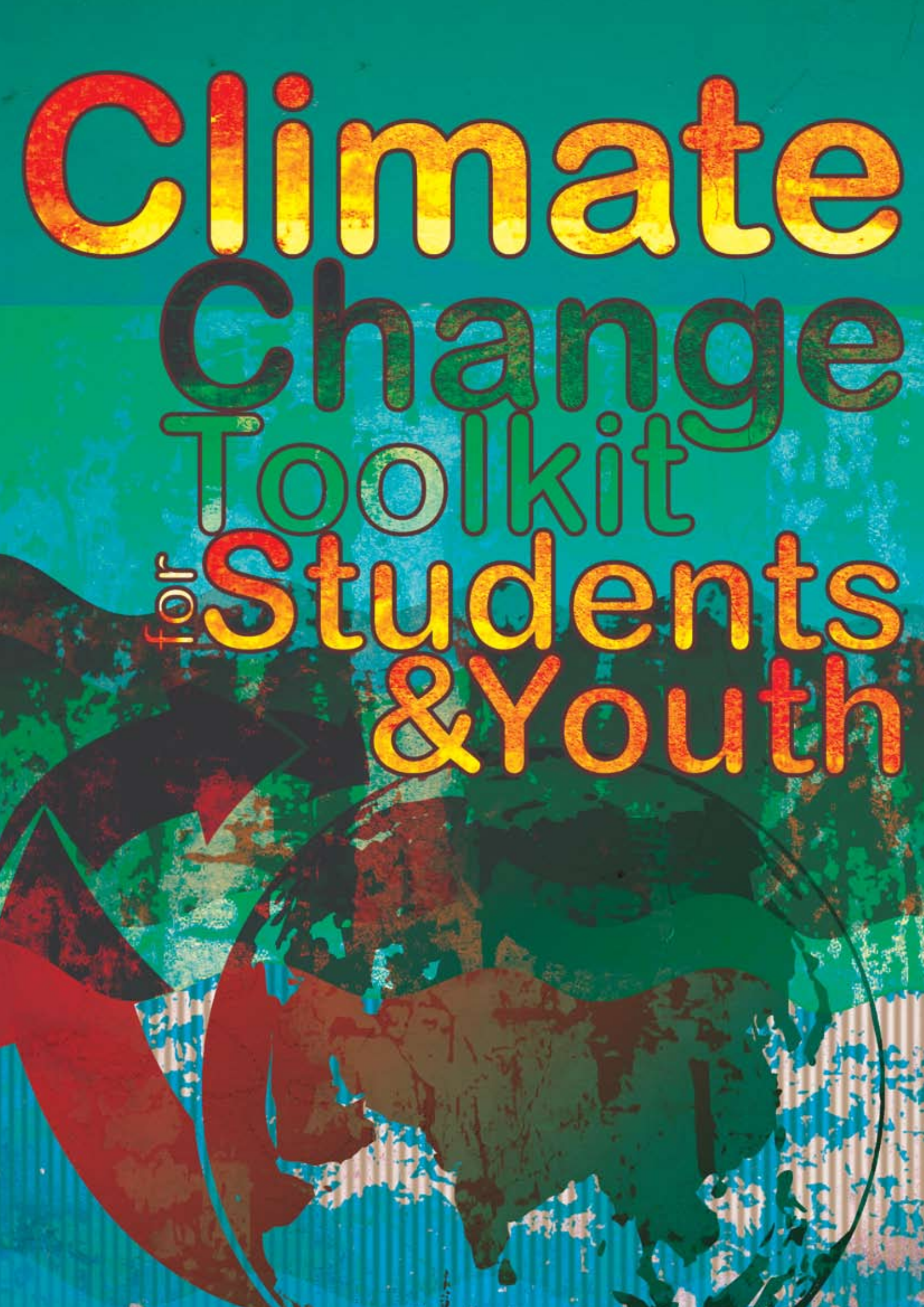
Climate Change Toolkit for Students & Youth



Climate Change Toolkit for Students and Youth

LIVE&LEARN
Environmental Education

Mangroves for the Future
INVESTING IN COASTAL ECOSYSTEMS
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Climate Change Toolkit for Students and Youth

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Adapted from:

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This tool kit was prepared by Live & Learn Environmental Education through Mangroves for the Future (MFF) with the financial support of Norad and Sida. The findings, interpretations, and conclusions expressed within do not necessarily reflect those of IUCN/MFF. No warranty as to the accuracy or completeness of this information is given and no responsibility is accepted by IUCN/MFF or its employees for any loss or damage arising from reliance on the information provided. The content is designed to be used in B.Atoll, Maldives, where the community can greatly benefit from knowledge about climate change, however the content is relevant to communities facing the impacts of climate change.

Contents

Introduction

This toolkit has been developed as part of the Project “Promoting community resilience to Climate Change, by the introduction and dissemination of conservation agriculture, through Island Women’s Development Committees, in five islands in Baa Atoll in the North Province of Maldives”. The Project funded by IUCN/MFF is partnered with the Ministry of Fisheries and Agriculture, the Environmental Protection Agency and the Atoll Ecosystem Conservation Project under the Ministry of Housing and Environment. The Project’s aim is to initiate practical action and ensure future action is planned by Island, Atoll and Provincial stakeholders and in particular by island women, to strengthen community resilience to Climate Change in five islands in Baa Atoll by December 2012.

This toolkit has been designed based on the widely accepted premise that global Climate Change represents both the most immediate and most significant threat to coastal resource management in Maldives. While it is true to say that concern and understanding about the causes and consequences of global Climate Change are now well established at the national level within Maldives, at the community level there is much less awareness of the threat posed by Climate Change to individual islands and the actions that could be taken to strengthen community resilience to Climate Change.

Context

The Maldives is a chain of 1,190 small low-lying coral islands grouped into 26 natural atolls in the Indian Ocean: 198 islands are inhabited and over 90 house tourist resorts. The islands are predominantly coastal entities. The Maldives have a narrow economic base that relies on 2 critical sectors: tourism and fisheries. Unique geography and vulnerability pose key development challenges for the country. The dispersion of the population across the archipelago raises the cost of delivering social services, as economies of scale are difficult to achieve in service provision.

Baa Atoll is the southwestern most atoll in the North Province. There are 13 inhabited islands, 57 uninhabited islands and currently six resort islands in Baa Atoll. The distance from Baa Atoll and Male’ is between 58 and 74 miles. The capital of Baa Atoll is Eydhafushi.

