United Nations
Educational, Scientific and
Cultural Organization

CLIMATE CHANGE EDUCATION INSIDE AND OUTSIDE THE CLASSROOM

Climate Change Education Inside and Outside the Classroom

UNESCO Course

United Nations Educational, Scientific and Cultural Organization

UN DECADE OF EDUCATION FOR SUSTAINABLE DEVELOPMENT
DÉCENNIE DES N.U. POUR L'ÉDUCATION EN VUE DU DÉVELOPPEMENT DURABLE
2005-2014

Sandwatch Foundation

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Course Introduction

Helping the next generation of young people understand what climate change is and how they can work to address the impact of climate change is crucial to the future of this earth. UNESCO and the Sandwatch Foundation partnered with Rhodes University to create a course that would empower educators to teach the elements of climate change inside and outside their classrooms. The course combines elements from UNESCO's *Climate Change Education for Sustainable Development Course for Teachers* with the Sandwatch programme's 'MAST' methodology. As you will discover during this course, MAST (measure, analyse, share and take action) is a prime example of climate change education for sustainable development.

This course has been developed specifically for educators in African coastal regions and small-island developing states (SIDS). These regions are especially vulnerable to the impact of climate change and the challenges it raises for the wellbeing of people and the ecosystems on which they depend. For this reason, educators are encouraged to incorporate climate change into their teaching. This course supports a range of educators, most especially secondary school teachers, teacher educators and community educators, to teach about climate change in ways that reflect the principles of Education for Sustainable Development.

Education for Sustainable Development (ESD) is about encouraging behaviour that promotes a sustainable future. ESD is based on five types of learning:

- Learning to know
- Learning to do
- Learning to live together
- Learning to be
- Learning to transform oneself and society

In the last decade, ESD materials have been presented to teachers around the world describing methods they can use to incorporate ESD in the classroom. While the overall goal and purpose of ESD may seem overwhelming, emphasis has been placed on ease of use and implementation for teachers. New courses do not need to be created; rather, various conceptual approaches and techniques can be incorporated into existing classroom teaching and into the curricula of teacher education courses.

In 2008 Sandwatch was presented as an example of how to integrate the five types of learning for ESD. Students learn about scientific observation methods, focus those methods on the beach environment, monitor and analyse the issues facing the beach; they share the information with other members of their community and then try to address the issue.

Sandwatch is a volunteer network of children, youth and adults working together to enhance their beach environment and build resilience to climate change. Since its beginning in 2001, the network has grown to include more than 30 member countries with hundreds of schools and community groups actively monitoring change in their beach environments.

Course Aims & Objectives

Aims:
1. Stimulate and support the integration of education for sustainable development (ESD) approaches in pre- and in-service teacher education courses, in cross-curricula classroom practice, and in non-formal (community-based) learning programmes.

2. Support educators to take local, contextualised action to mitigate and especially to adapt to climate change.

Objectives:
1. Introduce educators to the MAST (measure, analyse, share and take action) application of ESD in the context of climate change.

2. Incorporate rigorous scientific knowledge and ethical reflection into climate change adaptation and mitigation approaches and measures in small islands and coastal regions.

3. Provide an outline course and supporting documents which educators can use to develop Climate Change ESD programmes, activities or materials specific to their professional and social-ecological context.

Course Orientation

This course is guided by four principles: contextual relevance, knowledge-based learning, action-oriented learning, and curriculum links.

1. Contextual relevance
'Context' refers to the situation in which we find ourselves; it is the *milieu* or circumstances in which we live and work. Context also influences the ways in which people learn, the quality of their learning and the ways in which they apply what they learn. By the end of this course, you should be able to make links between your own context and the new knowledge gained from the course. You will also be supported to incorporate these contextual links into your future teaching activities, thereby making knowledge about climate change and sustainable development more locally applicable.

2. Knowledge-based learning
There are many different forms of knowledge (* scientific knowledge *contextualised knowledge * local knowledge *indigenous knowledge etc.) and it is important for us to consider the contributions that each can make to an effective response to climate change.

On this course, we will work a lot with scientific knowledge and bodies of information about climate change. We will also consider how the form and quality of knowledge about climate change influences our ethical responses and how we interact with others to address climate change challenges.

You will be asked to contribute your own prior knowledge and local, contextual knowledge to the course as this will broaden the knowledge-base and learning potential of all the course participants. By the end of the course, you should be able to access a range of information about climate change and use it – selectively and critically – as a foundation for your own climate change education teaching.

3. Action-oriented learning
Challenges posed by climate change require that we use our knowledge to take action (at a small, local scale, or nationally or globally according to what we are able to do).It also means that on this course we take an active

approach to teaching and learning. Much of this course focuses on practical activities that not only support your own learning about climate change risks and adaptations in coastal areas, but stimulate you to integrate action-oriented learning in your own teaching practice. By the end of the course, you will have been exposed to a range of climate change action possibilities and you should be able to adapt some of these ideas for climate change education and action in your own context.

4. Curriculum-linked (for classroom teachers and teacher educators)
This course also emphasises the links between climate change and the school curriculum. Climate change is a cross-cutting concern and can therefore be addressed across the school curriculum.

If you are a classroom teacher or teacher educator, throughout this course you will be encouraged to think about how climate change and ESD can be integrated in the subject(s) that you teach. By the end of the course, you will develop lesson plans to take back to your school or institution to strengthen climate change education and ESD.

Learning Outcomes

By the end of this short course, you should be able to:

- incorporate an Education for Sustainable Development (ESD) approach into your own educational practice;
- engage critically with bodies of knowledge about climate change (basic science of climate change; social impacts of climate change; adaptation and mitigation) and consider their relevance to your educational context;
- use the MAST methodology (measure, analyse, share and take action) in a coastal context;
- design an action-oriented educational programme related to climate change that is relevant to your context.

Course Structure

The course consists of three modules presented over four days. Module 1 (1½ days) focuses on understanding climate change and ESD; Module 2 (1½ days) focuses on action-oriented learning outside the classroom (using the Sandwatch methodology) and includes a field-trip; Module 3 (1 day) builds on what was learned in Module 1 and 2 and participants work to create lesson plans/educational projects for implementation in their classrooms. A follow-up is conducted 2-3 months after the course to determine how the educational activities have been implemented.

Module 1 (1½ days)
Understanding climate change and ESD

- Outline of ESD;
- Pooling personal experiences of climate change;
- Exploring the social impacts of climate change;
- Understanding the basic science of climate change;
- Past changes and future scenarios (exploring uncertainty);

- Understanding adaptation and mitigation;
- Linking climate change adaptation and disaster risk reduction.

Module 2 (1½ days)
Using action-oriented learning outside the classroom to understand the past and prepare for the future at the local level

- Understanding how the Sandwatch approach (MAST) brings together ESD and climate change education and examples of success and failure;
- Field trip to the beach to observe the beach, make a sketch map, understand the issues, talk to the local community to understand the past changes, research available information on past changes on the web;
- Measuring changes over time e.g. erosion and accretion;
- Scenario mapping – discussion of past beach changes at the field trip site and determining how the beach might change under climate change scenarios;
- Planning local action using Sandwatch and other examples;
- Post field trip or evening activity to show the Sandwatch training videos to give participants an idea of the scope of Sandwatch and for participants to share some of their related activities;
- Introducing the Sandwatch database

Module 3 (1 day)
Designing climate change teaching elements inside and outside the classroom

- Using elements from ESD, climate change and Sandwatch in Modules 1 and 2, review the school curriculum (for teachers and teacher educators) and select one topic where elements of ESD/climate change/Sandwatch could enhance the understanding of that topic and develop those elements.
- Course consolidation, reflections and evaluation

Course Overview

Day 1 - Module 1

- Course Orientation
- Climate Change: Local and Global Perspectives
- ESD as a response to climate change in Africa and SIDS
- Future climate change scenarios?
- Wrap-up Day 1, looking ahead to Day 2

Day 2 - Modules 1 & 2

- Group discussion on Day 1 matters
- Basic Science of climate change
- Climate Change: adaptation, mitigation

[End of Module 1]

- Exploring Sandwatch
- Field Trip Preparations

- Evening Activity (Optional)

Day 3 - Module 2

- Field trip: Travel to/from beach location, complete field activities, picnic lunch
- Reviewing Past Changes & Building Future Scenarios
- Introducing the Sandwatch International Database

Day 4 - Module 3

- Preparing a classroom activity
- Choosing an Educational Intervention
- Developing your educational intervention
- Evaluation & Closing

Module 1

Understanding Climate Change and Education for Sustainable Development

Module 1 Overview

Module 1 lays the foundation for the rest of the course by introducing climate change and describing how Education for Sustainable Development (ESD) might support communities around the world to mitigate and adapt to various climate change challenges. As this course is aimed at small island developing states (SIDS) and other coastal regions vulnerable to the effects of climate change, the activities and case examples have a marine and coastal focus.

Module 1 introduces key ideas about **Education for Sustainable Development** including:

- A background to ESD (its history and aims)
- Educational approaches associated with ESD
- Links between the secondary school curriculum, ESD and climate change.

