into freshwater systems, and reduce the health of mangrove ecosystems, making them less able to protect farmland and crops from storms, heavy winds and sea level rise.



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## WHAT ARE SOME AGRICULTURAL ADAPTATION STRATEGIES?

Farmers need to look at all of the factors that influence their harvest quantity and quality when making adaptation plans.

In addition to protecting the necessary ecosystem services, the following adaptation techniques can increase climate resilience for crops:

### ANNUAL CROPS

For annual crops, adaptation strategies for climate change usually are based on management decisions that farmers make throughout the year. For example, some farmers in India have learned to be flexible about what crops they plant. They make the decision based on the weather patterns they see or expect. If the monsoon rains are delayed, they can plant crops with shorter growing seasons to ensure a successful harvest despite the reduced availability of water. The mid-season adjustments for changes in the weather vary from place

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Small-scale farmers commonly have more flexibility to make mid-season changes or incorporate traditional practices into how they manage their farms. If they have or expect to have a drier year than normal, they can plant a crop that is more resistant to drought to reduce their sensitivity. However, large-scale industrial farmers often do not have the same flexibility to make rapid changes to adapt to climate hazards. To increase their resilience to climate changes, both large agricultural operations and small scale farmers can evaluate the ecosystem services they need to increase their resilience and include the protection and sustainable management of these ecosystems in their adaptation strategies.

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## CASE STUDY: AGRICULTURAL ADAPATION IN COSTA RICA



**Exposure:** In Costa Rica, temperatures have been rising, and scientists expect continued increases in temperature, temperature extremes (unusual heat

waves and cold spells) and changes in rainfall patterns (increased heavy rainstorms and dry spells). These changes are likely to affect coffee production.

**Sensitivity:** Costa Rican coffee depends on temperatures that are neither too high nor too low and on consistent wet and dry seasons. When plants do not have these conditions, they can flower too soon and miss the necessary rainy season to produce. Or they dry up before becoming productive. Costa Rica has many microclimates (small areas with their own distinct climate) that communities have relied upon for years, knowing where it is best to grow different crops, like coffee. With climate change, those microclimates are changing. This reduces the reliability of local knowledge and decreases the adaptive capacity of farmers.

to place, depending on the rainfall pattern, soil type and choice of crop. Farmers can take a number of possible actions:

- Thinning the plant population to reduce competition for available moisture
- Thinning crop stands during the growing season as the intensity and duration of rainfall becomes more obvious
- Providing supplemental irrigation
- Changing crop varieties, or planting a mix of different crops instead of just one crop

## PERENNIAL CROPS

For plants that take several years to reach maturity and then yield regularly (such as coffee), a different approach is required, since it is more difficult for farmers to react to changes during the year. Several ecosystem-based approaches to adaptation can help reduce the climate vulnerability of these crops:

- Integrated pest management (monitoring pest levels, using natural predators and adjusting pesticide use)
- Mulching to retain moisture
- Fire management
- Planting rows of trees or shrubs to shelter crops from wind and protect soil from erosion
- Shade management, such as planting trees among the crops in agroforestry.

## AGROFORESTRY

**Agroforestry** is the practice of planting trees or shrubs together with crops and/or within livestock pastures. Agroforestry increases resilience, as the trees provide shade to keep the crops cooler and add to soil nutrients. **Live fences**—lines of trees, shrubs or other plants that keep animals in or out and protect crops from wind—also can be planted.. They provide an adaptation option that costs less money

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### Adaptation Actions:

- Agroforestry: Coffee farmers in Costa Rica have been using agroforestry for a long time to reduce the impacts from heat—they understand the protection that shade trees, alley cropping (planting coffee between trees or between rows of other crops) and live fences can provide. The ability to use these existing and accepted technologies can help to reduce the impacts of increased temperatures (Reduced Sensitivity).
- Diversification: Many coffee farmers have been willing and able to diversify their income by changing to timber harvesting, horse farming and other activities when their land is no longer able to grow coffee (Improved Adaptive Capacity).
- Applying new methods: Farmers are also applying new methods, such as silvopasture (combining forestry and grazing areas, fodder banks (use of specific trees to provide shoots for grazing to increase fodder for animals) and live fences (fruit trees or other trees that provide natural wind-breaks, reduce the cutting of wood for fencing, and provide additional food sources for people and animals). These new methods address the needs of both agriculture and livestock rearing at the same time (Improved Adaptive Capacity)
- Improved social networking: Farmers in Costa Rica have recognized the value of discussing and sharing vulnerabilities and adaptation methods among themselves, as well as with the government and scientists, as an important element of their adaptation planning (Improved Adaptive Capacity).
- Address the needs of both agriculture and livestock rearing at the same time.



than traditional fencing. Live fences planted with fruit trees can provide additional food and income or animal fodder.

### CROP DIVERSIFICATION

With increasingly variable climates, another popular form of adaptation for farmers is to plant several different types of crops, thus reducing their sensitivity to a single event, such as a pest attack or drought. This requires new skills that increase adaptive capacity. For example, a farmer that diversifies into a new crop will need to learn new growing practices, and possibly how to participate in a completely new market.

### TRADITIONAL AND LOCAL KNOWLEDGE

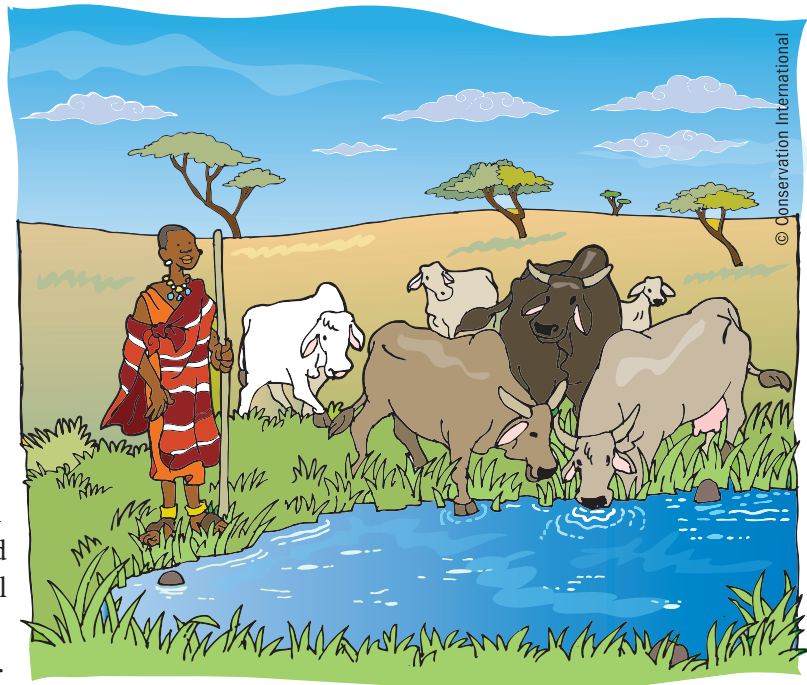
Traditional knowledge can also provide solutions for adapting agricultural practices. In Bolivia, the Quechua and Aymara peoples use the differences in temperature and moisture at different altitudes in the mountains to plant different crops—such as potatoes in the highlands and corn in the low valleys. This practice is known as **ancestral vertical control**. Understanding the best environment in which crops can thrive and having a system that is flexible enough to move them around makes the crops more resilient to climate impacts.