Live & Learn selected Baa Atoll as the location for the MFF Project after conducting consultations with United Nations Development Program (UNDP), Environmental Protection Agency (EPA) and Atoll Ecosystem Conservation (AEC) project under the Ministry of Housing and Environment. During these discussions it was decided and agreed that the project will be implemented in Baa Atoll, due to the following reasons;

- Currently there is an ongoing project funded by UNDP in Baa Atoll, which is the AEC project, therefore UNDP stated that it will be easy to monitor 2 projects if they take place in the same region.

- As highlighted by both UNDP and EPA, there is also a livelihood component in the AEC project, which is also in line with MFF.

- These areas are representative of the most diverse terrestrial and non terrestrial environments in the Maldives and the Indian Ocean.

- Further to this Baa Atoll was selected as a priority through our partnership with UNDP, EPA and AEC as these are representative of important ecosystems under pressure from many interests including tourism, fisheries and island-based subsistence.

Following this decision, the four islands where the Project would be implemented were proposed, once again in consultations with UNDP, EPA and AEC. The four islands selected were Maalhos, Goidhoo, Kudarikilu and Dharavandhoo. During the revision stage of the proposal, Goidhoo was replaced with Kamadhoo and Kihaadhoo, after considering the relatively more easy access and transportation to these two islands, than to Goidhoo, which was the most remote of the four islands originally proposed. Kamadhoo and Kihaadhoo were also included due to the existing agricultural practices on the two islands. As a result the original plan to work in four islands was revised to enable the Project to target five islands in Baa Atoll, Kudarilkilu, Kamadhoo, Kihaadhoo, Dharavandhoo and Maalhos.

A Critical Thinking Model

Model	Plan
STEP 1: Consider an idea or information. Participants are presented with a concept, idea or information to consider. These can be sourced from many different media, including a person's opinion,a question, a media article, a cartoon, artwork etc.	**Consider** The case studies (Activity 2)
STEP 2: Think critically about the idea or information. • What does it mean? • What is its purpose or agenda? • Who is it from and what is their intention? • Do I agree with it? Is it valid? • Is it relevant in my community? • What are the alternatives to this idea?	**Think critically** **Activity 2:** Case studies **Activity 3:** What is Climate Change? **Activity 4:** Speaking about Climate Change **Activity 5:** Exploring sea level rise
STEP 3: Investigate the idea or information. Participants will design methods to test the information or ideas in the community.	**Investigate** **Activity 4:** Speaking about Climate Change **Activity 5:** Exploring sea level rise **Activity 6:** Exploring ocean acidification **Activity 7:** How will the beach look as the Climate Changes? **Activity 8:** Finding out how Climate Change will affect beach users
STEP 4: Take action on the idea or information. Participants will critically reflect on their responsibility with respect to the information and ideas, and formulate an appropriate response.	**Take Action** **Activity 8:** Finding out how Climate Change will affect beach users **Activity 10:** Action planning

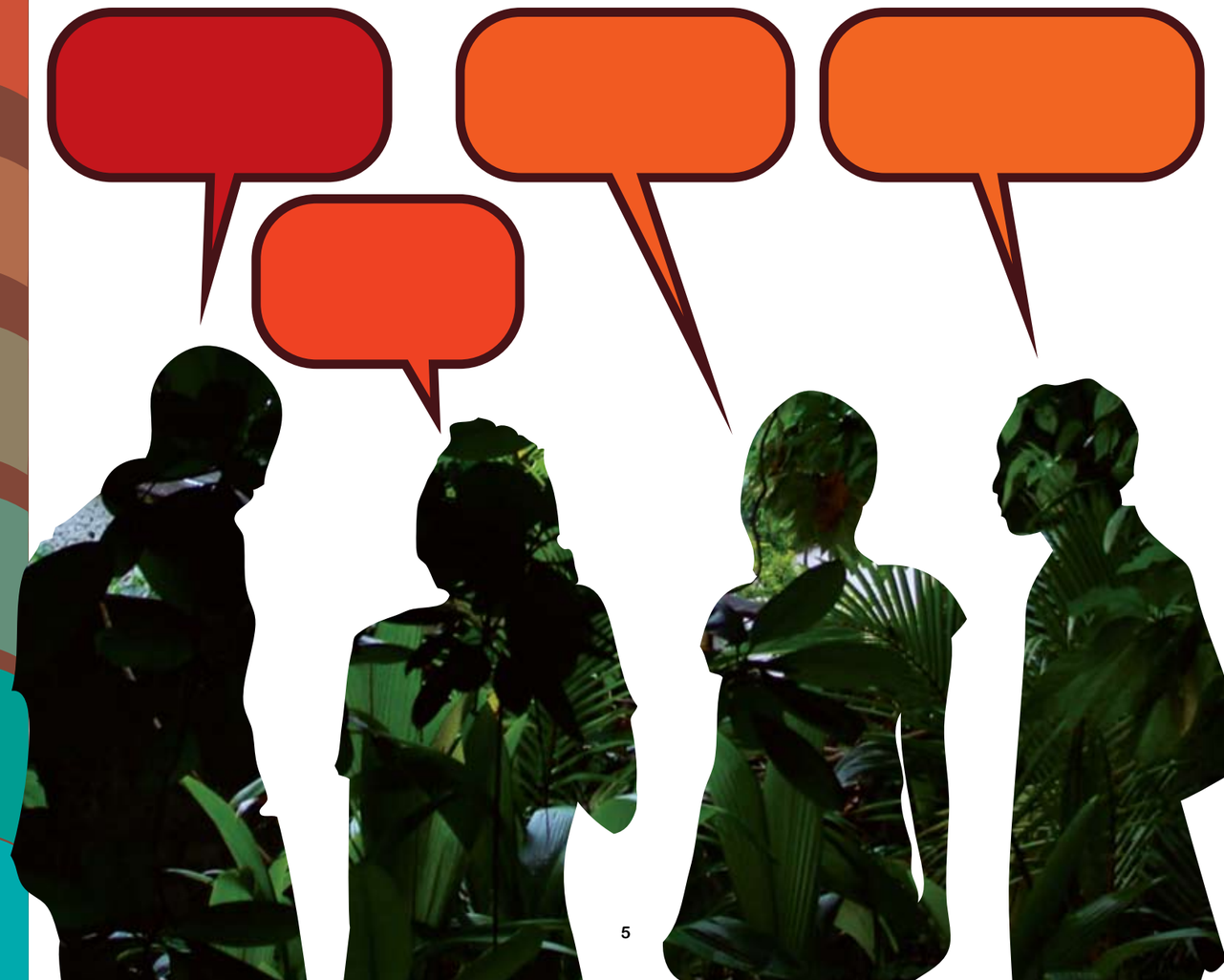
Ice Breaker

ACTIVITY 1
Purpose: To get to know each other
Time: 30 minutes
Materials: name tags, index cards

What to do:

1. Each person is given a name tag and an index card. The name tag has the name of an other person. Everyone is told to circulate, meet, mix and mingle to gather information, insights or stories about the person on their tag from group members. The opening line "Do you know me?" is used to help generate clues and conversation.