Keys ideas related to **climate change** include:

- The basic science of climate change
- Social and ecological impacts of climate change
- Uncertainties about climate change (future scenarios)
- Climate change adaptation and mitigation
- Climate change and disaster risk reduction

Module 1 Detailed Agenda

Day 1

8.30 - 10.00 Course Orientation
- Welcome and housekeeping
- Group Introductions
- 1.1 Presentation: Course Overview

10.00 - 10.20 Morning Tea

10.20 - 12.30 Climate Change: Local and Global Perspectives
- 1.2 Activity: Circle Sharing
- 1.3 Activity: Some Climate Change Stories
- 1.4 Handout: Climate Change Impact Descriptions for Africa & SIDS

12.30 - 1.30 Lunch

1.30 - 3.30 ESD as a response to climate change in Africa and SIDS
- 1.5 Presentation: ESD as a response to climate change in Africa & SIDS
- 1.6 Handout: An Introduction to Education for Sustainable Development
- 1.7 Handout: Climate Change & Education for Sustainable Development
- 1.8 Handout: The Focus of Climate Change Education
- 1.9 Activity: Educational Approaches

3.30 - 3.45 Afternoon tea

3.45 - 4.30 Future climate change scenarios?
- 1.10 Activity: Future Scenarios

4.30 - 5.00 Wrap-up Day 1, looking ahead to Day 2

Day 2

8.30 - 9.00 Group discussion on Day 1 matters

9.00 - 10.00 Basic Science of climate change
- 1.11 Presentation: Climate Change Basics
- 1.12 Handout: Climate Change Basics

10.00 - 10.20 Morning Tea

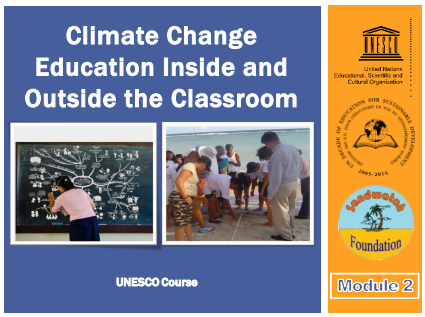
10.20 - 12.30 Climate Change: adaptation, mitigation
- 1.13 Activity: Adaptation or mitigation?

12.30 - 1.30 Lunch

End of Module 1

1.1 Presentation: Course Overview

Slide 1



Slide 2

OUR 1ST FOCUS: CLIMATE CHANGE

- **Climate** is defined as the average weather over 30 years or more.
- **Climate change** refers to any significant change in the measures of climate lasting for an extended period of time. This includes **major changes in temperature, precipitation or wind patterns**, among others, that occur over several decades or more. (EPA, 2013)
- Climate change may also be defined as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCC)

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CLIMATE CHANGE FOCUS

- Climate change has been described as "**the defining challenge of our times**" (United Nations, 2010)
- In May 2013, scientists announced that, for the first time in human history, the concentration of carbon dioxide in Earth's atmosphere reached **400 ppm** (parts per million). 200 years ago, that number was 280 ppm. A major cause of these unprecedented CO_2 levels is the burning of fossil fuels which releases CO_2 into the atmosphere.
- We will discuss the basic science of climate change on Day 2 of this course.

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OUR 2ND FOCUS: ESD AS A RESPONSE TO CLIMATE CHANGE

- ESD = Education for Sustainable Development
- In 2005, the United Nations declared the Decade of Education for Sustainable Development (UNDESD) – 2005 – 2014.
- This course is modelled on the UNESCO Course for Secondary Teachers on Climate Change Education for Sustainable Development (UNESCO, 2012)
- We will discuss the background and objectives of ESD and climate change education in more detail later in today's programme.

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This course aims to:

- Support you to **take local, contextualised action** to mitigate and adapt to climate change.
- Extend your **understanding of climate change** and its relevance to where you live and teach.
- Introduce you to the **Education for Sustainable Development (ESD) approach** in the context of climate change.
- Introduce you to the **MAST (measure, analyse, share and take action)** approach in the context of climate change.
- Support you to include **rigorous scientific knowledge** and **ethical reflection** when teaching about climate change.
- Provide you with knowledge, skills and resources to **integrate climate change education in your curriculum work**.

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Course Orientation

As we work together on this course, we are guided by the following 4 principles:

1. Contextual relevance

'Context' refers to the situation in which we find ourselves; it is the milieu or circumstances in which we live and work.

By making links between the new knowledge gained from the course, and your own context, your learning will be more relevant and applicable.

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Course Orientation [Continued…]

2. Knowledge-based learning

There are many different forms of knowledge (* scientific knowledge *contextualised knowledge * local knowledge *indigenous knowledge etc.) and it is important for us to consider the contributions that each can make to an effective response to climate change.

On this course, we will work a lot with **scientific knowledge** and bodies of information about climate change. You also contribute your own **prior knowledge** and local, **contextual knowledge**. This will broaden the knowledge-base of the course and help you and your learners make more informed decisions.

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Course Orientation [Continued…]

3. Action-oriented learning

The challenges posed by climate change require that we use our knowledge to **take action** (at a small, local scale, or nationally or globally according to what we are able to do).

It also means that as we take an active approach to teaching and learning on this course.

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Course Orientation [Continued…]

4. Curriculum-linked

As this course is for classroom teachers and teacher educators, it emphasises the links between climate change and the school curriculum.

Climate change is a cross-cutting concern and can therefore be addressed across the school curriculum.

Throughout the course, you are encouraged to think about how climate change and education for sustainable development can be integrated in the subject(s) that you teach.

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Course Structure

- Module 1 (1½ days):
  "Understanding climate change and ESD"
- Module 2 (1½ days):
  "Using the Sandwatch approach to understand the past and prepare for the future at the local level"
- Module 3 (1 day):
  "Designing climate change teaching elements based on ESD and Sandwatch"

1.2 Activity: Circle Sharing

The aim of this activity is to enable course participants to share their personal experiences and knowledge of climate change. As a group, it helps us to establish the type and extent of knowledge that we bring to this course, as well as to identify knowledge gaps and 'blind spots' about climate change.

1. Course participants make two circles; half making an inner circle facing outwards and the other half making an outer circle facing inwards, each person standing opposite someone in the inner circle.

2. Everyone thinks quietly think about **what they know about and have experienced of climate change**.

3. Facing pairs take turns (given two minutes each) to share their knowledge and stories.

4. Everyone in the outer circle moves one position to the left and discusses the same topic with their new partner.

5. Now course participants in the outer circle move two positions to the left to face a new partner and exchange their views on **what causes climate change**. After four minutes, people in the outer circle move two positions to the left and discuss the same topic with a new partner.

6. Finally, participants in the outer circle move three positions to the left to face a new partner to exchange views on **what needs to happen to reduce climate change**. After four minutes ask students in the outer circle to move three positions to the left and discuss the same topic with a new partner.

Hold a whole class reflection on what we discussed about each of the three topics. What was surprising? What was new? Were there points of agreement and/ or disagreement?

1.3 Activity: Climate Change Stories

Work in groups of 4 - 6 educators and allocate one of the following climate change stories to each group (the same story will be allocated to more than one group, depending on the class size):

- Fishing in The Seychelles
- Nowhere to Hide from Climate Change in a Kenyan Refugee Camp
- Climate Witness: Be Mangaoka, Madagascar

Groups should read through their story and discuss the following:

- What are the ecological, scientific, economic, and social justice dimensions of this story?
- What is the role of education in responding to the climate change challenges raised in this story?
- Do any members of the group have similar stories from their countries or communities?

Fishing in the Seychelles

Story by: Mikael Barbe, Ryan Benstrong, James Ernesta, Mario Dubel.
Photograph by Mikael Barbe

According to local fishermen in Seychelles, these days they have to fish deeper because the sea surface temperatures are rising and fish are going deeper in the ocean.

They also need to go out fishing for longer periods of time and further out than usual. Because of a warmer sea temperature, they also report that the fish they are catching are changing shape.

In addition, they have to spend more money on food supply, fuel and fishing materials. We need to be aware about our ecosystem and how climate change will impact on it. The impacts mentioned above mean fish are more expensive on the local market. Fishing livelihoods are getting harder and our economy suffers.

Source: UNEP/GRID-Arendal and CICERO, *Many Strong Voices: Portraits of Resilience*

Nowhere to Hide from Climate Change in a Kenyan Refugee Camp

Story by Andy Needham in Dadaab, Kenya

DADAAB, Kenya, December 18 (UNHCR) – Dulane Jama and his family suffered in silence for three years in a remote corner of eastern Ethiopia before he finally decided to go and look for a safe place to live before they all died. After an arduous and dangerous trek across Somalia, he ended up about four months ago at Dadaab, a sprawling and overcrowded refugee complex in north-east Kenya housing almost 300,000 refugees. Most are Somalis who have fled conflict or persecution in their troubled homeland.

Dulane is slightly different – he and his family have been forced to flee by climate change and general insecurity. But more and more people are fleeing for a similar mix of reasons. Conflict in the region, especially in Somalia, has made it more difficult to manage the effects of climate change. Demand for precious and scarce resources such as water and grazing land is leading to conflict, followed by displacement, more environmental degradation and more conflict.

The 44-year-old Dulane is a member of the Marehan, an ethnic Somali clan whose members live all over the region. He, his wife and their 12 children raised livestock near the town of Korahay, close to the border with Somalia. Then one day, the rains stopped coming and life became harder and harder.

"There have been drought conditions in Ethiopia for the past three years," he said with a bitter smile. "Originally I had 50 camels, 30 cattle and 35 sheep and goats, but they are all dead now," Dulane added. The situation was dire, so he decided to make his way to Somalia and then get the family to follow, but because of the general insecurity he ended up going all the way to Dadaab. Dulane realised that the weather was at the root of most of his problems, but he had no idea that the abnormal weather conditions were due to climate change. Indeed, he had no idea what climate change meant.