Sharing new technology and practices is also important for successful agricultural adaptation. Forming cooperatives, farmer groups and self-help groups, or making connections with producers, government experts or NGOs,<sup>2</sup> can help farmers learn new methods and the best ways to apply these methods in their own areas. These social networks, combined with the skills of individual farmers, are important to agricultural adaptation in smaller communities. Farmers can learn together how to develop and share new technologies and practices, thus increasing their adaptive capacity.

## PASTORALISM

### HOW DO ECOSYSTEMS SUPPORT PASTORALISM?

**Pastoralism** is the practice of raising livestock, also called animal husbandry. It is done differently in different parts of the world, but generally pastoralists travel with their herds to where they know they can find resources like water and pasture. Their lifestyles are often well adapted to their environment. Pastoralism generally occurs in areas where there is low population, high mobility, and high dependence on traditional knowledge. It has evolved as a result of climate, as traditional agriculture and livestock rearing are not possible in certain climates. While pastoralism may be a simpler



system than fisheries and agriculture, it is a critical way of life for many people. Pastoralism is closely linked to ecosystem services and vulnerable to climate change. Several ecosystems support pastoralism:

- Grassland ecosystems—provide food for livestock and erosion control.
- Forests—provide critical water storage and absorption for ground and surface water.
- Freshwater ecosystems (wetlands and freshwater fisheries in lakes)—provide water and additional sources of food and income.

### **HOW DOES CLIMATE CHANGE IMPACT ECOSYSTEM SERVICES THAT SUPPORT PASTORAL LIVELIHOODS?**

Pastoralists have developed livestock and crops that are adapted to survive in difficult terrain and over long traveling distances. While pastoral communities may have more flexibility than some communities, since they move to where the water or pasture is, their livelihood depends on knowing where the natural resources are located. However, climate change is increasing the vulnerability of the ecosystems they rely on and making it difficult for them to find the resources they need.

- Grasslands may dry up as temperatures rise, making pasture harder to find. This changes the land into desert, as there is no grass to hold onto the soil.
- Increasing temperature and decreased rainfall can cause forest fires and weaken forest ecosystems, harming the watersheds which support the water supply on pastoral lands.
- Increased heat causes lakes to dry up, which limits water availability and reduces fish populations that communities depend on for food and income during dry seasons, or short periods of drought.
- Climate change is changing the land pastoralists know and making their traditional knowledge less reliable. Rains come at different times, temperatures change more than in the past, and resources are no longer located where and when they are expected.

All these changes can also affect other, non-pastoral, communities and cause greater competition for land and resources. In some places where pastoralism has had a long tradition, such as the Sahel in Africa, the increased use of irrigation for farming has created additional tensions between pastoralists and farmers, as agriculture moves into areas formerly used for grazing animals and competes for a limited water supply.

### **WHAT ARE SOME PASTORAL ADAPTATION STRATEGIES?**

Pastoralists often have a long historical knowledge of the land—over thousands of years—that can help the community and others better understand the impacts of climate change. Even though their knowledge is changing, they still have valuable information about biodiversity, ecosystem services and the changes that are occurring to those ecosystems. This knowledge is critical for understanding those ecosystems and can help the community's adaptive capacity. However, as changes happen and traditional knowledge becomes less reliable, pastoralists will need to work together, have better access to climate science and weather forecasts, and options for alternative livelihoods. The locally adapted crops and livestock they have developed increase their resilience to climate impacts and could be helpful for the adaptation strategies of non-pastoralists as well.

Many species and ecosystems also rely on grazing pastures. Some birds need open lands to nest, and livestock helps spread and fertilize plants in many regions and contributes to plant diversity. Thus, if pastoralists have to change their livelihoods, ecosystems may be harmed by the loss of pastoralist activity.

Although each pastoral community has different resources and needs that must be considered, there are several adaptation strategies that pastoralists can use to protect the ecosystem services they rely on and adapt to climate change:

- Protect key watershed ecosystems
- Increase access to alternative and expanded pasture areas
- Increase information sharing and relationships among pastoralists, scientists and decision makers

### PART 3. HOW CAN PEOPLE INCREASE ECOSYSTEM RESILIENCE TO CLIMATE CHANGE AND HUMAN PRESSURE?

A rural community's climate vulnerability is closely connected to its local ecosystems. And, in turn, an ecosystem's vulnerability is influenced by the communities that use its services. Floods, droughts, storms, sea level rise and extreme changes in temperature affect the availability of water, food, shelter and many other critical resources that healthy ecosystems provide, but they may not always be the most immediate or biggest threat to these ecosystems. Human activities, such as development and new roads, can also weaken ecosystems.

#### UNDERSTANDING AN ECOSYSTEM'S VULNERABILITY

To determine the vulnerability of ecosystems and develop adaptation plans to protect them, communities need to:

- Understand how their local ecosystems are exposed to impacts from climate change and human activities
- Determine how sensitive the ecosystems are to those impacts
- Manage the resources and develop livelihood options that increase the resilience of both the ecosystems and the people who depend upon their services

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#### CASE STUDY: PASTORAL ADAPTATION IN WESTERN AFRICA



*In Tchad (Chad), a country in western Africa, the Mbororo pastoralists move across the land with their livestock to survive in the dry Sahel region where limited rainfall is still sufficient to maintain the grassland ecosystem. Moving from place to place enables Mbororo people to cope with the scarcity of water and maintain a sustainable relationship with the ecosystems on which they rely.*

**Exposure:** Higher temperatures and longer periods of drought are threatening the health of the community, their livestock and the grasslands.

**Sensitivity and Adaptive Capacity:** Pastoralists are seeing large impacts to their livestock as lakes and

Communities can use both local and external knowledge to identify the vulnerability of their ecosystems to climate change and human activities, such as development planning and new roads. Communities can also identify other resources and livelihoods to reduce their dependence on specific ecosystems.

## DIVERSIFYING LIVELIHOOD STRATEGIES

Although it is important to develop adaptation plans for existing livelihoods, it may also be wise to introduce additional options for how community members can make a living (diversify). Diversifying makes communities more resilient. For example, in Aceh, on the island of Sumatra in Indonesia, the Aceh Coffee Forum now suggests that the climate change strategy for coffee farmers should include livestock management. Diversifying to include livestock will increase the farmers' resilience to climate change impacts by reducing their over-all risk: Even if a pest destroys one year's entire coffee crop, for example, the farmers will have other sources of income. Depending on only one livelihood option also creates high pressure on the area's ecosystem services, so diversifying will also increase the health and resilience of the ecosystems.

## TAKING ACTION FOR ADAPTATION PLANNING

Adaptation planning for climate change is increasingly focusing on ecosystems as well as infrastructure, public services, and communication systems. Climate change adaptation planning that focuses on actions to increasing the resilience of ecosystems and ecosystem services is often referred to as **Ecosystem-based Adaptation (EbA) Planning**.

By working together to use both local and external knowledge and resources to design and implement effective and sustainable adaptation and development planning, governments and communities can take actions that make ecosystems more resilient to climate change. If ecosystems are more resilient, people and communities will be more resilient as well.

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watering holes dry up. Longer warmer seasons increase insect populations that attack the animals and change the growing season, and damage the grazing land ecosystems. The Mbororo have a long history of living in a climate that has limited water and poor soil. They have developed strategies to cope with this by moving to different regions during different times of the year and spending dry spells near established water sources. However, the water in Lake Tchad is so shallow in many places that the fish they depend upon for additional food and income are not available, and they must sell or eat their livestock to survive. Their adaptive capacity is limited when climate changes so much that their knowledge of alternative livelihoods and areas that are normally resilient is no longer reliable.