2. The index card is to be used to write down the information collected. At the end of a designated time - about 15 minutes, each participant introduces their "name tag" and the information collected on the index card to the group.



Case Studies

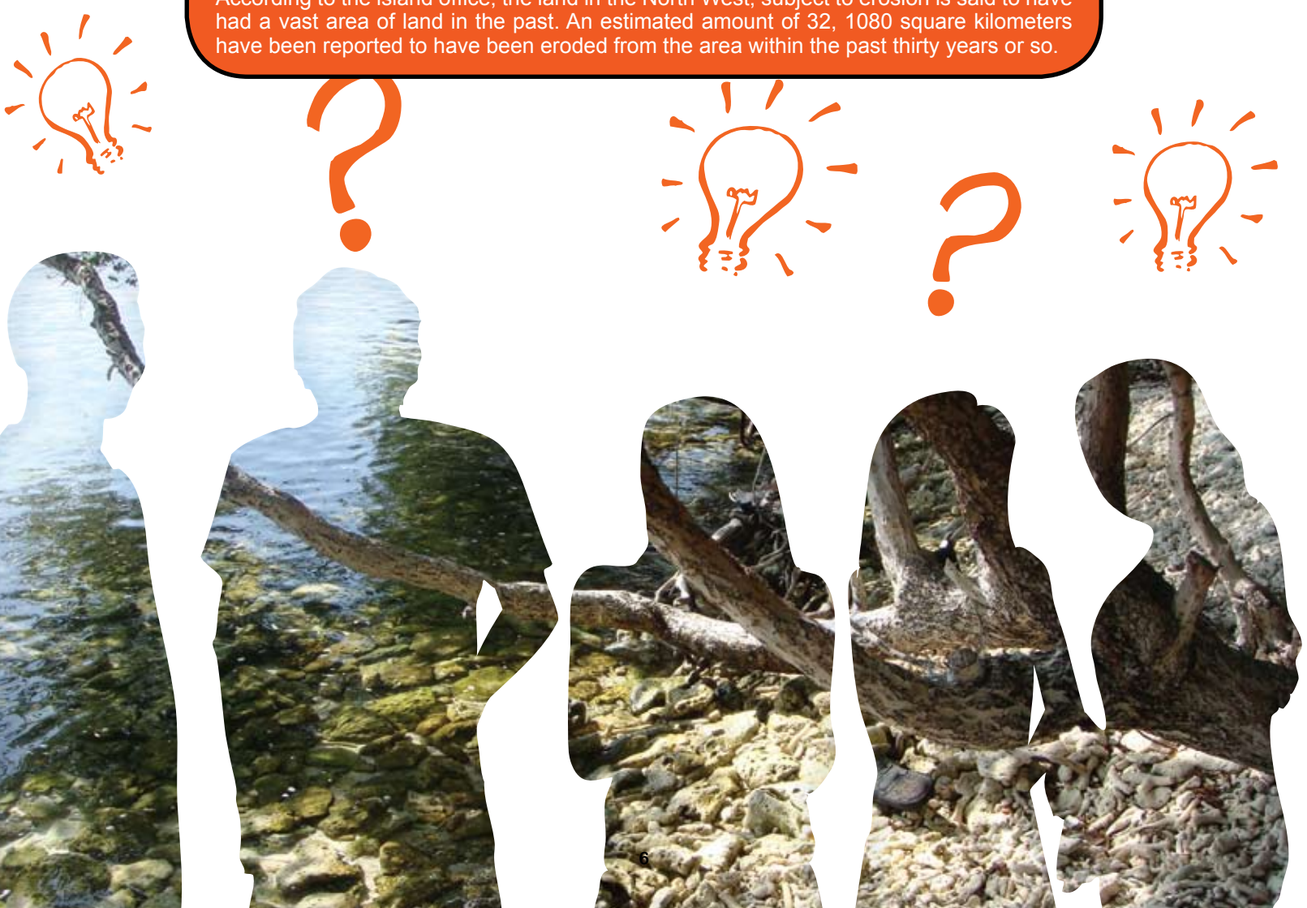
ACTIVITY 2
Purpose: To facilitate critical thinking
Time: 45 minutes
Materials: Case studies
What to do: Share the case studies with the participants and ask questions.

Case Study 1
Seenu Maradhoo and Maradhoo Feydhoo

Being two islands on the same land, Maradhoo and Maradhoo Feydhoo experience similar type of conditions. The land on the North Western side of the island is noticed to erode along the entire coastline. However, this eroding is not considered as an issue of much importance.

According to sources, it is known that the island experienced 'Bodu Vissaara' (meaning heavy rain) during the June – July of the year 1991. During this natural disaster, the island had suffered great losses, such as erosion of a large part of the beach and felling of trees. Hence, it disturbed the natural equilibrium of the beach (eroding and land formation) and suddenly destroyed a large part of the beach which had taken years to form. The incident that occurred in 1991 could be a possible cause for the continuous erosion of the island at present.

According to the island office, the land in the North West, subject to erosion is said to have had a vast area of land in the past. An estimated amount of 32, 1080 square kilometers have been reported to have been eroded from the area within the past thirty years or so.



Case Studies

Case Study 2
Hanke'de' and Gauke'de'

This area is a narrow, but quite long stretch of land between the islands Maradhoo and Hithadhoo. The road joining Maradhoo and Hithadhoo runs through these two islands. The narrowness of the island makes it prone to erosion and therefore, puts the road at risk.

The erosion of Gauke'de' is to be taken as a serious issue and efforts have already been made to protect the area. Part of this area had been protected by a revetment wall. The area has been specifically considered to be at risk, as the area that is eroding is about to reach the road. The clearing of trees in the area, to make way for the road could have been a possible cause for this erosion. Immediate action needs to be taken to conserve this area.