And having escaped his drought-ridden home region and reached Dadaab, he and his family now face another feature of climate change – flooding. Meteorologists fear that torrential El Nino rains, a phenomenon caused by the periodic warming of the oceans, will once more cause widespread flooding over a wide area in eastern Africa this year and in early 2010.

UNHCR and its partners are on an emergency preparedness footing for the potential effects of flooding, including the mass outbreak of diarrhoea, water-borne diseases and cholera in the congested camps. El Nino rains have struck Dadaab before, causing turmoil and destruction in 1997, 2003 and 2006 and causing people to move to safer areas.

Meanwhile, much of northern Kenya, is suffering from the same drought affecting Dulane's home area in Ethiopia and parts of south-central Somalia. Kenya's Crisis Response Centre reported earlier this month that 3.8 million Kenyans were facing starvation as a result of a lack of rain over the past two years. Extreme climatic events such as flooding, soaring heat, storms and drought are on the rise in Africa. Temperature increase and its effect on crop production has been linked to an upsurge in conflict in Africa over the past decade.

Dealing with extreme climate conditions and their after-effects is often beyond the scope and capacity of humanitarian agencies, but UNHCR and its partners are working hard to mitigate the short-term effects in places like Dadaab while also

putting in place more long-term strategic projects.

"UNHCR is addressing the immediate El Nino response needs by sandbagging vital areas of the camps, such as tapstands, boreholes, hospitals and health posts, as well as improving drainage in critical locations," explained UNHCR's Dinesh Shrestha, a water and climate specialist who recently spent two months in Dadaab. He added that the refugee agency was investigating longer-term strategic projects, including reforestation, water harvesting and the possibility of using water from swamps, dams and shallow wells to meet the needs of livestock kept by the refugees and by the local communities around Dadaab.

"These projects require time, effort and donor support," noted Dinesh, who was in Dadaab's Ifo camp on December 16 when a two-hour downpour left areas of the camp under many feet of water and forced refugees to stow their aid packs up trees and make their way through waist-high water. Meanwhile, Dulane's mind is on the present and he takes a pragmatic approach to the possibility of floods. "If it is the will of God that this happens, then it will happen."

Source: Taken from UNHCR website http://www.unhcr.org/4b2b76a79.html (2009)

Climate Witness: Be Mangaoka, Madagascar

My name is Be Mangaoka and I am 50 years old. I live in the small village of Ankingameloka in the very north of Madagascar. Our village is right next to the Nosy Hara Marine Protected Area. There is no electricity and running water in our village. There is no school or health centre either.

I am a fisherman and a farmer. I collect fish and sea cucumbers and sell them to businessmen in Mangoaka. I plant rice and manioc for my family's needs and maize for selling as well. I have four children. They will have to find another source of income, so I encourage them to study. I hope that they will do well in their studies so they can help us later.

In 1984, there was a cyclone called Kamisy that caused a lot of damage on the coastline. We had to move the village inland, 100 meters away from where it originally was! The cyclone destroyed our mangrove forests. For two years now we haven't found any shrimp in the remaining mangroves. In the old days, we used to collect 10kg of crab, now we can only gather 3kg a day at most. Due to the sediments in the mangroves it is difficult for them to regenerate.

From 1999 to 2000 a severe drought passed through our village and we had problems cultivating the rice. Unfortunately, this was not a one-time occurrence; the seasons have really changed a lot. For the last 20 years, there has been less and less rain. Normally the rainy season is from November until May, but nowadays it is only from January until March. Rice cultivation is particularly affected by this shortage. We have to find other varieties. Some of our wells have run dry.

The varatraza – the main wind in northern Madagascar – used to blow from July to August. Now we get it from April to November. When the varatraza blows, we can't fish! Our income is less and less. At the same time, the number of fishermen has increased over the last couple of years, especially fishermen from other places who do not respect our rules. Also, we have to walk very far to find fire wood due to the overexploitation of wood and bush fires. To find wood for construction, we have to walk many kilometres.

I don't know, who or what is responsible for all those changes but I am really worried that our future generation will not have access any more to the natural resources we rely upon.

Source: Taken from: WWF Climate Witness: Be Mangaoka, Madagascar, http://wwf.panda.org/about_our_earth/aboutcc/problems/people_at_risk/personal_stories/witness_stories/?184921

1.4 Handout: Climate Change Impact Descriptions for Africa & SIDS

Key Climate Change Impact Descriptions for Africa and Small Island Developing States (SIDS)

The IPCC Fifth Assessment Report (2014) shows the regional key risks for Africa and SIDS as follows:

AFRICA

- The IPCC Fifth Assessment Report (2014) shows that there will be compounded stress on water resources that are already facing significant strain from overexploitation and degradation at present. There will be increased demand for water in the future, with drought stress exacerbated in drought-prone regions of Africa.
- Reduced crop productivity associated with heat and drought stress, with strong adverse effects on regional, national, and household livelihood and food security, also given increased pest and disease damage and flood impacts on food system infrastructure.
- Changes in the incidence and geographic range of vector- and water-borne diseases due to changes in the mean and variability of temperature and precipitation, particularly along the edges of their distribution.

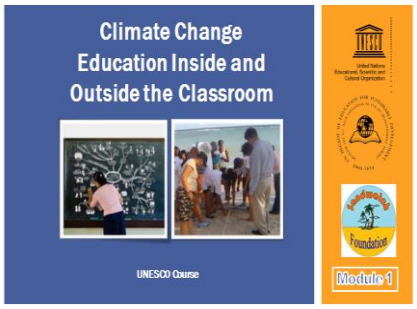
SIDS

- Loss of livelihoods, coastal settlements, infrastructure, ecosystem services, and economic stability.
- The interaction of rising global mean sea level in the 21st century with high-water-level events will threaten low-lying coastal areas.

Source: **IPCC**, 2014: Summary for policymakers. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

1.5 Presentation: ESD as a Response to Climate Change in Africa & SIDS

Slide 1



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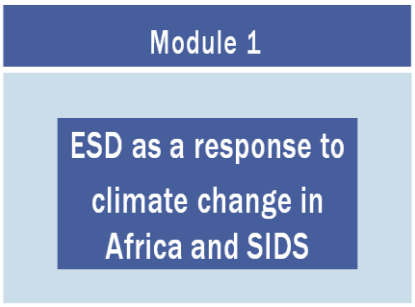

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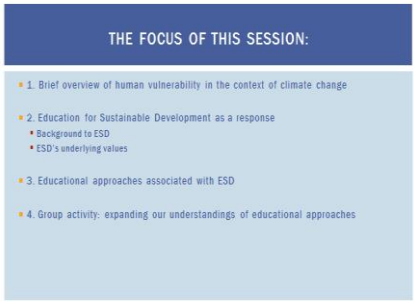

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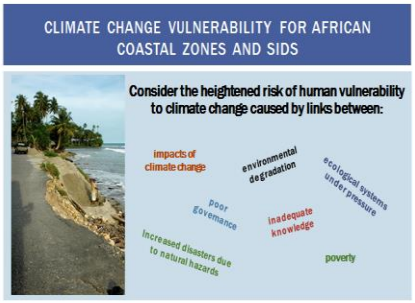

Slide 5

CLIMATE CHANGE-INDUCED STRESSES

- Stresses linked to climate change are predicted to include:
  - inundation of low-lying coastal areas due to rising sea levels;
  - shortages of fresh water;
  - changes in agricultural practices (and hence economic activity) due to changed climate patterns;
  - loss of biodiversity and the decline of natural ecosystems;
  - vulnerability to extreme weather events.
- (See notes: "Climate Change Impact Descriptions")

Slide 6

WHAT IS EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)?

- ESD offers a holistic framework for considering and integrating ecological, economic, social and cultural sustainability.
- ESD addresses the complexity and interconnectedness of global issues with a framework of underlying values:
  - Respect for the dignity and human rights of all;
  - A commitment to social and economic justice for all;
  - Respect for the greater community of other-than human life and protection of ecosystems;
  - Respect for cultural diversity and commitment to building a culture of tolerance, non-violence and peace.

(UNESCO, 2005, p. 7-8)

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THE DYNAMICS OF CLIMATE CHANGE ESD

- MITIGATION: identifying the causes of climate change and developing the knowledge, skills and values needed to rectify those causes.
- ADAPTATION: building resilience and reducing vulnerability to climate change impacts.
- UNDERSTANDING & ATTENTIVENESS: not only understanding the causes and impacts of climate change, but creating a mind-set of alertness, care and responsibility at individual and communal levels.

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ROLE OF SECONDARY SCHOOL TEACHERS

- Secondary school teachers have a vital role to play in equipping young people and communities to reduce their vulnerability to multiple stresses caused by climate change.
- Through locally relevant, up-to-date and critically-informed curriculum activities, secondary school teachers can:
  - Develop knowledge, skills and values needed in communities to adapt to climate change stresses;
  - Provide essential information related to disaster risk management;
  - Initiate projects and networks to take appropriate action, locally and globally;
  - Develop critical thinking skills and ethical responses in young people to foster the social change needed for climate change mitigation.

Slide 9

ESD APPROACHES IN THE CONTEXT OF CLIMATE CHANGE :

- Holistic, multidisciplinary and interdisciplinary
- critical and creative thinking
- science-based and information-based
- open-ended
- local and global
- ethics-oriented
- futures-oriented
- action and change-oriented
- whole-school approach

Slide 10

GROUP ACTIVITY: EDUCATIONAL APPROACHES

- Divide the class into nine groups, and allocate each group a different subsection from the Educational Approaches section.
- Each group should read, discuss and report back to the rest of the class a **summary of the main points** in their section.
- As the notes on each section are presented as 'starting points' rather than definitive texts on each approach, groups are encouraged to **engage critically**, to **identify gaps**, and elaborate by providing **examples of the opportunities and limitations** of this approach from their **own context**.