### Adaptation Actions:

- Moving from lake areas to areas with springs that flow all year and to river banks (Reduced Sensitivity),
- Taking their animals to graze earlier in the day to avoid overheating and to reduce the amount of water they need (Reduced Sensitivity),
- Sharing information on traditional medicine to treat insect bites and diseases caused by insects (Reduced Sensitivity),



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## IMPORTANT THINGS TO REMEMBER:

- Ecosystem services provide many basic resources to support people's livelihoods.
  - Climate change will impact ecosystem services (such as access to water, food, protection from storms, flooding and drought)
  - Adaptation strategies must consider each community's local knowledge and specific environmental situation.
  - Important livelihood options depend on ecosystems services—understanding how climate change impacts these services will help communities create effective adaptation plans to protect livelihoods.
  - Healthy ecosystems that are managed well are more resilient than ecosystems that are weakened from overuse and poor management
  - Diversifying livelihoods is an adaptation strategy that increases a community's resilience to climate impacts and takes pressure off of ecosystems that are heavily used.
  - Adaptation strategies that include ecosystems ensure that ecosystem services, communities and their livelihoods are resilient.
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## KEY TERMS TO REMEMBER:

**Agroforestry:** An approach to agriculture and livestock raising that incorporates trees and/or shrubs together with agriculture to produce increased productivity and sustainability.

**Aquaculture:** The cultivation, or “farming” of freshwater and saltwater fish species, such as finfish or shellfish, in pens and other enclosed areas under controlled conditions.

**Coral Bleaching:** Death of the small colorful organisms that live inside the tissue of coral.

**Ecosystem:** A group of plants, animals (including people) and microorganisms that live together in a specific place with a particular environment that enables them to survive.

**Ecosystem Services:** The resources and services provided by natural ecosystems.

**Environment:** The external surroundings (for example soil, rocks and water availability) in which

a plant or animal lives that impacts its behavior and ability to live.

**Marine Protected Areas (MPA):** Areas of the coast and/or ocean that have been established as “protected” and given rules about access and use. MPAs are designed to conserve fish and other species and maintain healthy fisheries for long-term use.

**Locally Managed Marine Areas (LMMAs):** MPAs that are managed largely or wholly by local communities including near-shore waters and coastal resources.

**Ocean Acidification:** Process in which oceans absorb excess CO<sub>2</sub> from the atmosphere and become more acidic. Ocean acidification is increasing with climate change.

**Pastoralism:** The raising of livestock that involves moving herds from place to place to find pasture and water.

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## SESSION 6. HOW TO PLAN FOR ADAPTATION AND TAKE ACTION

### LEARNING OBJECTIVES

At the end of the session, participants should be able to:

- Understand what an adaptation plan is and why it's important to have one
- Understand the steps for creating an adaptation plan and putting it into action
- Understand what a vulnerability assessment is and why it's an important foundation of an adaptation plan
- Explain the importance of community participation in adaptation planning
- Understand the importance of measuring success and revising actions
- Understand why adaptation is a continual process of learning and acting
- Explain how adaptation planning can be joined with other planning processes

Session 1

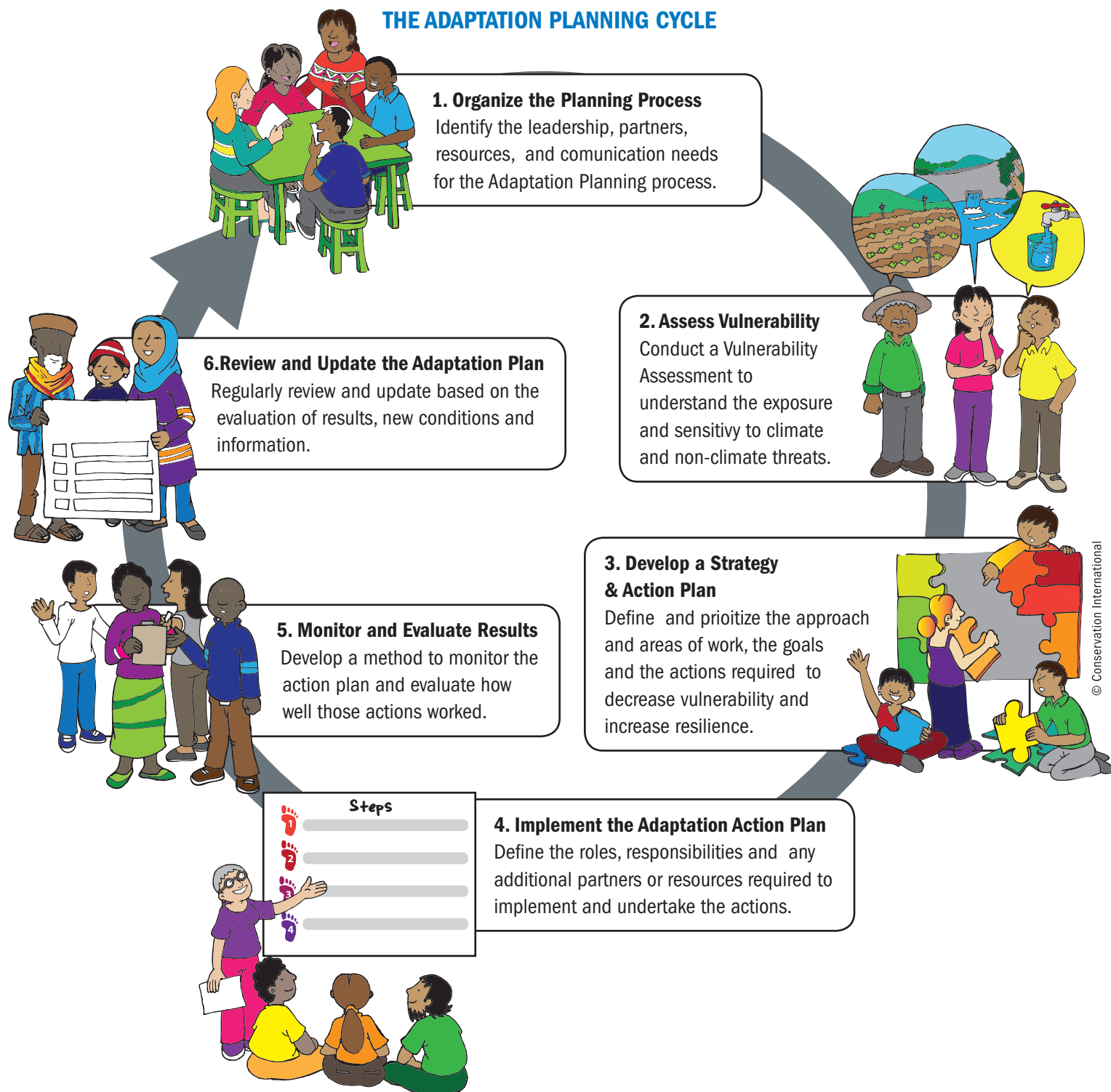
This session covers the steps and considerations needed to design an effective adaptation plan and put it into action. It also provides general information on how to conduct vulnerability assessments and other tools that can help communities with adaptation planning. The session builds on the information about ecosystem services and assessing climate vulnerability that were presented in earlier sessions and discusses the importance of combining adaptation planning with other planning processes.