Case Study 3
Gan

The largest island in the Maldives, Gan in Laamu atoll comprises of 516.59 hectares and has been divided into three wards for the convenience of administrative purposes. Though vast in terms of land, its width is 1400 metres compared to its length of 6800 metres, making it long and narrow. Therefore, the area lacks thick vegetation, despite its vastness. Until 2007, the island has a small population of only 972 people and land for housing had not been leased under an appropriate land use plan. Gan, where a lot of international companies have invested infrastructure-wise, also has the advantage of being connected to nearby islands such as Kahdhoo, Fonadhoo and Maandhoo.

The most northern ward of the island, known as Thundi ward, is faced with the serious problem of removing sand from the beach. Investigations made by a survey team revealed that there had been huge pits dug in the sand, suggesting that the island has eroded due to excessive removal of sand from the area. Removing sand has become so extreme in the area, due to the illegal trade of sand taken from the beach. This may be due to the fast development in projects that require a lot of sand these days. This includes constructing houses, buildings or roads either financed by government aid or that of other international organisations. According to the residents of the island, they were strongly against this.

Ask the participants the following questions:

- Do you think that the situations are real? Why?
- Are the case studies relevant to your community? Why?
- Which case study is the most relevant? Why?
- What kind of solutions can you think of?

What is Climate Change?

ACTIVITY 3

Purpose: To find out what participants already know about Climate Change and where the gaps are.

Time: 2 hours

Materials: A film about climate, two sheets of flipchart paper, with:
- 'Climate Change – what we know' written in the middle of one and
- 'Climate Change – our questions' in the middle of the other

What to do: Ask the groups to put up their hands if they have heard of 'Climate Change' or 'global warming', and then brainstorm with them:
- What they know about it

Write the responses up as a connections web on the flipchart paper.
At this stage, accept all their ideas and don't attempt to clarify or explain.
Pin up the two flipchart sheets to add to later.

Show them the documentary "Home" (CD attached in this toolkit) which shows Climate Change in different areas. Before showing the documentary, tell the participants to look out particularly for the causes of Climate Change identified by the documentary.

Go back to the flipchart sheets and ask the participants:
- If they want to add anything?
- Has the film answered any of their questions?
- Has it raised more questions they want to add?

Add anything they say to the appropriate flipchart.

Speaking about Climate Change

ACTIVITY

Purpose: Investigate the causes of Climate Change and Climate Change's impact on the local environment.

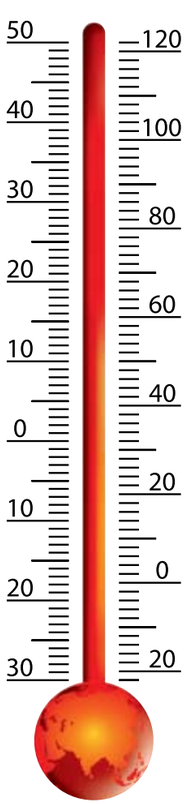
Time: 90 minutes (Full day if conducting demonstration using the seedlings).

Materials: Two small thermometers or two small seedlings in a small pot (no larger than 5cm diameter), one large clear glass jar

What to do:

Activity summary

In two demonstrations, participants will learn how global warming happens, be able to explain why the climate is changing and understand how Climate Change will impact on the local environment.



Tuning in:

1. Before you begin the activity ask the participants how much they know about different types of weather and climate. Explain the difference in weather and climate: Weather means the daily descriptions of what is hapening, i.e. sunny and hot today, raining and cold tomorrow. Climate describes the long term variations of an area, for example, in New Zealand; there is a winter, which is very cold, and a summer, which is warm.

2. Ask participants to explain what the weather and climate is like in the Maldives. You could expect to receive answers such as: We have a wet and dry season, where the wet season has a lot of rain and is very humid and the dry season usually has a lot of sunny and warm days.

3. Ask participants if they have ever heard of global warming. Ask the participants to refer to fact sheet (what is Climate Change) show the diagram in the fact sheet and ask participants to have a look. Ask the participants if they think global warming could have an effect on their lives. Ask them to provide reasons for their answers and note down.

4. Discuss how in our daily activities we might add to the amount of bad gases in the atmosphere. Ask participants if they are aware of what we do that does this. Assist participants with their answers.

5. Explain that an increase in these bad gases will cause temperatures to rise and climate to change. Help participants to understand how this happens by using information from the fact sheet (Gases trapping heat)

Speaking about Climate Change

Global warming experiment

6. Tell the participants that they are going to undertake a demonstration that aims to simulate global warming.

7. Place two thermometers or two small seedlings side by side on the same kind of surface outdoors. If using the seedlings you should start this activity in the morning, leaving the seedlings for several hours, to see the effects in the afternoon.

8. Explain to the participants that the glass jar will represent the blanket of gases that surround the earth, which is very thick because of the increase in bad gases released into the atmosphere. Ask for a volunteer to then cover one of the thermometers with the large jar. If you are using seedlings, cover one of them; note, this would have been done in the morning.

9. If using a thermometer, you do not need to begin this activity in the morning as with the seedlings. Record the readings from each thermometer at the beginning of the experiment, again after 30 minutes and again after one hour. If you are using seedlings describe their appearance after 3 hours and again after 3 hours.

10. Discuss the results. What were the differences in temperatures shown on the thermometers? or indicated by the seedlings between the one covered by the 'blanket of gases' (simulated by the jar) and the one that is not covered? Note that the seedlings indicate temperature by the level of wilting.

11. Discuss how the increased thickness or concentration of bad gases causes the Earth to become warmer. In the case of the seedling, the extra heat caused it to wilt more in comparison to the other seedling. Discuss the sorts of impacts that an increased temperature would have on the participants and their surrounding enviroment?

Exploring Sea Level Rise

ACTIVITY 5

Purpose: To observe practically how sea level rise

Time: 1 hour

Materials: Flip chart, world map, water, bucket, ice cubes, paper, ruler, blue tack or sticky tape, block of wood or a brick.

What to do:

1. When you are satisfied that participants understand the concept of global warming, use the following demonstration to show how Climate Change can affect our world. If you have a world map point to the Poles and ask the participants if they know what the environment is like in these areas. If your participants have difficulty with this, lead them with clues such as: These areas are further away from the Sun. We are in an area that is close to the Sun...Here we are hot...so there it would be... You should get answers such as cold and dark. Use their answers to expand on what the areas are like, e.g. that they are mostly covered in snow and ice.