1.6 Handout: An Introduction to Education for Sustainable Development

The United Nations Decade of Education for Sustainable Development was launched in 2005 with the aim of integrating the principles, values and practices of sustainable development into all aspects of education and learning.

Education for Sustainable Development (ESD) offers a holistic framework for considering and integrating issues of environmental, economic, social and cultural sustainability in working towards a sustainable future. ESD aims to address the complexity and interconnectedness of global issues. It sets learning within a framework of 'underlying values' including:

- respect for the dignity and human rights of all
- a commitment to social and economic justice for all;
- respect for the human rights of future generations;
- respect for the greater community of (other-than-human) life and protection of ecosystems;
- respect for cultural diversity and commitment to building a culture of tolerance, non-violence and peace (UNESCO, 2005, p. 7-8).

Education for Sustainable Development calls for the envisioning of change by looking at past, present and future in tandem. Its vision is one of cross-curricular and interdisciplinary treatment of sustainability precepts and principles. Education for Sustainable Development calls for a multi-method and participatory approach to teaching that integrates critical thinking and reflection with concrete and practical engagement with sustainability in the community (UNESCO, 2005, p. 30-31).

1.7 Handout: Climate Change & Education for Sustainable Development

In 2008, climate change was proclaimed by the UN Secretary-General, Ban Ki Moon, to be the defining challenge of our time (UNESCO, 2010, p. 2). Not long ago, it was treated more lightly. As recently as 2001 the UN Intergovernmental Panel on Climate Change (IPCC) more or less assumed, on evidence available at the time, that climate change would be gradual and incremental, and therefore manageable through progressive adjustments (IPCC, 2001). The Panel's tone was tentative. By 2007, as further scientific data accumulated including evidence of positive feedback mechanisms that would amplify the warming of the planet and of abrupt, irreversible climate 'tipping points', IPCC was adopting a firmly unequivocal and more urgent tone (IPCC, 2007). As one observer put it: 'Climate change is coming faster and rougher than scientists have expected' (Romm, 2007). The 2007 IPCC report also reflected the emerging global consensus amongst scientists that climate change is predominantly human-induced (IPCC, 2007). It signalled the need for urgent and transformative action, local through global, to address the threat of potentially runaway climate change. Since then, our understanding of the threat has become much clearer with some scientists already concerned as to whether the global community can act decisively and quickly enough to stabilize the global surface temperature rise at 2.0^0C above pre-industrial levels which is generally regarded as being a liveable increase (Oxfam International, 2009).

In this difficult task, education has a crucial part to play. Its role is threefold (*Figure 1*). First, it has to play its part in building social and individual capacities and attitudes for climate change *mitigation* so as to pre-empt worst case climate change scenarios in the future. Second, it has the task of developing the skills, capacities and attitudes for *adaptation* in the face of already evident and looming climate impacts. Third, it has an on-going role to play in stimulating and reinforcing *understanding of* and *attentiveness to* the realities of climate change.

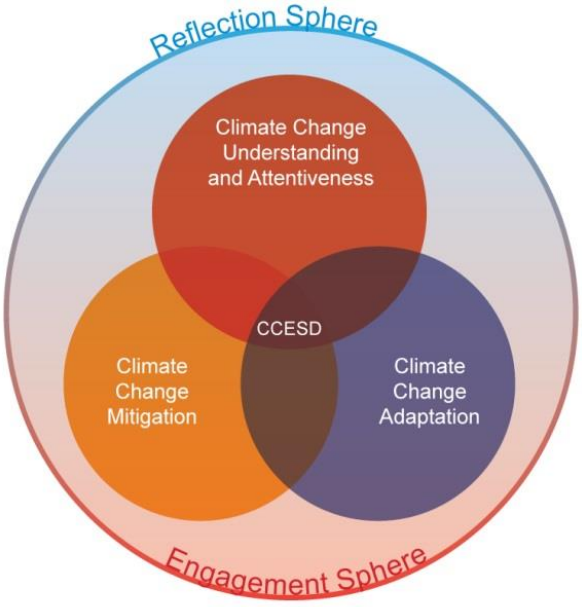


Figure 1 - The dynamics of transformation

1.8 Handout: The Focus of Climate Change Education

1. Transformation

Climate change education emphasises the need for transformation at all levels of society, from individual to institutional, from local to global. Each and every person has a role to play in bringing about the necessary social change, and this starts with recognising that neither a 'business as usual' approach nor scientific and technological solutions alone will help global society avoid the worst effects of the warming of the planet. Secondary schooling can help learners engage with the seriousness of climate change, search for new meanings and values, and move into personal and collective empowerment and action.

2. Mitigation

To 'mitigate' means to do something to reduce or relieve a situation. The *mitigation* dimension of climate change education is about identifying the causes of climate change and developing the knowledge, skills and dispositions required for individual and societal change to rectify those causes. Taken at its most basic level, the root cause of climate change is greenhouse gas emissions. At this level, education for climate change *mitigation* covers the various levels and types of energy consumption, the shift to non-polluting, renewable energy sources, energy conservation, environmental conservation, reforestation and afforestation. Going deeper, mitigation education also involves examining economic systems, social structures, cultural patterns, lifestyle expectations, consumerism, wealth distribution, aspirations and value systems and their causal relationships with greenhouse gas emissions.

3. Adaptation

The *adaptation* dimension of climate change education relates to building *resilience* and reducing *vulnerability* in the face of climate change impacts that are already happening or are soon to happen. The learning may be of a technical nature, for example, learning about drought resistant farming practices, or flood management behaviours. It may go beyond the technical aspects to a profound re-thinking of cultural practices and traditions. The adaptation dimension aligns climate change education with *disaster risk reduction education* (education to build *a culture of safety and resilience* in the face of potential cataclysm).

4. Understanding and attentiveness

The *understanding and attentiveness* dimension is about understanding what is happening to the climate, understanding the driving forces behind climate change, and creating a mind-set of alertness and mindfulness to changes that are already occurring. The climate change threat is huge and all-pervasive but, at the same time, stealthy and invisible, and is consequently easily put aside under day-to-day pressures of life. Furthermore, many misunderstandings about climate change are always in circulation and it is through careful scientific study, together with an attitude of care and responsibility, that appropriate mitigation and adaptation can be achieved.

1.9 Activity: Educational Approaches

The handout below outlines nine educational approaches (or principles) for secondary school teachers to consider in the context of climate change ESD in African coastal zones and SIDS.

The approaches are:

1. Holistic, multidisciplinary and interdisciplinary
2. Science-based and information-based
3. Critical and creative thinking
4. Open-ended
5. Local and global
6. Ethics-oriented
7. Futures-oriented
8. Action and change-oriented
9. Whole-school approach

Divide the class into nine groups, and allocate each group a different subsection from the Educational Approaches section.

Each group should read, discuss and report back to the rest of the class a **summary of the main points** in their section.

As the notes on each section are presented as 'starting points' rather than definitive texts on each approach, groups are encouraged to **engage critically**, to **identify gaps**, and elaborate by providing **examples of the opportunities and limitations** of this approach from their **own context**.

Recommended timing: 20 minutes for small group discussion; 10 minutes report back time per group.

Educational Approaches

1. Holistic, multidisciplinary and interdisciplinary

Traditional divisions between subjects are inadequate to deal with the scale and complexity of climate change. If we regard climate change to be a relevant topic in science and geography only, learners are at risk of developing oversimplified, compartmentalised and inadequate understandings of climate change. No one subject or specialist area can illustrate all the dimensions relevant to sustainability concepts and sustainable development. Exploring environmental, economic and social dimensions will inevitably require teachers and learners to consider cultural, ethical, philosophical, political, scientific, spiritual and technological factors. The more thoroughly this is done, the closer the approach comes to an *interdisciplinary*, *holistic approach* whereby all subjects contribute insights on sustainability through their own disciplinary lens.

> "…from a pedagogical viewpoint, climate change is uniquely challenging…climate change tests the capacity of education to organize learning around problems characterized by complex social dynamics, uncertain knowledge and risks."
>
> *-Læssøe,J. et al. Climate Change and Sustainable Development: The Response from Education. 2009.*

2. Science-based and information-based

This course recognises the importance of having access to scientific knowledge and up-to-date, trustworthy information to develop our understandings of climate change and to make informed decisions about how to respond. Through the course, in particular through using the Sandwatch methodology, we will work with the scientific dimensions of climate change in rigorous, critical ways, and consider ways in which to promote well-informed, science-based starting points for our creative and ethics-based engagement with climate change.

Many climate change projections are very technical and detailed, and draw on scientific reports and data generated over years. Often, these scientific reports are also contested or misrepresented through the media or special interest groups. An important aspect of climate change education is thus to equip learners to access high quality, contextually relevant information about climate change, to interpret it and to be able to make informed decisions as local citizens.

3. Critical and creative thinking

Often, it is with a 'creative leap' that people can solve problems and imagine new possibilities. In this course, we encourage an integrated approach to the value of scientific, ethics-based, creative and expressive responses to climate change; all of them together can make essential contributions to communities' abilities to adapt to and mitigate the impacts of climate change.

Climate change education asks that educators continue their constant questioning of what 'development' means. If current 'western' economic models, lifestyle patterns, aspirations and purposes, value systems and worldviews are suspected as fuelling climate change, then what are appropriate development directions? How can education help us to reimagine them?