### PART 1: WHAT IS AN ADAPTATION PLAN AND WHAT IS THE PROCESS TO CREATE ONE?

An adaptation plan is a set of actions that a group decides to take to reduce their vulnerability to climate change. Adaptation plans can be made for whole countries (remember the National Adaptation Plans and National Adaptation Programs of Action discussed in Session 3), or for individual communities. A community can make an adaptation plan for different livelihoods and ecosystem services that are important to the community or for one key resource or activity, such as fresh water or fisheries. What the plan covers and the size of the area included will determine how much and what type of technical, human and financial resources the community needs to complete the adaptation plan.

The following page has a model showing the adaptation planning process. While not every community or government group makes its plans in the same way, this cycle shows some steps or components that are common to most adaptation planning processes.

## THE ADAPTATION PLANNING CYCLE



### 1. ORGANIZING THE ADAPTATION PLANNING PROCESS

Each community has different ways that they make decisions, so each community must decide how they will organize their planning process. NGOs or government agencies may be available to work with communities to help them access funding, information and other resources for planning and also to help them put the adaptation plan into action. However, the community leadership should provide guidance and direction to

developing the plan and putting it into action. Some important steps to consider when organizing the adaptation planning process are discussed below:

### **Understand all parts of the adaptation planning process:**

Communities should decide exactly what the adaptation planning process is intended to do, so that they can identify how much time and resources the process will require, both from within and from outside the community. Seeking the advice of outside organizations, government agencies, or other communities in the area that have already done adaptation planning can be helpful for understanding the process.



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### **Identify the resources needed to complete the adaptation planning process:**

Before starting the planning process, communities should review information and resources that can help with the planning. They should identify what financial, human and technical help is available, both from within the community and from outside (government, local and international organizations).

### **Identify the adaptation planning team and team leader:**

Community leadership should decide if they will lead the adaptation planning process, or choose to assign that duty to other community members or outside partners, under their supervision. Whatever approach is taken, clearly identify what each person will be responsible for doing, and work within the community's existing decision-making processes to help the planning run smoothly.

### **Design a participatory communication and community engagement process:**

Design a process for informing and seeking input from the whole community and from any other people or groups who may have an interest in the plan or be affected by the actions taken. Sharing information and seeking input will make people more aware of the need for climate change adaptation and provide a way for all community members to understand the planning process and how they can contribute. Community members and other interested people should know what activities will happen in the community, when they will happen, and who will be involved from both inside and outside the community. Community meetings or other functions can provide an opportunity to provide regular updates on the activities and their results. This will help everyone in the community understand and participate in the planning process.

## **2. ASSESSING VULNERABILITY**

After the planning process has been organized, a climate **vulnerability assessment (VA)** is usually the next step in the adaptation planning. A vulnerability assessment involves gathering information to identify an area's exposure to climate hazards and how ecosystems and communities are sensitive to harm from climate hazards and climate change. For example, are crops threatened by flooding? Are freshwater supplies threatened by drought from decreasing rainfall? Doing a vulnerability assessment is commonly the first step in designing an adaptation plan.

### **At what level are vulnerability assessments done?**

A vulnerability assessment can be done for an entire region, country, province, district or community. It can be done for one sector, such as tourism or agriculture, or for all of the areas and sectors important to a community, including ecosystems, livelihoods and infrastructure. Even if



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the assessment is done for a specific community, changes that are happening to ecosystems outside the community—such as a watershed, or an important fishing ground used by many—should be considered, particularly if the community depends on the services from those ecosystems.

Information in national or regional vulnerability assessments can help communities understand how their own resources are affected by the other communities and countries that depend upon the same ecosystems.

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Sometimes countries work together to assess the vulnerability of ecosystems that they share. The Amazon Basin in South America, for example, is a very large and important forest ecosystem that provides direct ecosystem services to eight different countries and many communities. In 2011, a vulnerability assessment on tropical fisheries and aquaculture in the Pacific Ocean involved input from 22 Pacific Island countries and territories.

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### **Who is involved in doing a vulnerability assessment?**

To be successful, all people or groups who have information important for the vulnerability assessment should be consulted. This can include:

- Community members
- Community leadership
- Community experts (women, elders, hunters, fishermen)
- Local and external scientists
- Development and conservation experts or organizations
- Government agents

All of these people will have knowledge to share and need to have a voice in the assessment. For example, in the Verde Islands in the Philippines, local leaders, fishermen, representatives of women's groups, government officials, and local and international scientists all worked together on a vulnerability assessment of an important fishing area. Information from all of these groups was needed to make the adaptation plan effective at reducing the vulnerability of the area to climate change impacts.

### **Organizing the vulnerability assessment**

Many steps for organizing the vulnerability assessment are the same as for organizing the overall adaptation planning process. First, it is necessary to select an assessment team and team leader, gather background information, identify all people and groups that need to participate in the assessment, and develop a process for doing the assessments.

Before starting the assessment, it is also important to review national and local planning documents that may contribute important information. These can include territorial plans, development plans, national climate and adaptation plans, and plans to manage water and electricity supplies.

### **Conducting the vulnerability assessment**

Each vulnerability assessment will be different, but some common things should be in every assessment to make sure that communities understand their exposure, sensitivity and adaptive capacity to climate change and other non-climate threats. These elements include:

- **Consider threats that are not from climate hazards or climate change**—communities need to identify all the ways they are vulnerable, not just to climate change. The vulnerability of ecosystems (forests or coral reefs), infrastructure (roads or water systems), institutions (schools or hospitals), and social networks (churches or community groups) may also be due to natural non-climate events such as earthquakes or tsunamis (large waves sometimes caused by earthquakes) or to changes in the economy, weak management of natural resources, overpopulation or deforestation. Human activities such as agriculture or mining and logging may be bigger and more immediate threats to ecosystem services than climate change. Identifying these threats shows communities which resources are healthy and which are already weakened and need help.
- **Develop a picture of local climate**—knowledge from local and external experts and scientific studies can help the assessment team create a picture of past and future climate.
- **Assess the community's vulnerability**—after identifying both climate and non-climate threats to its resources, and creating a picture of the likely impacts to the community based on these expected changes, communities can assess what important resources are vulnerable to climate change and determine the community's vulnerability.