   Explain to the participants that we are going to see whether an increase in a few degrees (which is what scientists predict will be the effect of Climate Change) can cause much damage to the world.

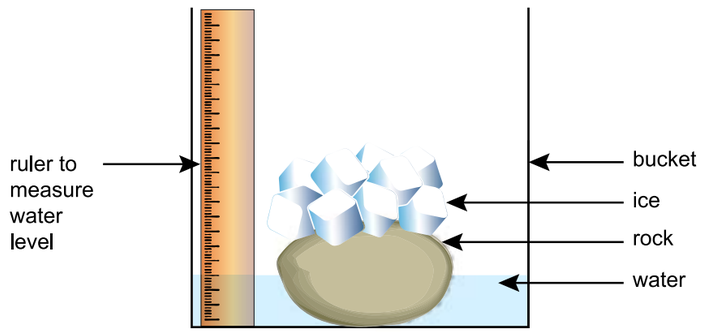
Conduct the demonstration:

2. Put a piece of wood or stone into the bucket or plastic box. Fix a ruler to the inside of the box with sticky tape or Blue Tack.

3. Put the ice on the block of wood or brick. This represents ice, just like the ice and glaciers that cover land in the far south and far north of our planet.

4. Ask a participant to pour water into the bucket until the level is just below the top of the block.

5. Get another participant to record the level of water on the ruler. Leave the box to warm up to room temperature, and all the ice has melted. This should only take about 10 minutes.



Exploring Sea Level Rise

6. Tell participants to draw a diagram of the experiment and the table (below) in their notebooks. Record the level of the water after the ice has melted.

	Level Before	Level After	Change in Level
Land Ice Box			

7. After the participants have completed the measurements and entered it into their notebooks, you could generate a discussion with the following questions:
   - What causes ice to melt?
   - Why did the water level rise in the bucket?
   - With global warming, we are expecting the icebergs and ice sheets covering land at the Poles to melt. If the ice melted at the Poles, causing the sea level to rise, how would it affect your island?

8. Make a list of possible effects to your community if the sea was to rise by 1 metre.

Exploring Ocean Acidification

ACTIVITY 6

Purpose: Discuss how ocean acidification works by showing examples.

Time: 1 hour

Materials: Vinegar, rock, sea shells, powdered chalk, beach sand, egg, glass or jars

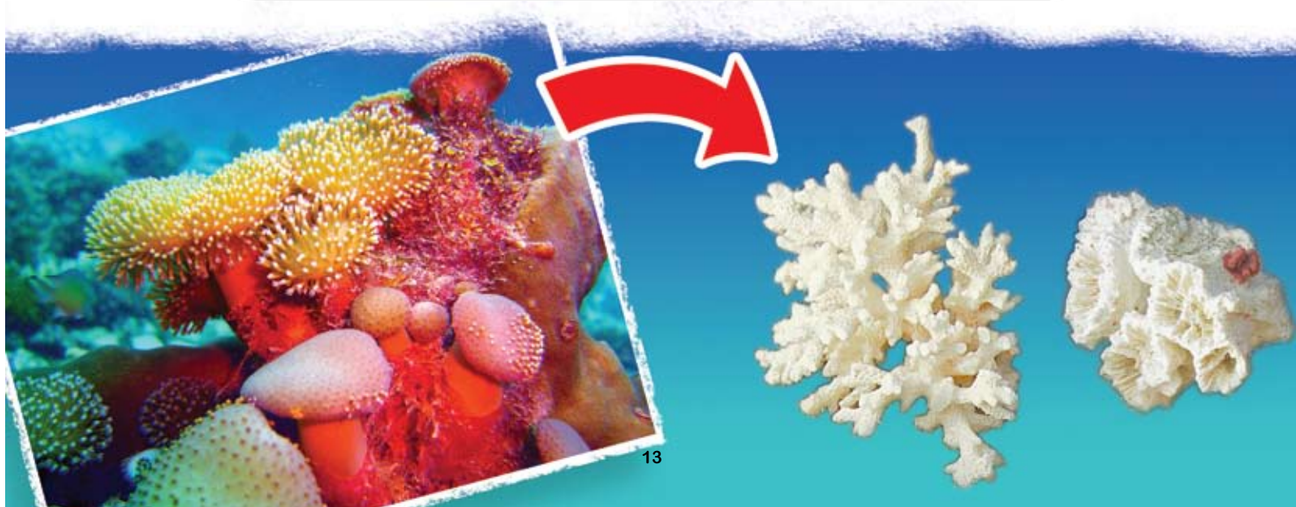
What to do:

1. Observe and record→ Place some specimens of rock, sea shells, powdered chalk and beach sand in separate glass jars. Cover each specimen with vinegar and let the samples sit for an hour or so, or even overnight. Bubbles will form on the specimens containing calcium carbonate. The vinegar, which contains acetic acid, reacts with the calcium carbonate to produce calcium acetate and carbon dioxide (the bubbles).

2. Alternatively place an egg in a jar and cover the egg with vinegar. Wait a few minutes and look at the jar. You should see bubbles forming on the egg. Leave the egg in the vinegar for a full 24 hours in the refrigerator. After the 24 hours, carefully pour the old vinegar down the drain and cover the egg with fresh vinegar. Place the glass with the vinegar and egg back in the refrigerator for a full week. One week later pour off the vinegar and very carefully rinse the egg with water. The egg looks translucent because the outside shell is gone. The egg shell is made of calcium carbonate and is dissolved by the acetic acid in the vinegar.

3. Discuss how ocean acidification works→ Carbonic acid in the oceans works in the same way as the acetic acid in the vinegar, it dissolves the calcium carboate. Ask the participants to:
   - list all the animals on the beach that have shells or skeletons made of calcium carbonate and ask them what will happen to those animals as the ocean acidifies.
   - think about how acidification will affect the beach and coral reef
   - discuss how acidification affect the food chain and the worlds fisheries

4. Discuss what, if anything can be done:
   - To reduce carbon dioxide emissions;
   - Improving the health of coral reefs, e.g. by reducing pollution, preventing over-fishing, creating marine protected areas;
   - To making everyone, from fishermen to politicians more aware about ocean acidification.



Exploring Ocean Acidification

Reflection

1. Ask your participants to imagine the impacts on their lives if the coral reefs found on their coasts were to disappear because of Climate Change.