4. Open-ended

Climate change education requires the learner to critically review their own and others' assumptions, perspectives and worldviews. Its pedagogy is, therefore to prepare learners to deal with *uncertainty within complexity*. This uncertainty requires that we think of *learning as an open-ended process*. There is no fixed and final destination to our learning - only learning that adjusts what we think before new learning comes along to bring a further shift in perception and understanding. Solutions are, thus, provisional adjustments in an ever-changing world (Pike & Selby, 1988, p. 35).

If we recognise that knowledge is fallible, impermanent and socially constructed, then we are more likely to see education as an open-ended process. Here, 'open-ended' refers to our willingness and ability to respond to new knowledge, understandings or circumstances and to allow educational processes to shape and be shaped by them. This requires a mix of being certain about what will happen in the learning process, and also being uncertain, allowing learning processes to unfold and new knowledge and understandings to emerge.

5. Local and global

The locality and local community provide concrete, real life contexts for exploring and experimenting with new practices, economies and forms of social organisation in response to climate change. By taking sustainability learning out of the classroom and into the community, students can work alongside community members in thinking through and implementing local initiatives for climate change mitigation, adaptation, and disaster risk reduction.

But climate change does not stop at national borders, and local decisions have global implications. Climate change is a vivid example of the interconnected global system in which we live. The lifestyle decisions and behaviours of one part of the world can have serious implications for most if not all other parts of the world. For this reason, climate change education for sustainable development includes a strong global dimension.

- Students everywhere need to know what other societies are doing (or not doing) that is exacerbating the warming of the planet.
- Students everywhere need to understand the global economic, social, cultural and political forces that drive the problem.
- Students everywhere need the inspirational stories of successful actions by groups and communities to mitigate or adapt to climate change.
- Students everywhere need to know what other young people are thinking and doing. This speaks for curricula, teaching and learning materials and media that enable a global and intercultural dialogue to take place on climate change (Lotz-Sisitka, 2010, p. 71-88). The many voices and experiences of people from around the world need to be heard in the classroom.

6. Ethics-oriented

According to the Global Humanitarian Forum report of 2009, the 'silent crisis' of climate change is already causing, on yearly average, 300,000 deaths, seriously affecting 325 million people, with 4 billion people vulnerable (Global Humanitarian Forum, 2009, p. 1). Learning about climate justice concerns the issues and ethical dilemmas surrounding

the injustice of impacts of climate change falling unfairly and disproportionately on the people in the developing countries who are least responsible for the emissions of greenhouse gases that are contributing to climate change. It also calls for debate and discussion on the question of whether, to what extent, and in what ways the countries of the developed countries should offer restitution and compensation for their polluting of the atmosphere that all countries share. As climate change migration increasingly happens, learning about climate justice extends to the consideration of climate refugees and their rights and privileges within host countries.

The following questions related to climate change have a strong ethical dimension:

- Who should take responsibility for climate change?
- What should be done, for whom and how soon?
- Which countries should do the most to reduce their greenhouse gas emissions, and why?
- Are rich countries obliged to help poor countries deal with the effects of climate change?

7. Futures-oriented

Sustainable development has long been defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their needs (World Commission on Environment and Development, 1987, p. 43). In the definition is a clear recognition of the responsibilities of those alive today to generations to come through what is referred to as *intergenerational accountability* or *intergenerational justice*. The 'sustainable' element of 'sustainable development' is about ensuring that future generations can enjoy at least the same level of opportunity for a fulfilling life as present generations.

> *"The startling conclusion is that continued exploitation of all fossil fuels on Earth threatens not only the other millions of species on the planet but also the survival of humanity itself –and the timetable is shorter than we thought."*
>
> *- James Hansen, Storms of My Grandchildren, 2009.*

We recognise now that the effects of global climate change that we are currently experiencing are the delayed impact of CO_2 emissions from some time in the past, and that our present-day emissions will have delayed but mounting consequences for future generations. We must also recognise that to choose the convenience of doing nothing or making ineffectual gestures goes against the grain of the intuitive desire to build for a better future.

Futures-oriented learning involves exploring *probable*, *feasible* and *preferred* futures (respectively, futures that are *likely to come about given present trends*, futures that *might conceivably come about*, and futures that *we would like to see realised given our values and priorities*). It is also about identifying and seeking to achieve *desired* futures while identifying and acting to avoid *undesired* futures (Pike & Selby, 1988).

8. Action and change-oriented

Sustainability is often a matter of a taking practical action that is based on concern for local problems. Much can be learned by tackling climate change challenges through practical action: not only the practical know-how (e.g. how to cultivate drought-resistant food crops) is gained, but also the underlying knowledge (e.g. the impacts of local climate on food production, what vegetables need to grow well, and what nutrients they provide), as well as a sense of agency and

resilience (e.g. we can feed ourselves even if we are unemployed).A sense of citizenship and responsibility may also be among the things learned through practical climate change projects.

If Education for Sustainable Development is concerned with bringing about social-ecological change, it must equip learners to engage critically, creatively, yet cautiously with contemporary lifestyle patterns and knowledge systems as well as with future scenarios. This challenges educators to equip future citizens with knowledge, skills, values and attitudes to re-imagine future possibilities whilst engaging critically with current situations of, for example, social injustice, incomplete knowledge and unquestioned cultural practices. Practical action projects are one approach to fostering new understandings and ways of doing things.

9. Whole-school approach

A whole-school (or whole-institution) approach has been widely encouraged for education for sustainable development involving the entire school community: students, teachers, administrators, parents, and local community members.

A whole-school approach is also considered vital for effectively addressing climate change challenges and demonstrating the urgent need for practical action. The characteristics of a whole-institutional framework for climate change education for sustainable development are captured in a holistic 4C model comprising curriculum, campus (physical environment), community and (institutional) culture. The 4C model is designed to create synergies and energy flows between different change initiatives in the respective spheres (see *Figure* 2).

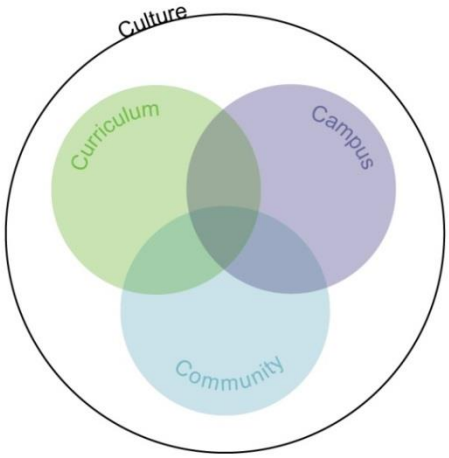


Figure 2 - The holistic 4C model

In terms of **curriculum**, as discussed earlier, various aspects of climate change, from personal to global, are *infused* into existing subjects and/or *integrated* within cross-curricular spaces. To these can be added new curricular elements drawn from school climate change actions and student involvement under the campus, community and culture headings.

Under **campus** fall various initiatives towards making the school carbon neutral, greening and landscaping initiatives (e.g. tree planting) and transforming unsustainable institutional practices (in building design and use, energy use, resource use and procurement, catering and transport). Students are encouraged to directly engage with climate change adaptation and mitigation initiatives within their school as part of their non-formal learning – that is fed back into formal learning. Alternatively, campus can become part of formal curriculum with, for instance, students involved in food growing, designing and installing water conservation measures, designing and managing a preventative health garden, developing a nature conservation area, researching the school's level of commitment to 'reduce, re-use, recycle, refuse', and researching ways of cutting down the school's fossil fuel dependency before starting change initiatives.

School/community action partnerships fall under the **community** heading. Some might focus on mitigation efforts, say, through growing food locally, while others might focus on climate change adaptation and disaster risk reduction by creating a community hazard map and conducting evacuation drills to make the community more resilient in the face of extreme weather events. Students' community based project experiences are also fed back into the formal curricula or are undertaken as formal curriculum.

The sphere of **culture** is about transforming the 'hidden curriculum' of the institution itself, including its 'business as usual' nature and style of school management and decision-making mechanisms. Democratic leadership and participatory decision-making processes are encouraged in planning, implementing, monitoring and evaluating initiatives in school. For example, the students can play a key role, in an internal consultation process towards developing a climate change and sustainable development school mission statement. This is nothing short of creating a Climate Change Education for Sustainable Development 'learning organisation'.

The integration of curriculum, campus, community and culture offers learners hands-on opportunities for an exciting, practical and safe apprenticeship in transformative action.

1.10 Activity: Future Scenarios

Have participants and read the below handout, Climate Change: Two Histories of the 21st Century. As individuals, ask them to think about the following three questions:

1) What kind of education would your learners require to adapt to/ cope with the scenarios presented above (History 1 and History 2)?

2) What kind of knowledge and skills are needed for you and your learners to engage critically with these scenarios?

3) What kind of ethical questions do these scenarios raise for you?

4) What are the potential educational benefits and/ or shortcomings of future scenarios like the two presented here?