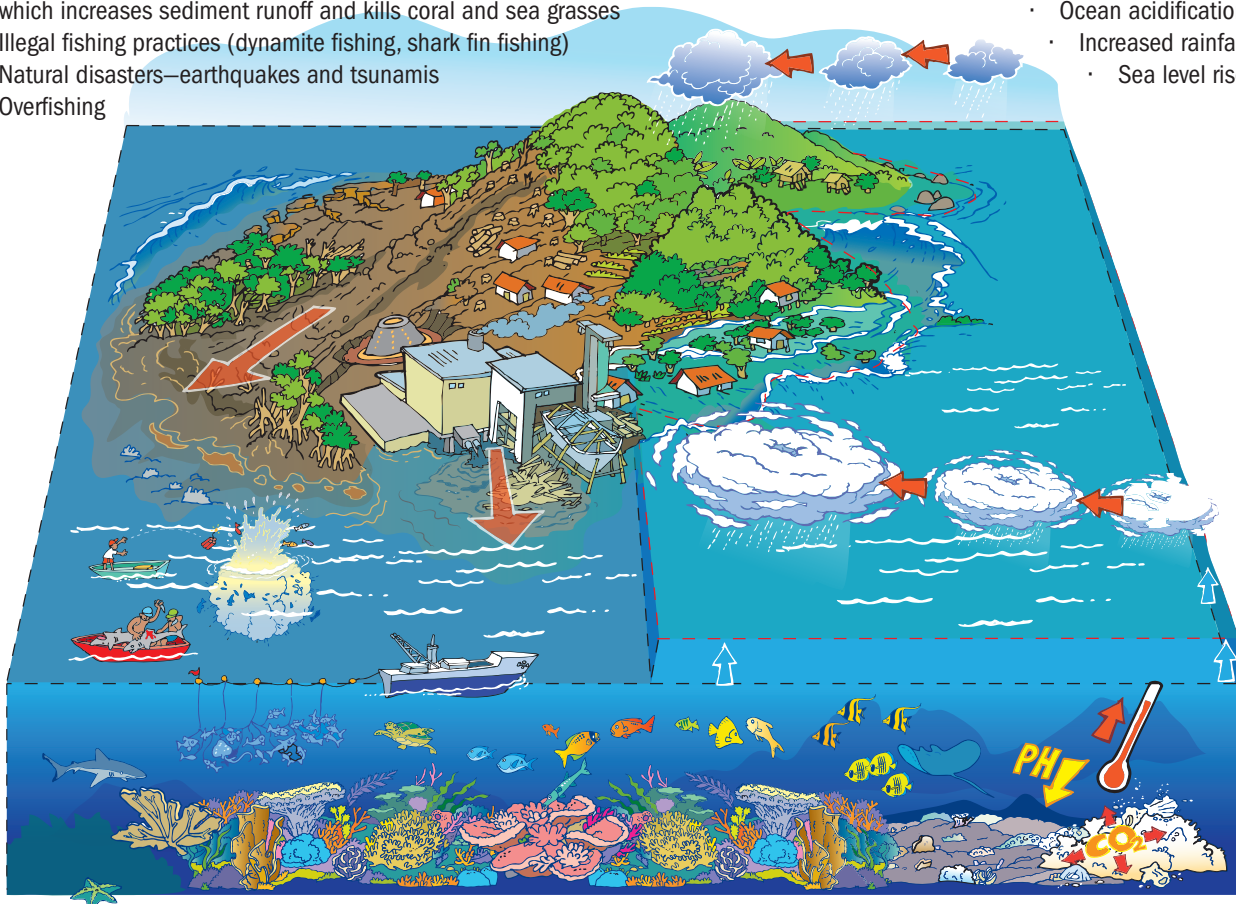
### Example: Non-climate threats and climate threats to natural resources in the Verde Island Passage

#### Non-climate threats

- Pollution, including disposal of solid waste (plastics), and industrial waste
- Removal of mangroves and upland forests due to quarries and sand mining, which increases sediment runoff and kills coral and sea grasses
- Illegal fishing practices (dynamite fishing, shark fin fishing)
- Natural disasters—earthquakes and tsunamis
- Overfishing

#### Climate threats

- Increased storm frequency and intensity
- Increased sea surface temperature
- Ocean acidification
- Increased rainfall
- Sea level rise
















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### What tools can help a community conduct a vulnerability assessment?

In addition to external information from government agencies and other organizations, communities can bring together their members to share local knowledge about changes they are observing in the climate, in resources and in the ecosystem services they rely on in their daily lives. The following are some research tools based on community participation that can help communities record and make use of this knowledge:

- **Community Resource Mapping:** This tool helps communities map and identify where their most important resources are located—where people hunt, fish, farm, herd livestock and gather wood and other natural products.
- **Climate Risk Mapping:** This map builds on the community resource map by collecting information about how climate impacts the areas that a community lives in and these impacts can be recorded on the community resource map, so that the community can study the resources and climate impacts together. This activity can also indicate where the risk is highest.
- **Seasonal Calendars:** Using this tool, communities can record recent weather patterns—when rainy and dry seasons occur, or when storms, flooding, or changes in temperature occur. They can also record when livelihood activities, such as crop planting, depend upon ecosystem services and weather. Records can be made for current and past conditions—10 years or even 20 years ago—so a community can study how weather patterns have changed and if their livelihood activities have been adapted successfully to meet these changes. They can also look at how they need to adapt their current activities and discuss what changes may need to happen in the future.

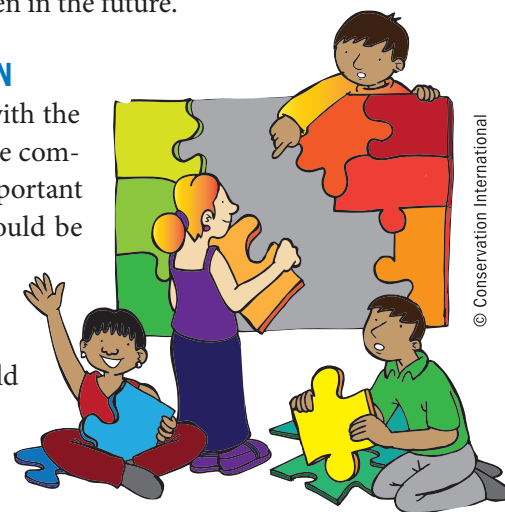
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### 3. DEVELOPING AN ADAPTATION STRATEGY AND ACTION PLAN

After completing the vulnerability assessment, sharing the results with the community and other groups, and receiving additional feedback, the community can use the information to decide what actions are most important to help reduce vulnerability and increase resilience, when they should be taken and what group or organization will lead the implementation of the activities in the adaptation plan.

Before finalizing the adaptation action plan, the community should determine what additional funding, materials, information and other resources will be necessary and determine if these additional resources are available.



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#### 4. IMPLEMENTING THE ADAPTATION ACTION PLAN

Once a community has gone through the steps of conducting a vulnerability assessment and has identified actions to take and found the required funds and other resources, it is time to put the plan into action. Some examples of actions in an adaptation plan include:

- Establishing an early warning system to increase access to information on possible flooding or prediction of heat waves or drought. that will help communities.
- Moving homes to higher ground or building water and food storage facilities to improve infrastructure and provide reserves.
- Planting mangroves or protecting watershed areas to strengthen ecosystem services.



The community should be kept informed about how the work is going and the results of the actions, just as they were kept informed during the vulnerability assessment. This communication is especially important for people or groups who will need to adapt their own actions. The rights of all groups involved must be respected, and consent must be obtained before any actions are carried out that will impact their lands and livelihoods (see sidebar below).

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#### Free, Prior, and Informed Consent (FPIC)

The principle of **FPIC** refers to the right of indigenous peoples to give or withhold their consent for any action that would affect their lands, territories or rights, as recognized in the **United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)** and the **International Labour Organization Convention 169 (ILO 169)**. UNDRIP has been adopted by the UN General Assembly, but it is not legally binding. However, ILO 169 is legally binding, and has been ratified by 22 countries.

In the context of FPIC, “**free**” means that indigenous peoples’ consent cannot be given under force or threat. “**Prior**” indicates that indigenous groups must receive information on the activity and have enough time to review it before the activity begins. “**Informed**” means that the information provided is detailed, emphasizes both the potential positive and negative impacts of the activity, and is presented in a language and format understood by the community. Finally, “**consent**” refers to the right of the community to agree or not agree to the project before it begins.

While FPIC is the right of indigenous peoples alone under international law, the principles underlying it are generally considered to be a good practice for engaging any community or group in decisions about actions that affect their lives and lands. It is important to understand how FPIC is understood and recognized in a particular country from the perspectives of communities and government, and how national laws and international law may impact how FPIC is applied.