2. Either photocopy or handout the coral bleaching section of the fact sheet for participants to read through or read it out loud to the whole group.

3. After the participants have had read through and think about it, ask them to respond to the following questions by writing it in their note books.
   - Why are coral reefs important?
   - How do you feel about the threat to coral reefs?
   - What would change in your community if you didn't have coral reefs?
   - What changes could your community make so that it could survive without coral reefs?
   - What do you and your family do that may contribute to the Climate Change problem?
   - What could you or your community do to help address the impact of climate change? (Aim to list 5 to 10 things you can do.)

How will the beach look as the Climate Changes?

ACTIVITY 7
Purpose: Think how Climate Change might impact our beach and how it will look in 10 and 20 years time
Time: 1 hour
Materals: A3 papers, markers, pencils, colours

What to do:

Discuss how Climate Change might impact your beach and how it will look in 10 and 20 years time. Items to consider are:
- Size of the beach: will it be larger or smaller?
- Trees and vegetation behind the beach: will they still exist?
- Animals: will the crabs, birds, fish and coral reefs still be as plentiful and healthy as they are now?
- Houses and buildings behind the beach: will they be in the same condition? Will there be more buildings?

Ask the participants to draw the beach as it is now and as it might be in 20 years times, taking into account the possible impacts of Climate Changes and note down the changes that they think will occur after 20years.

Finding out how Climate Change will affect beach users

ACTIVITY 8

Purpose: To understand effect of Climate Change

Time: 1 hour

Materials: A4 papers, pens,

What to do:

1. Brainstorm with the participants how they think Climate Change will affect their beach. Some suggestions include:
   - beach will erode and get smaller as a result of rising sea levels;
   - rising temperatures will cause coral bleaching and the corals may die;
   - high waves from increased storms and cyclones will undermine the trees and as a result they will fall down and die providing less shade for the beach;
   - a more acidic ocean will result in fewer shells and marine animals;
   - there will be no space or vegetation for the sea turtles to nest;

This list contains mainly negative changes likely to affect the beaches of Maldives but in some parts of the world there may be positive changes, e.g. in for countries like New Zealand, the warmer temperatures may make the beach a more attractive environment for visitors and residents.

2. Categorise the users of the beach:

- Are users' residents or tourists or both?
- What type of groups use the beach: families, tourists, youth, fishermen?
- Are the beach users ecologically conscious or not?

3. Design a questionnaire to find out how beach users will respond to one or two of the most relevant Climate Change impacts. An example is given below. Your questions will depend on the particular Climate Change impacts that are most important at your beach and the type of beach users.

Sample Questionnaire

This questionnaire is designed for tourists. The most significant Climate Change impact at the sample beach is beach erosion.

1. Where do you live?
2. Is Climate Change a big issue in your country? Yes/No
3. Is this your first time to Maldives? Yes/No
4. When you visit the beach do you go:
   - swimming Yes/No
   - snorkelling Yes/No
   - diving Yes/No
   - walking Yes/No
   - other (please specify)

Finding out how Climate Change will affect beach users

5. Due to Climate Change, the beaches of the Maldives are eroding at a faster rate and getting smaller
   - Would you still come to the resort you are staying if the beach were 50% smaller? Yes/No
   - Would you look for another resort which has a bigger beach? Yes/No
   - Would you stop coming to the Maldives if there were no resorts with nice beaches? Yes/No

Tabulate the results of your survey. Discuss the responses with the participants and ask them whether they expected these results. You might like to share the results of your survey with your local Council, the Environmental Protection Agency or the tourism agency since this might sensitise officials as to how beach users value the beach resources under threat from Climate Change.

Action Planning

ACTIVITY 9

Purpose: To have some ideas of how you can start to plan in your own community.
Time: 2 hours
Materials: A3 papers, markers, colours, rulers, pencils

What to do:

1. Divide the participants into three equal groups. Make sure there is equal number of girls and boys in each group.

2. Gather information: Ask each group to write down all the big weather events over the past 30 years – like big storms or flooding. How did your community respond to these events? How did your community try to protect the island? (the participants can get help from the elders in gathering information)

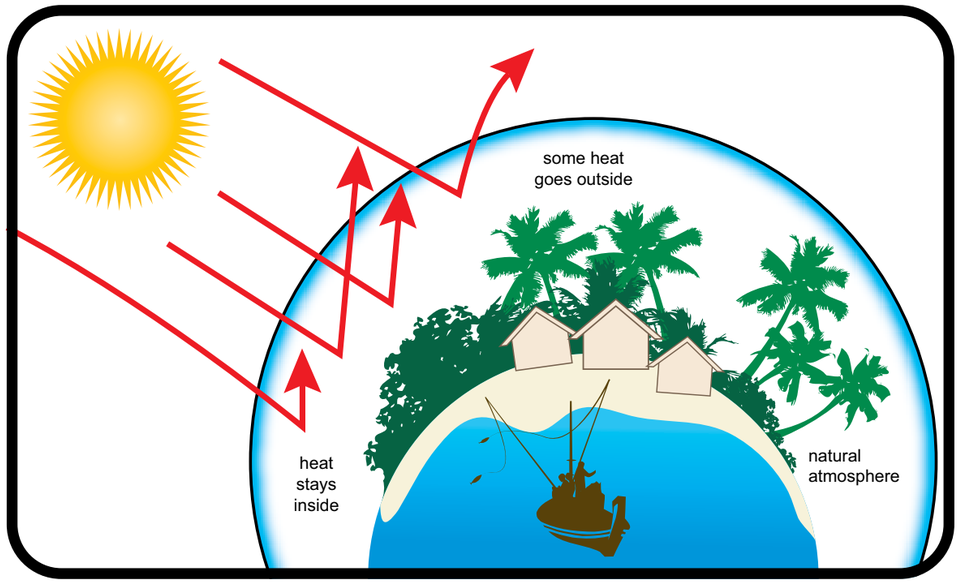
3. Mapping: Ask each group to draw a map of the island including all the houses, mosque, powerhouse, school, health center, farming plots…etc. Next draw on top of this map all the dangers that might face the community. Where is the sea level rising? Which houses will be hit first by strong waves and winds? Who are the pe ple in the island that might need help in an emergency? Next, think about what resources does your community already have that you could use to help protect against these dangers?

4. Discuss and make a plan: Once the groups finish their maps, bring all the maps together and look at the difference and similarities. Discuss and make a simple action plan of how your community can work together to protect against the dangers faced by Climate Change.