Climate Change: Two Histories of the 21st Century

History 1

A 1^0 warmer world (above pre-industrial levels):

- Creeping desertification of the present North American wheat belt
- Arctic meltdown begins
- Amazon pushed to the edge
- Pacific atoll nations swamped

A 2^0 warmer world:

- Increasing acidity of oceans makes seas toxic to sea life
- Heat wave emergencies in Europe and other temperate areas
- Ecosystems already under pressure suffer significant species loss

A 3^0 warmer world:

- Amazon dies and burns
- Arctic ice almost gone
- Seawater penetrates coastal cities
- Uncontrollable wildfires in Australia and elsewhere
- Loss of glacial melt in Himalayas dries water supplies in the Indus
- Hundreds of millions have no choice but to migrate

Source: Mark Lynas, *Six Degrees: Our Future on a Hotter Planet* (2007)

History 2

Global scenarios

- A large fraction of both terrestrial and freshwater species faces increased extinction risk under projected climate change during and beyond the 21st century, especially as climate change interacts with other stressors, such as habitat modification, over-exploitation, pollution, and invasive species.
- The fraction of global population experiencing water scarcity and the fraction affected by major river floods increase with the level of warming in the 21st century
- Due to sea level rise projected throughout the 21st century and beyond, coastal systems and low-lying areas will increasingly experience adverse impacts such as submergence, coastal flooding, and coastal erosion
- Climate change over the 21st century is projected to increase displacement of people. Changes in migration patterns can be responses to both extreme weather events and longer-term climate variability and change, and migration can also be an effective adaptation strategy.
- The impacts of climate change on the critical infrastructure and territorial integrity of many states are expected to influence national security policies. For example, land inundation due to sea level rise poses risks to the territorial integrity of small island states and states with extensive coastlines.

Source: IPCC, 2014: Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

1.11 Presentation: Basic Science of Climate Change

* The PowerPoint file for this presentation contains facilitator notes, only the slides are shown here.

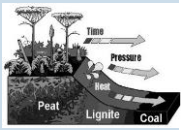
Slide 1

The Basic Science of Climate Change

Slide 2

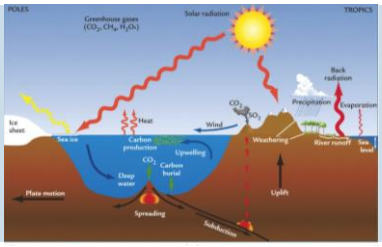
What Are Carbon-based Fossil Fuels?

- Carbon-based molecules are the basic building blocks of all life forms (animals, plants)
- Fossil fuels were formed millions of years ago when prehistoric plants and animals died and sank to the bottom of the vast oceans and swamps.
- Under the intense pressure buried deep inside the earth, the rotting organic matter formed what is today mined as fossil fuels (coal, oil and natural gas).



Slide 3

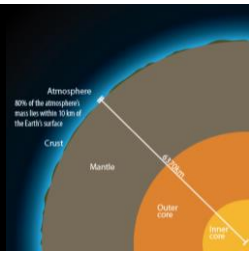
Components of Earth's Atmosphere



Slide 4

Composition of the Atmosphere

- Thin layer of gases; 80% of the mass is contained below 10km of altitude
- Predominantly made up of nitrogen (78%) and oxygen (21%)
- Remaining 1% is made up of water vapour, carbon monoxide, carbon dioxide, neon, methane, krypton and ozone, some of which are so-called greenhouse gases



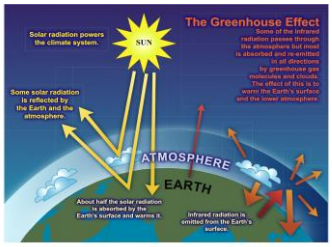
Slide 5

The Greenhouse Effect

- Weather is the temperature, precipitation and wind as they change hour by hour and day by day
- Climate is the average weather and the nature of its rhythmical variations that we experience over time
- The greenhouse effect is the natural process of the atmosphere letting in some of the energy we receive from the Sun and trapping it. For several thousands of years the atmosphere has been delicately balanced
- Human activities have led to an increase in greenhouse gases in the atmosphere causing an increased greenhouse effect and extra warming
- The main greenhouse gas responsible for recent climate change is carbon dioxide (CO_2). Others greenhouse gases produced from human activities include methane (CH_4) and nitrous oxide (N_2O).

Slide 6

The Greenhouse Effect Illustrated



Slide 7

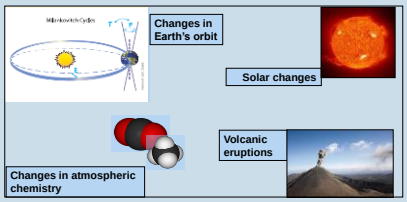
Weather and Climate

'Weather' describes current atmospheric conditions e.g. rainfall, temperature, wind speed, at a particular place and time

'Climate' is the average pattern of weather for a particular place over a long period of time – several decades

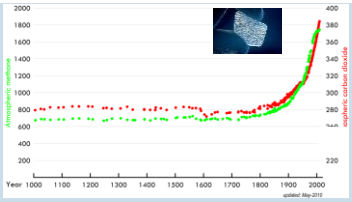
Slide 8

Factors Causing Changes In Climate



Slide 9

Changes in Atmospheric Carbon Dioxide and Methane Concentrations

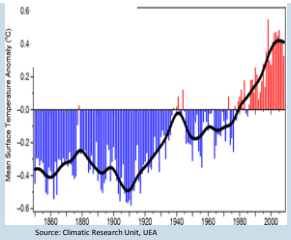


Carbon dioxide concentrations are now greater than at any time during the past 650,000 years. The rate is accelerating.

Source: CSIRO

Slide 10

Global Temperature Change



Source: Climatic Research Unit, UEA

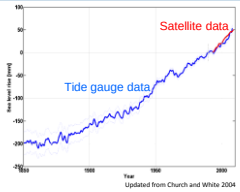
13 of the past 14 years are the warmest ever recorded

Source: Climatic Research Unit, UEA

Slide 11

Sea Level Rise

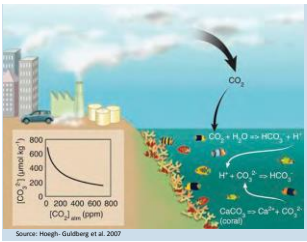
- As water warms, it expands
- As ice-sheets and glaciers melt, they add to the ocean volume
- Both lead to sea-level rise (about 20 cm over last 100 years)



Updated from Church and White 2004

Slide 12

Ocean Acidification



Source: Hoegh- Guldberg et al. 2007

Much of the CO2 gets absorbed by the ocean – GOOD for slowing global warming – BAD for ocean acidification.

1.12 Handout: The Basic Science of Climate Change

What is climate change?

The Earth's climate has changed many times in response to natural causes. The term climate change usually refers to man-made changes that have occurred since the early 1900s.

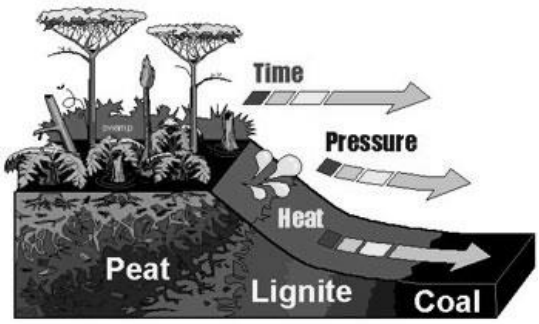
Climate change refers to any significant change in the measures of climate lasting for an extended period of time. This includes major changes in temperature, precipitation or wind patterns, among others, that occur over several decades or more (EPA, 2013).

What is the difference between climate and weather?

To understand climate change, it's important to recognise the difference between weather and climate. Weather is the temperature, precipitation (rain, hail, sleet and snow) and wind, which change hour by hour and day by day. Climate is the average weather and the rhythmical nature of its variations that we experience over time.

The Earth's climate is affected by multiple drivers that operate over different time scales and result in different changes over various geographical scales and geological eras. The movement of heat around the Earth is accomplished via the global climate system, which comprises the atmosphere, the oceans, the ice sheets, the biosphere (all living organisms) and soils, sediments and rocks. The climate system is made up of numerous subsystems with many processes occurring within and between each subsystem. These complex interactions result in intermittent and constantly changing phenomena (e.g. El Niño and the North Atlantic Oscillation).

Fossil Fuels and the Carbon Economy



The process that created **fossil fuels** is a natural process of the earth's systems. The remains of plants and animals that died millions of years ago were slowly buried under sediment from the earth and compressed by the weight of the sediment. Over millions of years, the pressure of being compressed by the sediment turned the dead plants and animals into oil, coal, and natural gas.

Coal was formed from the remains of ferns, trees and grasses that grew in swamps around 345 million years ago. The plant material continued to decay in layers forming beds of peat, a soft brown substance that is up to 30% carbon. Peat is the earliest stage of coal formation. Later, shallow seas covered the swamps depositing layers of sand and mud over the peat. These sediments exerted pressure and over thousands of years the chemical changes transformed the peat into lignite or brown coal which contains around 40% carbon. Millions of years later, increasing pressure and heat changed the lignite into bituminous or soft coal which contains around 66% carbon. Finally anthracite or hard coal that is over 90% carbon. Coal is mainly used to generate electricity at power stations, however it is also used to produce fertilisers, dyes, soap, tar, disinfectant and pesticides.