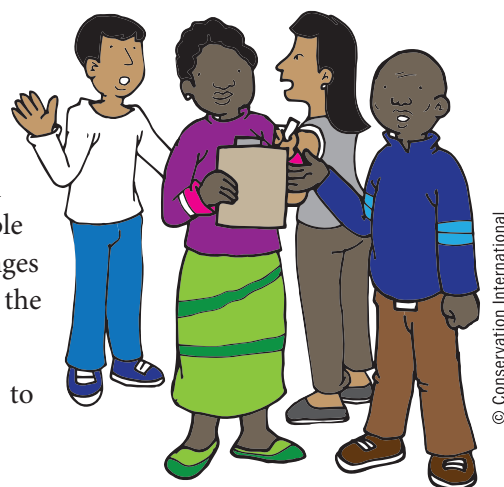
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## 5. MONITORING AND EVALUATING THE RESULTS OF THE ADAPTATION PLAN

Communities and their leaders will need to carefully monitor the effectiveness of their adaptation actions and consider new information as it arises, so that they can make sure the plan is taking the best possible approach. Progress and results will need to be recorded to evaluate changes in behavior and attitudes. Monitoring and evaluation tools include the following:

- Periodic reporting (reporting during the time period required to complete activities)
- Individual or group interviews
- Feedback from regular community meetings
- Measuring the benefits of the activities versus their costs
- Measuring changes in the health of important ecosystems



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Monitoring and evaluation should be repeated regularly, so community leaders will know how well the adaptation plan is working and that it is continuing to meet the needs of the community.

## 6. REVIEWING AND UPDATING THE ADAPTATION PLAN

Adaptation planning and action are continual processes, or cycles, much like managing daily life—growing crops, raising children, and managing household income. There is always new information, new impacts, and new opportunities to consider. Political priorities can change quickly, for example, such as when new officials are elected. Or financial resources are often available only for short periods of time, such as the length of a project.

An important part of adaptation planning and action is to look regularly at the results of the actions taken and study new information, so the adaptation plan can be adjusted or new activities added when necessary. Adaptation is about adjusting to change. Because change always happens, adaptation plans must be able to change and adjust as well.



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As part of the adaptation strategy, community leaders should plan when and how they will review the results of the adaptation action plan, based on the ongoing monitoring and evaluation of the results. Wherever possible, the review of an adaptation plan should be ongoing, and those working on it should meet regularly. Reviews should include all relevant groups and individuals. The time between reviews will depend on the community's needs and can be done within the community's regular process for development and natural resource management planning. Using the Adaptation Planning Cycle as a guide, community leaders can, on their own or with partners, review new conditions and information, re-assess the community's vulnerability, revise the adaptation strategy and action plan, and continue to monitor, evaluate and update as needed.

## PART 2. HOW CAN CLIMATE CHANGE ADAPTATION PLANNING BE INTEGRATED WITH OTHER PLANNING PROCESSES?

Many communities, governments and organizations are already involved in ongoing planning processes. Combining or integrating climate change adaptation planning with planning for economic development,

water management, or conservation planning makes sense because climate change impacts all of these issues. Including ecosystems in all areas of planning is also important, since ecosystem services support human development in so many ways. Combining these planning processes is called integrated adaptation planning, which means adaptation planning is done in combination with one or more other planning processes.

Although integrating climate change adaptation planning with other planning processes can be a challenge, it makes adaptation more effective over the long term and allows communities to address issues that are important to them, such as food security or economic development, in the adaptation plan. Below are examples of how climate change and ecosystems can be linked with other planning processes.

## INTEGRATING CLIMATE CHANGE ADAPTATION AND ECOSYSTEM SERVICES INTO DEVELOPMENT PLANNING

Development planning (such as a poverty reduction strategy) helps governments decide how to spend resources on infrastructure, services and natural resources. Development planning often involves strategies for many separate sectors, such as water and sanitation, energy, education and agriculture. The environment is typically considered through environmental safeguards, or measures put in place to avoid harming the environment; however, protecting ecosystem services is also key to a good development strategy, and climate adaptation planning provides an opportunity to make this link.

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### CASE STUDY: MALAWI

**Background:** The Malawian economy relies heavily on agriculture; about 80% of its people work in farming. Thus, it is very dependent on rainfall. However, due to irregular rainfall and limited ability to store water, Malawi is very sensitive to droughts and floods.

Originally, climate change in Malawi was seen as an increased disaster risk, and Malawi's National Adaptation Program of Action (NAPA) focused on addressing urgent adaptation needs from these risks. Later, however, people saw that climate change would also hurt Malawi's economy (affecting food security, energy and water supply, and health). Malawi's NAPA needed to be integrated with Malawi's development strategy. With support from several multilateral organizations, the Government of Malawi developed a framework to bring the adaptation plan for climate change together with ongoing planning for agriculture, land management, and health.



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## INTEGRATING CLIMATE CHANGE ADAPTATION INTO CONSERVATION PLANNING

Conservation efforts and efforts to protect ecosystem services need to be included in adaptation planning. Solutions to climate impacts need to address the long-term health of the human population and the environment on which they depend. Conservation planning (focused on protecting species and biodiversity rather than ecosystem services) should also consider climate adaptation. While many conservation-focused approaches, like community managed marine protected areas, and agroforestry can be very effective, natural

resources are best protected when the communities know what climate impacts are likely to affect them in the future. Some examples of integrating conservation, ecosystem and climate adaptation priorities include:

- If a community wants to protect wetlands, and information from scientists predicts sea level is likely to rise, they can consider moving homes, roads or farm locations further inland to ensure that the wetlands have room to move inland when the sea rises.
- If a community that depends on fishing for their livelihoods knows that climate events are likely to negatively impact the fish populations that they rely on, they can establish temporary fishing bans or establish protected areas for the mangroves or coral reefs that can help to protect these fish.
- In Colombia, the government, NGOs and universities are studying how water flows will change due to climate change. As they make their adaptation plans and look at which areas to conserve, they are working to ensure that the high altitude grasslands they protect contribute as much as possible to increased water flow and regulation to avoid water-shortages and flooding.

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### CASE STUDY: MALI

**Background:** The Youwarou flood forest ecosystem in northern Mali in Africa offers many ecosystem services. It is a breeding ground for pollinators and birds that help spread seeds. It provides



cattle with shade during the dry season, and is also home to much aquatic biodiversity. Local communities fish and harvest aquatic grasses from the flood forests for their livelihoods. However, as a result of both human activities and climate change, the flood forest has been threatened by steadily declining rainfall since 1970. As a result, drought, reduced flooding, and extreme heat have caused crop damage and loss, water scarcity, income loss and social conflict.

An international conservation organization worked with communities to develop projects to restore and protect the flood forest and reduce poverty. The conservation group and local community members held consultations to understand how the project could reduce their vulnerability to climate change. Community members suggested small-scale improvements to improve their adaptive capacity and climate resilience, including constructing small footpaths and bridges across flood channels, increasing the area of land to be restored, creating maps of endangered species habitats (to reduce human-wildlife conflicts), and improving safety and early warning systems on fishing boats.

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### INTEGRATING CLIMATE CHANGE ADAPTATION AND ECOSYSTEMS INTO DISASTER PLANNING

Climate change can increase the risk of natural hazards, including hurricanes, storms, drought and extreme flooding. A hazard becomes a disaster when it seriously disrupts a community's daily life and causes major human, economic and environmental loss. Recovering from a disaster usually requires outside help, but a community can reduce the risk of harm by planning what to do if disaster strikes.<sup>1</sup>

**Disaster Risk Reduction Planning (DRR)** is a way to reduce the risk of disasters by planning ahead—reducing exposure or vulnerability to hazards, and improving resilience to potential hazards.<sup>2</sup> This can

include creating an early warning system, for example, to warn people when severe flooding is expected and give them time to leave their homes and go to a community shelter on a hill. It can also involve planning reserves of fresh water, or changing how or where a community builds its houses.