Fact Sheets
What is Climate Change?

The atmosphere

The Earth has an atmosphere that covers it like a blanket. The sun shines down on the Earth. Some heat is trapped between the Earth and the atmosphere. Some of the heat goes back out. The blanket is made up of different gases. One gas comes from water that has floated up from the ocean (evaporation). Water helps to keep heat on the Earth. The heat that stays on Earth is the right amount for people to live and plants to grow.
An increase in the quantity of gases is making the natural blanket of the atmosphere thicker.
One of these gases is carbon monoxide which comes from cars.

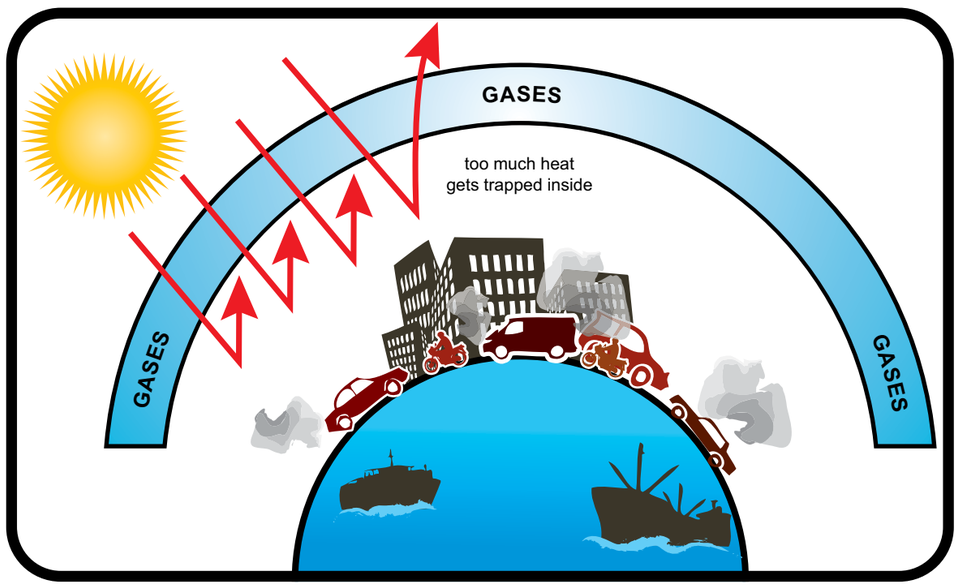


In the natural atmosphere some heat stays inside and some heat goes outside. There is natural balance that is the right amount for people to live, and for plants to grow.

Gases trapping heat

There are other types of gases (like carbon dioxide and nitrous oxide) that also trap heat. These gases are known as Greenhouse gases and are produced when fuels such as diesel, or coal are burnt. These fuels are burnt to power a car or to make electricity. Burning waste also releases these greenhouse gases.
You cannot see the blanket these gases make, because the gases are invisible.
Countries like Australia, the United States and China produce more greenhouse gases than the Maldives. This is because they drive more cars, have more factories and use a lot of electricity in their homes and businesses.

Fact Sheets
What is Climate Change?



Gases from cars and factories and airplanes make the blanket around the Earth thicker and thicker. This blanket traps heat making the Earth become hotter. This is called global warming.

Global Warming

The gases from cars, factories and airplanes float up into the sky and make the atmosphere thicker and thicker, similar to a blanket. This thick blanket stops heat from leaving the Earth. Over time, more heat will be trapped between the blanket and the surface of the Earth. This thick blanket wrapped around the Earth is causing the Earth to become hotter and hotter. This is called global warming.

Climate Change

The thick blanket of gases in the sky is making the Earth hotter. The warming of the Earth is causing the normal wind and rainfall patterns to change. In the Maldives, frequency and intensity of rain storms may increase. Duration of dry periods may also increase leading to shortages in drinking water. In many parts of the world, the frequency and intensity of extreme weather events (snow storms, hurricanes, forest fires…etc) has already been increasing. Together these changes are called Climate Change.

Climate Change is defined as a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is observed over long time-periods (many decades).

Fact Sheets
Impacts of Climate Change

Sea Level Rise

This is happening for two reasons. The first reason is melting ice. There is a lot of ice at the bottom and the top of the Earth, known as the North and South poles. As the Earth is warming, this ice is melting. The melted ice runs into the sea and is making the sea level rise.

The sea is also getting bigger as it gets warmer. This is the second reason why the sea level is rising. Water takes up more space as it gets warmer.

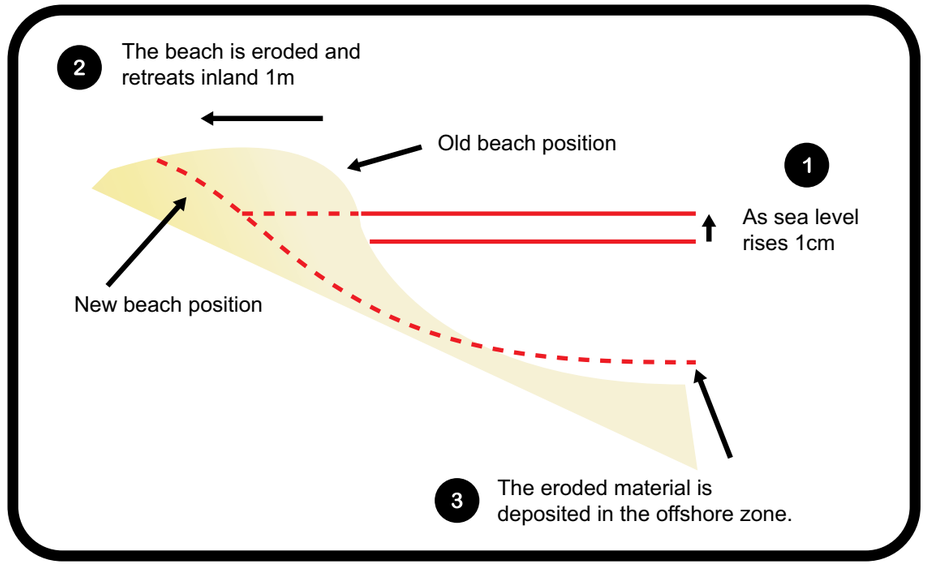
Sea level rise is a big concern for the Maldives, as the islands are very small and low-lying.