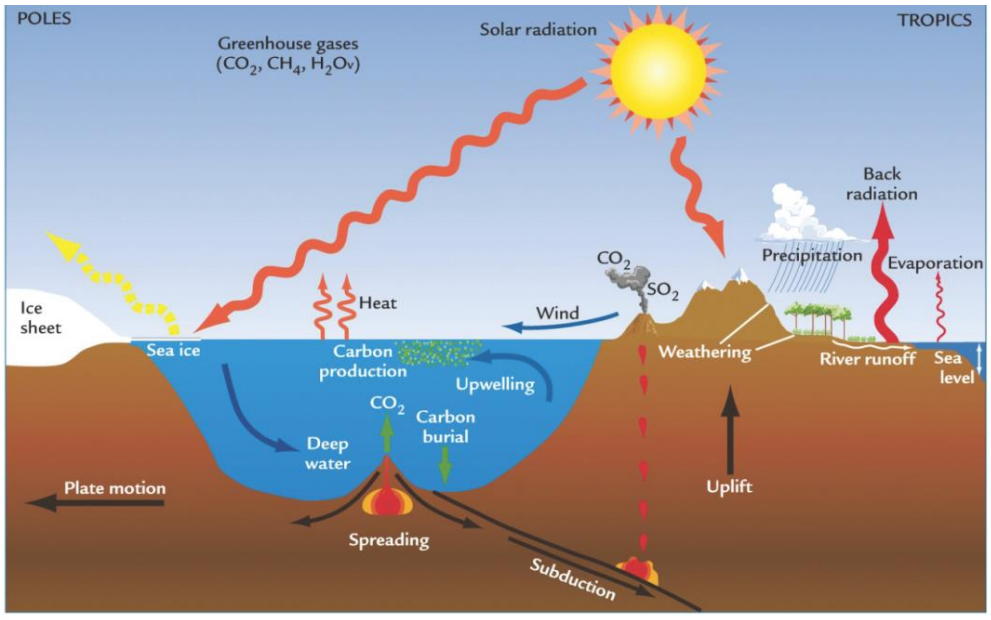
Oil and Natural Gas are also found in beds of sedimentary rock. These sediments were deposited by

shallow seas millions of years ago. The remains of plants and animals living in the sea settled to the bottom and were buried under layers of sediment. These layers were also subjected to heat and pressure transforming into beds of rock. The plant and animal remains went through a process of slow chemical change forming pockets of oil and natural gas. Oil is mainly used to power motor vehicles and small amounts are used at power stations. Other uses for refined oil include medicines, plastics, glues, detergents, cosmetics and paints. Gas is also used to power vehicles and generate electricity. Many homes and industries use gas as their main source of heating and cooking.

To use the energy stored in fossil fuels it must go through many stages of processing. First the fuel must be extracted from rock deposits and transported to a processing station. The fossil fuels then need to be converted into a form of energy that can be used.

Today, the world's economy is based on **carbon**: the "fuel" in fossil fuels. The gas called **carbon dioxide (CO_2)** is a by-product of burning these fuels. So every time coal, oil, petrol, paraffin, natural gas and wood burn, they release CO_2. Eliminating these CO_2 emissions would literally bring modern society to a stop, which is why solving the climate change crisis is so difficult!

The atmosphere is a comparatively thin layer of gases which fades rapidly away with altitude and does not have a definite top[1]. About 80% of the mass of the atmosphere in contained below 10 km of altitude (see Figure p.5). Compared with the Earth's radius (6370 km) the atmosphere is just one sixth of one percent. Yet it is an extremely important multifunctional layer composed of numerous gases in varying proportions in different regions, and which serve different functions. It is predominantly made up of nitrogen (78%) and oxygen (21%). Besides water vapour, several other gases are also present in much smaller amounts (Carbon monoxide (formula CO), Carbon dioxide (CO_2), Neon (Ne), Oxides of nitrogen, Methane (CH_4), Krypton (Kr), and Ozone (O_3)).



From: Clark College, 2003.

[1] If one considers the size of a standard classroom globe, the atmosphere would be approximately as thick as a coat of paint on its surface.

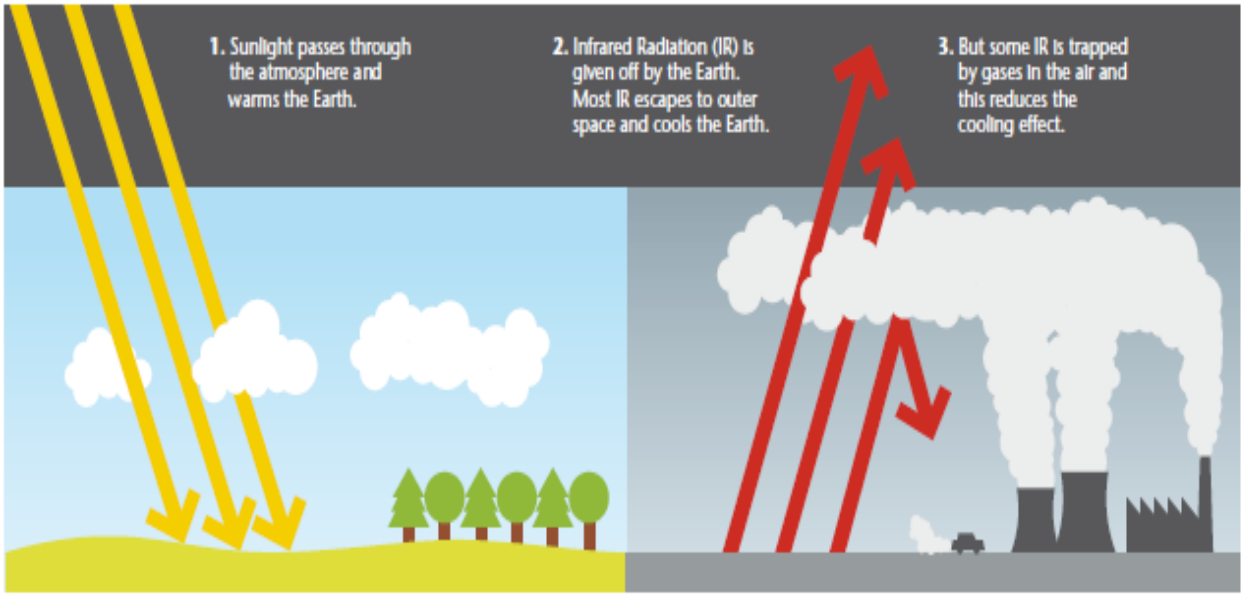
What is the greenhouse effect?

The greenhouse effect is the natural process of the atmosphere letting in some of the energy we receive from the Sun (ultraviolet and visible light) and stopping it being transmitted back out into space (infrared radiation or heat). This makes the Earth warm enough for life.

For several thousands of years the atmosphere has been delicately balanced, with relatively stable levels of greenhouse gases. Human influence has now upset that balance and, as a result, we are seeing climate change. **1.** Ultraviolet (UV) sunlight hits the Earth – some is reflected by the atmosphere and some UV passes through and hits the Earth's surface. **2.** Areas of the Earth which are covered in snow and ice reflect most UV back into space. UV that is not reflected hits the Earth and is transformed into Infrared Radiation (IR) or heat energy that is then given off by the Earth. Most IR escapes the atmosphere into outer space and has no warming effect. **3.** But greenhouse gases in the atmosphere trap some IR and this warms the air, water and land. The more greenhouse gases in the atmosphere, the larger the warming effect.

El Niño / La Niña (ENSO) and the North Atlantic Oscillation

El Niño/La Niña-Southern Oscillation, or ENSO, is a climate pattern that occurs across the tropical Pacific Ocean roughly every five years. It is characterized by variations in the temperature of the surface of the tropical eastern Pacific Ocean—warming or cooling known as El Niño and La Niña respectively—and air surface pressure in the tropical western Pacific—the Southern Oscillation. Mechanisms that cause the oscillation remain under study. ENSO causes extreme weather (such as floods and droughts) in many regions of the world. There is high confidence that ENSO will remain the dominant mode of interannual variability in the tropical Pacific, with global effects in the 21st century. Changes in the frequency and intensity of ENSO are still under research. North Atlantic Oscillation: A permanent low-pressure system over Iceland (the Icelandic Low) and a permanent high-pressure system over the Azores (the Azores High) control the direction and strength of westerly winds into Europe. The relative strengths and positions of these systems vary from year to year and this variation is known as the North Atlantic Oscillation.



The greenhouse effect.

How are we causing climate change?

Human activities, such as burning coal, oil and gas, have led to an increase in greenhouse gases in the atmosphere causing an enhanced greenhouse effect and extra warming. As a result, over the past century there has been an on-going increase in average temperatures. Globally, the ten hottest years on record have all been since 1997.

What will happen if we don't reduce carbon emissions?

If emissions continue to grow at present rates, carbon dioxide (CO_2) concentration in the atmosphere is likely to reach twice that of pre-industrial levels by around 2050. Unless we limit emissions, global temperature could rise as much as 7 °C above pre-industrial temperature by the end of the century and push many of the world's great ecosystems, such as coral reefs and rainforests, to irreversible decline.

Even if global temperatures rise by only 2 °C it would mean that 20–30% of species could face extinction. We can expect to see serious effects on our environment, food and water supplies, and health.

Which gases are causing the most change?

The main greenhouse gas responsible for recent climate change is CO_2. This gas has been released in huge quantities by our modern way of life. Levels have also increased due to the destruction of rainforests, which play an important role in absorbing and storing CO_2.

Human activities are increasing atmospheric concentrations of other greenhouse gases too, such as methane (CH_4) and nitrous oxide (N_2O). Methane is produced by bacteria that live in places like landfill sites, peat bogs and in the guts of animals like cows and sheep. Nitrous oxide is increased by the use of nitrogen fertiliser in agriculture.

Both these gases have a powerful greenhouse effect and also contribute to climate change. However, they have not been released in such large quantities as CO_2, and methane does not last for as long in the atmosphere. So, while they make a significant contribution to climate change, it is man-made CO_2 that has by far the greatest influence.