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### CASE STUDY: **TONGA**

**Background:** Tonga has been exposed to a variety of natural and climate-related hazards, including drought, flooding, cyclones, and tsunamis. These disasters have caused severe damage to crops, drinking water supplies, housing, infrastructure and the economy.

At first, disaster management and climate change adaptation were done by two separate government ministries in Tonga, and each of them was responsible for writing their own planning documents. However, a task force joining the two groups was formed to write and put into action an integrated plan. This plan combined the resources of both ministries and allowed them to hold talks together with people and groups affected by the plan.



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### **INTEGRATING NATIONAL AND LOCAL CLIMATE CHANGE ADAPTATION PLANNING**

Planning done by national governments—for adaptation, development, disasters and conservation—can be a way to share information, highlight important needs and identify and fund key activities. Local plans should be linked to national plans in order to be truly effective. Ideally, national planning will involve detailed consultation with all communities or groups involved. Some countries have been particularly good at doing consultations with a wide variety of stakeholders as they created their National Adaptation Programmes of Action (NAPA).

Local governments are increasingly considering climate change adaptation in their own planning processes. This is important, as local governments are usually the ones responsible for approving local development projects, including urban development plans. Often, the community's assessment and adaptation planning can help the government and other groups with their ongoing policy and planning efforts.

### **INTEGRATING PLANNING THROUGH AN ECOSYSTEM-BASED ADAPTATION APPROACH**

One common link across these planning processes is **Ecosystem-based Adaptation (EbA)**, which was described in Session 5. Through the EbA approach, communities can connect planning processes that are often separate, combining ecosystem services management and biodiversity protection to support human development, risk management, and conservation for more effective and integrated results.



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## CASE STUDY: KIRIBATI

When the government of Kiribati wanted to integrate climate change adaptation into its national development strategy, it gathered the input of representatives from each of the major inhabited islands for national meetings.

At the first consultation, these representatives identified recent major hazards and proposed strategies for coping with them. At the second consultation, the representatives divided the adaptation options into four categories:

- Urgent options that communities could implement themselves
- Urgent options that communities would need help from the government to implement
- Less urgent options
- Options that were not needed/wanted

The adaptation options were prioritized, taking into account the results of the national discussions, as well as factors like urgency, likely degree of environmental impact, cultural acceptability, and overlap with poverty reduction efforts. They were then circulated to government ministries where they were identified for funding under specific government programs and matched with 50% external funding.

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## IMPORTANT THINGS TO REMEMBER:

- Adaptation planning requires:
    - good organization;
    - using all available information;
    - assessing climate and non-climate risks and threats;
    - defining and implementing a strategy and action plan;
    - and identifying the necessary resources for implementation;
  - Communities should define an Adaptation Planning process that works best for their community and that involves the whole community and other groups or individuals who will be affected by the actions.
  - Vulnerability Assessments help communities understand the threats they might face (their vulnerability) from climate change and enable them to develop effective adaptation strategies.
  - It is important to continually monitor, evaluate, and revise the adaptation plan.
  - Adaptation planning needs to be evaluated and updated on a continual basis, incorporating lessons learned and new conditions and information.
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## KEY TERMS TO REMEMBER:

**Adaptation Planning:** A continual process that a community or group undertakes to assess its vulnerability to climate change and identify actions to reduce that vulnerability. Also involves implementing the actions, monitoring and evaluating the results, and revising and updating the action plan.

**Adaptation Strategy:** The approach, areas of focus, and goals that an adaptation plan takes.

**Adaptation Plan:** A plan made by a group of people (a country or a community) that describes the actions they will take to reduce their vulnerability to climate change. Activities can include creating new management policies, building a storm shelter, creating an early warning system, or rotating crops, among many other things.

**Ecosystem-based Adaptation:** Using ecosystem services as part of an overall plan to help people adapt to climate change.

**FPIC:** “Free, prior and informed consent recognizes indigenous peoples’ consent (FPIC) inherent and prior rights to their lands and resources

and respects their legitimate authority to require that third parties enter into an equal and respectful relationship with them, based on the principle of informed consent.”<sup>3</sup>

**Integrated adaptation planning:** Brings together adaptation planning for climate change with other planning processes— such as planning for development, or disaster risk reduction, or water utility management. (To integrate means to combine two or more things.)

**Monitoring and Evaluation:** Assessing the effectiveness of an action, activity, policy or program.

**Participatory Processes:** Method for making decisions that involves the active participation by all members of a group.

**Vulnerability Assessment:** A process that gathers information to identify areas where a community is exposed or sensitive to climate and non-climate hazards, or where and how their ecosystems and resources or livelihoods could be damaged.









## SESSION 1

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<b>Adaptation</b>	A change in the way of doing something. In the case of climate change, it involves addressing and adjusting to climate impacts. Because the climate is changing, plants, animals and people need to adapt to new conditions.
<b>Adaptation Plan</b>	A plan made by a group of people (a country or a community) that describes the actions they will take to reduce their vulnerability to climate change. Activities can include creating new management policies, building a storm shelter, creating an early warning system, or rotating crops, among many other things.
<b>Adaptive Capacity</b>	The ability to adjust to current and future changes caused by climate change and to acquire the skills and manage the resources needed to recover from the impacts of climate change.
<b>Agroforestry</b>	An approach to agriculture and livestock raising that incorporates trees and/or shrubs together with agriculture to produce increased productivity and sustainability.
<b>Aquaculture</b>	The cultivation, or “farming” of freshwater and saltwater fish species, such as fin fish or shell fish, in pens and other enclosed areas under controlled conditions.
<b>Atmosphere</b>	The atmosphere is the part of Earth that begins at the surface and extends upward into outer space in many layers. It is composed of a mixture of gases. Most processes that affect life on Earth happen in the lowest layer of the atmosphere, nearest to the Earth’s surface
<b>Carbon</b>	One of the most common elements in the universe, found in all living things.
<b>Climate</b>	The “average weather” or weather conditions that happen over a long period of time.
<b>Climate change</b>	The change of the normal weather patterns around the world over a long period of time
<b>Climate Exposure</b>	The likelihood that naturally occurring climate events (such as storms or floods), or changes to climate conditions (such as less rainfall, or hotter temperatures) will harm a community’s natural resources, livelihoods and infrastructure (roads, houses, communications systems.
<b>Climate Hazard</b>	Climate events that cause damage or harm to a community or its surrounding environment, including hurricanes, cyclones, drought, and extreme flooding.