Beach erosion and sea level rise

As the temperature rises, the ocean water expands, and this change combined with the melting of the polar ice caps and glaciers, results in a rise in sea level. Rising sea levels result in increased beach erosion, reducing the area of beaches and impacting coastal habitats. Of particular concern is the fact that sea level will continue to rise for centuries, regardless of mankinds efforts to stabilise greenhouse gases. This is because the temperature of deep ocean water changes very slowly, so the process of expansion that has already started cannot be stopped in just a few decades.

Research shows that for every 1 cm of sea level rise the shoreline will retreat inland 100 times that amount. This is known as the Bruun Rule and is essentially an approximation that varies according to the physical characteristics of the particular beach and the offshore slope. However, it is a useful rule of thumb that can be used to illustrate how the predicted global sea level rise of less than a metre will have a major impact on beaches around the world.

Bruun Rule



The Bruun Rule, as shown above, shows that as sea level rises by 1 cm, the position of the beach retreats inland by 1 metre, as sand is transported from the beach to the offshore bottom.

Fact Sheets
Impacts of Climate Change

Coral bleaching

Coral reefs are very important to the Maldives. They provide food for our communities, attract tourists and protect our coasts from storms that come from the ocean. They also provide homes for many animals and plants. Changes in ocean temperature create big problems for coral. Coral reefs are made up of millions of very small animals called coral polyps which are related to, and look like, miniature jellyfish. These polyps live in huge colonies and produce a hard substance known as calcium carbonate, which is the building block of the reef. Each coral polyp has microscopic algae living inside it, which helps the coral create sugars (food) using energy from the Sun. When the sea temperature rises, the corals are forced to spit out the algae. This turns the corals white in a process known as 'coral bleaching'. The coral that have turned white cannot survive for very long without their algae, and will slowly starve to death.

Ocean acidification

As the effects of Climate Change become apparent, one of the emerging concerns is the impact of ocean acidification. Atmospheric carbon dioxide dissolves naturally in the ocean forming carbonic acid, a weak acid. The pH of the oceans has decreased 0.1 unit compared to pre-industrial levels and the continued increases in atmospheric carbon dioxide are expected to significantly alter ocean pH levels, making them more acidic. The increased acidity will reduce carbonate, which is needed to build the calcareous shells and skeletons of many shellfish and coral reefs. Such impact on the coral reefs and organisms will have significant impacts on the beaches, since sand consists of pieces of coral and shell fragments. Coral reefs provide sand for our beaches and act as a natural seawall protecting our islands from strong waves.

Climate Change Predictions

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 to provide decision-makers and others interested in Climate Change with an objective source of information. The IPCC does not conduct any research nor does it monitor climate related data or parameters. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature relating to Climate Change. The IPCC consists of thousands of scientists from different disciplines, who work together to produce assessment reports at approximately five year intervals. The IPCC supports the United Nations Framework Convention on Climate Change (UNFCCC), which entered into force in 1994 and provides the overall policy framework for addressing Climate Change. Whilst the IPCC reports are very technical, they do contain supporting material such as "frequently asked questions" which help the general reader understand the contents. The IPCC reports are available on the website www.ipcc.ch/.
Projections for Climate Change vary regionally and readers are advised to contact local sources such as national meteorological offices and national reports on Climate Change (see each country's national communication available on the UNFCCC website www.unfccc.org) for country-specific information.

Fact Sheets
Adapting to Climate Change

Protecting and Planting Trees

Trees are very important for making the clean air we breathe. Trees take in from the air, gases such as carbon dioxide and hold it in their wood. Trees release oxygen for us to breath, and water. Keeping trees in the ground helps to clean the air, but burning trees means more carbon dioxide in the air. Trees also protect our islands and provide us food. Protecting or planting trees near the shore will protect the islands from strong wave action and help reduce erosion and flooding.
As Maldivians it is very important for us to plant trees that provide us food as we are very dependant on imported food items such as rice, milk, carrots, apples, sausages, noodles…etc. Due to Climate Change, a lot of farms and factories all around the world are being destroyed. Therefore, instead of depending on so many imported products, it will be wise to start growing our own fruits and vegetables in our homes. Protecting and planting trees that have medicinal value is also very important.

Building a raised garden bed

As the majority of our islands are small and low-lying, it will be wise to plant fruits and vegetable in raised garden beds to protect the plants against rising salt water. There are many ways to make a raised garden bed. One example is making a garden in an old Bokkuraa. You can place the old Bokkuraa in your backyard and fill it with soil. You can make compost and mix it with the soil in the Bokkuraa to provide nutrients for the plants.

Protecting the Mangroves

A number of islands in the Maldives have mangroves which play a very important role in the island ecosystem. Mangroves help to protect islands from storms and large waves. In this way they work like a natural sea wall. The roots of mangroves hold soil together to stop erosion by big waves and heavy rain. Mangroves also provide food and medicine for people. They also provide a home for fish to live and breed. If mangroves are removed or destroyed, the community will lose the protection from the mangroves, as well as their food and medicine source.

Fact Sheets
Adapting to Climate Change

Building a sea wall

In the Maldives, the capital island Male' has a sea wall built around with the aid from the Japanese government. The sea wall protects Male' from storm surges and large waves. The sea wall protected Male' from the tsunami in 2004. A lot of other islands and resorts also have sea walls built around the island to protect from waves and prevent severe erosion.

There are different kinds of sea walls. Some are made by placing large boulders or rocks, while others are made by placing cement bags. In recent times, geotextile sand bags have also been used to build sea walls. These bags allow corals to grow on them so in the long term they can act like artificial coral reefs. In some communities, trees are also planted on the sea walls as roots of the trees help to hold the wall in place.

If you are planning on building a sea wall you need to remember that the sea water will wash around the wall. Think about where the sea water will go and perhaps talk to your community members about where the sea water will go and what might happen. You may also like to speak with a technical expert or the government.

Collecting Rain Water

Long periods without rainfall, flooding due to "Udha erun" or from strong waves have resulted in saltwater entering freshwater supplies in most islands of Maldives. This means there is less water available to drink and to grow vegetables. Even though desalination water is used in Male', tourist resorts and some islands, making desalinated water is a very expensive process. Therefore collecting rainwater during rainy days by installing rainwater tanks in your homes is very important. Rainwater tanks can also be installed in your schools and community spaces so that everyone in your island can benefit from it. Special care must be taken when installing the rainwater tanks, to avoid contamination of water.

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