<b>Climate Models</b>	Computer studies that predict future exposure to climate change. Scientists take the data they collect on the atmosphere, greenhouse gases, oceans, land and ice and put it into computers to create different scenarios or pictures, showing what will happen to the climate in the future.
<b>Climate Monitoring</b>	Observing different aspects of climate (rainfall, temperature, storms) to understand a community's past and current exposure to climate hazards.
<b>Climate Resilience</b>	The ability of a community and its natural resources to recover from the damage or harm suffered because of climate hazards or climate variability and to return to normal functioning.
<b>Climate Risk<sup>1</sup></b>	The risk that climate and/or weather will negatively affect human life.
<b>Climate Sensitivity</b>	How much a community depends on natural resources, particularly livelihoods and infrastructure systems that are likely to be harmed by climate events and climate change.
<b>Climate variability</b>	Natural changes within the climate system that often occur in cycles or in particular areas over seasonal or longer time periods.
<b>Climate Vulnerability</b>	The degree to which climate changes can cause harm to a community or ecosystem.
<b>Convention</b>	A formal agreement (or treaty) between the people or groups who have signed it. It serves as a foundation for further discussions and treaties on specific issues.
<b>Coral Bleaching</b>	Death of the small colorful organisms that live inside the tissue of coral.
<b>Delegates</b>	People who represent a government or organization and have the authority to speak or vote for that organization.
<b>Disaster</b>	A hazard can become a disaster when it seriously disrupts a community's ability to lead their daily lives, causing major human, economic and environmental loss.
<b>Early Warning System</b>	Systems that alert communities to prepare for a climate hazard or event.
<b>Earth's poles</b>	Areas at the far north and far south of the Earth. Also called the "polar regions."
<b>Ecosystem</b>	A group of plants, animals (including people) and microorganisms that live together in a specific place with a particular environment that enables them to survive.

<b>Ecosystem services</b>	The resources and services provided by natural ecosystems, such as food, water and timber; services that control climate, floods, disease, waste, and water quality; cultural services that are a source of spiritual benefits and also enjoyment.
<b>Ecosystem-based Adaptation</b>	Using ecosystem services as part of an overall plan to help people adapt to climate change.
<b>Emission</b>	A substance discharged into the air. In climate change, the term refers to Greenhouse Gases sent into the atmosphere.
<b>Environment</b>	The external surroundings (for example soil, rocks and water availability) in which a plant or animal lives that impacts its behavior and ability to live.
<b>Evaporation</b>	The process in which water is heated and changes from a liquid into a gas. The sun heats water in lakes, rivers or oceans, causing it to evaporate or turn into a gas called water vapor.
<b>External Knowledge</b>	Knowledge that comes from outside a system or community.
<b>Forum</b>	A place for open discussion on specific issues.
<b>Fossil Fuel</b>	Fuel such as oil or coal that is formed inside the earth over a long time from decaying plants and other organisms
<b>FPIC<sup>2</sup></b>	“Free, prior and informed consent recognizes indigenous peoples’ consent (FPIC) inherent and prior rights to their lands and resources and respects their legitimate authority to require that third parties enter into an equal and respectful relationship with them, based on the principle of informed consent.” )
<b>Funds</b>	A financial mechanism to provide resources for activities to achieve goals. For example, the Adaptation Fund provides money to governments to pay for adaptation activities. Money is contributed to a fund by donations, pledges from country governments, taxes, or other sources.
<b>Glacier</b>	Layers of permanent ice found in very cold areas, either on land (in the polar regions, for example) or on mountains at high elevations. Sometimes glaciers extend into the ocean.
<b>Global warming</b>	The increase in the average temperature of the Earth’s atmosphere.
<b>Greenhouse effect</b>	The process of how the atmosphere keeps the Earth warm.
<b>Greenhouse gases</b>	The gases that help regulate the Earth’s temperature, keeping it warm.

<b>Integrated adaptation planning</b>	Bringing together adaptation planning for climate change with other planning processes— such as planning for development, or disaster risk reduction, or water utility management .To integrate means to combine two or more things.
<b>Land-use change</b>	Changes in the way a land area is used, for example, changing a forest to a farm, or changing farms to pasture, or returning pasture to forest by re-planting trees.
<b>Livelihood</b>	A person's means of living or earning an income to support themselves, such as fishing, farming and tourism.
<b>Local Knowledge</b>	Knowledge that comes from inside a system or community.
<b>Locally Managed Marine Areas (LMMAs)</b>	MPAs that are managed largely or wholly by local communities including near-shore waters and coastal resources.
<b>Marine Protected Areas (MPAs)</b>	Areas of the coast and/or ocean that have been established as “protected” and given rules about access and use. MPAs are designed to conserve fish and other species and maintain healthy fisheries for long-term use.
<b>Mitigation</b>	The process of stopping or lessening climate change by reducing greenhouse gas (GHG) emissions that come from industrial activities, forestry and agricultural activities.
<b>Monitoring and Evaluation</b>	Assessing the effectiveness of an action, activity, policy or program.
<b>Nutrients</b>	A substance that provides nourishment, or food, necessary for growth and life.
<b>Observers</b>	People who attend meetings or conventions to understand what is being discussed and to influence decision-makers, but who cannot negotiate or vote on proposed actions. Observers to the UNFCCC represent businesses, NGOs, indigenous peoples, and other organizations.
<b>Ocean Acidification</b>	Process in which oceans absorb excess CO <sub>2</sub> from the atmosphere and become more acidic. Ocean acidification is increasing with climate change.
<b>Ocean currents</b>	Movement of the ocean's surface water. Water is moved mainly by wind in regular, consistent patterns.
<b>Participatory Processes<sup>4</sup></b>	Method for making decisions that involves the active participation by all members of a group.
<b>Pastoralism</b>	The raising of livestock that involves moving herds from place to place to find pasture and water.

<b>Photosynthesis</b>	Natural process in which plants take in the light and heat from the sun and carbon dioxide from the air, and release oxygen to make plants grow and keep our air clean.
<b>Policy</b>	A guiding principle that directs decision-making and planning to achieve specific results.
<b>Pollination</b>	The transfer of pollen from one part of a flower to another part of that same flower or to another flower to enable seed production and plant reproduction. Depending on the plant, insects, birds, bats and even the wind can transfer the pollen and enable the plant to create seeds.
<b>Precipitation</b>	Rain, snow, or hail (ice) that forms from the moisture in the atmosphere and falls to the ground.
<b>Protocol<sup>3</sup></b>	An agreement that outlines specific obligations or actions that countries need to take to implement the objectives of the convention.
<b>Rural</b>	Relating to an area located away from cities and/or associated with farming or subsistence livelihoods.
<b>Sea level</b>	The height of the ocean's surface
<b>Sustainable Development</b>	Development that meets the needs of the present while still preserving resources for future generations.
<b>Traditional Knowledge</b>	The wisdom, knowledge and practices of indigenous people and local communities gained over time through experience and orally passed on from generation to generation.
<b>Urban</b>	Relating to a city or town.
<b>Volcanic eruptions</b>	Volcanoes are mountains formed over openings in the Earth's surface by melted rock that flows out of the Earth's surface and hardens. When a volcano erupts, melted rock, called lava, flows out of the mountain, and ash and gases are forced into the atmosphere.
<b>Vulnerability Assessment</b>	A process that gathers information to identify an areas where a community is exposed or sensitive to climate and non-climate hazards, or where and how their ecosystems and resources or livelihoods could be damaged.
<b>Weather</b>	The temperature, rainfall, or storms in a specific place on a specific day or over a very short period of time, like one season.



## ENDNOTES

1. <http://www.climate-risk-analysis.com/glossary/index.html>
2. Commission on Human Rights, Sub-Commission on the Promotion and Protection of Human Rights, Working Group on Indigenous Populations, Twenty-second session, 19 - 13 July 2004, p.5.
3. [http://treaties.un.org/Pages/Overview.aspx?path=overview/definition/page1\\_en.xml#conventions](http://treaties.un.org/Pages/Overview.aspx?path=overview/definition/page1_en.xml#conventions)
4. <http://world-changers.org/participatory-process-methods#guidelines>





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