Source: Met Office (2009) *Warming: Climate Change –The Facts* (pp.1-3)
Full document available from Extracts from Met Office (2009) Warming: Climate Change –The Facts (pp.1-2) Full document available from http://www.metoffice.gov.uk/media/pdf/p/a/quick_guide.pdf

1.13 Activity: Adaptation or Mitigation?

Work in groups of 4 to arrange the cards you have been given in two columns: 1) examples of ADAPTATION and 2) examples of MITIGATION.

Consider the following questions as you work on the activity:

1) Is there a relationship between adaptation and mitigation actions?
2) Can your group identify examples of an adaptation or mitigation action that might lead to unanticipated problems elsewhere?
3) As a group, try to decide on the 2 most important mitigation and adaptation actions from this set of examples.

Be prepared to share your ideas informally with the other groups.

[Approximate time: 15 minutes plus 15 minutes for plenary discussion]

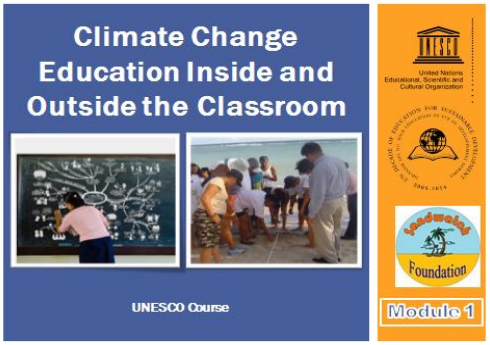
CARDS FOR ACTVITY 1.13 ON ADAPTATION OR MITIGATION

'Roll back Malaria' campaigns As temperate zones become hotter and the malarial mosquito migrates north and south, a 'roll-back malaria' campaign is put in place to stop malaria epidemics from breaking out in countries like Argentina and New Zealand.	***Coastal defences*** Coastal defences in New Orleans are built up so that the rising sea levels coupled with storm surges – both likely effects of global warming – don't lead to repeat of the events that occurred when Hurricane Katrina struck in 2005.
Drought-resistant seeds Scientists develop new strains of seed that will give a good crop yield even in drought conditions.	***Air travel restrictions*** Strict limits are placed on frequency of air travel and flying is also made much more costly for the traveller.
International disaster force The United Nations sets up a specialized international disaster force that is on standby to help nations and communities overrun by climate-induced disaster.	***Harnessing wave and tidal power*** Wave and tidal energy farms are set up along coastal areas to harness the energy of waves and tides and generate clean electricity.
Locally sourced food Growing and eating locally grown and seasonal food is encouraged in high income nations to cut down on food air-freight miles and to make people less reliant on food from other countries, the supply of which may dry up eventually as climate change intensifies.	***Shrinking beef Industry*** The tax on beef goes up and up so that beef burgers and steaks get more and more costly and the beef industry shrinks. [Beef cattle are often reared in areas of deforested areas that would have soaked up CO_2 and belching cattle emit a significant amount of methane (CH_4), a powerful greenhouse gas, into the atmosphere.]
Capturing carbon Technologies are developed to recover carbon from the atmosphere and seal it permanently away in deep underground reservoirs.	***Communities classes for adaptation*** At local community centres, classes are held to teach community members how to protect themselves from extreme weather events.
Stricter building insulation standards To cut energy losses from buildings, new regulations are brought in that require owners to insulate their buildings to the highest standards at their own cost, thus reducing personal and national energy consumption and CO_2 emissions.	***Emergency food stockpiling*** Governments build massive stockpiles of food for emergency consumption in the event that the effects of climate change – inland drought and wild fires, lowland and coastal flooding – lead to food shortages.

Flood management initiatives New flood protection and drainage systems are put in place to protect communities that have experienced flooding following heavy rainstorms.	***Voluntary simplicity*** A 'voluntary simplicity' movement encourages people everywhere to live a more simple life with few possessions and in ways that don't exploit and destroy the environment.
Species protection Deep water-preserving ditches are created to protect rare birds from extinction. The birds feed on insects that need water for breeding – water that has started drying up in the summer heat. Their food source is protected, the birds can survive in a warming climate.	***Reducing car usage*** The decline in oil supplies and the climate threat encourage governments to use taxes and restrictions to phase-out gas-powered vehicles while offering big tax breaks to 'car-less' families and some concessions to families with electric cars.
Education for sustainable consumption Schools introduce lessons to encourage students to consume more sustainably given that the global consumer economy is seen as a major cause of climate change.	***Capping carbon dioxide*** Over a ten-year period factories and industries are forced by law to reduce the amount of carbon dioxide released into the atmosphere by 50% with stiff penalties for failure to comply.

1.14 PRESENTATION ON ADAPTATION AND MITIGATION

Slide 1



Slide 2

Module 1

Climate Change Mitigation, Adaptation and Disaster Risk Management

Slide 3

MITIGATION AND ADAPTATION

- MITIGATION focuses on avoiding, reducing or, at least, delaying climate change mainly by reducing greenhouse gas emissions into the atmosphere
- ADAPTATION is necessary for responding to climate change that is already unavoidable because of past greenhouse gas emissions (there is considerable time lag before an emission contributes to global warming)
- MITIGATION and ADAPTATION are complementary aspects of a climate change strategy. Both call for lifestyle change. Both have to be factored into sustainable development plans.

Slide 4

CLIMATE CHANGE MITIGATION (1)

Mitigation efforts focus upon reducing greenhouse gas emissions. For instance:

- Reducing emissions released from burning fossil fuels by power stations, factories, buildings, motor vehicles and airplanes
- Reducing deforestation (including burning and decomposing of wood)
- Capturing greenhouse gases released from garbage and human waste
- Reducing meat eating as cattle and farm animals emit methane (the second most important greenhouse gas)

Slide 5

CLIMATE CHANGE MITIGATION (2)

- But some argue that 'deep mitigation' strategies are needed that address the underlying driving forces behind high levels of greenhouse gas emissions:
  - Rolling back mass consumerism, especially in high income societies
  - Moving away from a growth economy that exploits more and more natural resources
  - Prioritizing local economies as an antidote to globalization and the continual movement of people and goods around the world
  - Educating for a reconnected, non-exploitative relationship with nature

Slide 6

CLIMATE CHANGE ADAPTABILITY AND VULNERABILITY

- Adaptability is the degree to which a system (e.g. community, region) can adjust in response to or anticipation of climate changed condition;
- Adaptability can reduce vulnerability, i.e. the extent to which climate change may damage or harm a system;
- Vulnerability is made worse by other stresses such as poverty, unequal access to resources, food insecurity, economic globalization, conflict and disease.

Slide 7

SIX STRATEGIES FOR CLIMATE CHANGE ADAPTATION

- **Taking steps in advance to prevent losses**, for example building barriers against sea-level rise or reforesting hillsides to stop landslides
- **Taking steps to reduce losses**, for example using drought resistant plants in case of drought
- **Spreading or sharing losses**, for example setting a national disaster relief tax after a disaster
- **Changing how an activity is done**, for example mulching soil to reduce water loss
- **Changing the site of an activity**, for example relocating farming away from steep hill slopes and/or to where there is a surer source of water
- **Restoring a site with fit-for-purpose protection**, for example rebuilding a sacred site in a hazardous location with protective barriers
  - Inspired by: UNEP & UNFCCC, (2002). Climate Change Information Kit, Climate Change Information Sheet 9.

Slide 8

WISE PRACTICES TO COPE WITH CHANGE

2005 – Hurricane damage to coast and infrastructure

2005 – Hope Town School students work to plant dunes as part of a Sandwatch project

Slide 9

WISE PRACTICES TO COPE WITH CHANGE

2009 - Dune stabilised with sea oats

2011 – post H. Irene – the sea oats worked to hold the dune in place

Slide 10

GROUP ACTIVITY: ADAPTATION OR MITIGATION?

- Work in groups of 4 to arrange the cards you have been given in two columns: 1) examples of ADAPTATION and 2) examples of MITIGATION.
- Consider the following questions as you work on the activity:
  - Is there a relationship between adaptation and mitigation actions?
  - Can your group identify examples of an adaptation or mitigation action that might lead to unanticipated problems elsewhere?
  - As a group, try to decide on the 2 most important mitigation and adaptation actions from this set of examples.
  - Be prepared to share your ideas informally with the other groups.

Slide 11

CLIMATE CHANGE AND DISASTER RISK REDUCTION

Climate change will affect disaster risks in two ways:

- First, through the likely **increase in weather and climate hazards**.
- Second, by **increasing the vulnerability of communities to natural hazards**, particularly through ecosystem degradation, reduction in water and food availability, and changes to livelihoods.
- Climate change will add yet another stress to those of **environmental degradation and rapid unplanned urban growth**, further reducing communities' abilities to cope with even the existing levels of weather related hazards.

(Edited from the International Strategy for Disaster Reduction (ISDR) (n.d). Climate Change and Disaster Risk Reduction: Briefing Note 01)

Slide 12

DISASTER RISK REDUCTION: DEFINITIONS AND INSIGHTS

- 'Disaster Risk Reduction (DRR) is any activity carried out by a village, community, aid agency or government that helps prepare for, reduce the impact of, or prevent disasters. These activities can be policies, strategies, or practices that are developed and applied to minimize vulnerabilities and disaster risks throughout a society.'
  [Save the Children (n.d.) Reducing Risks, Saving Lives]
- 'Natural hazards by themselves do not cause disasters – it is the combination of an exposed, vulnerable and ill-prepared population or community with a hazard event that result in a disaster.'
  [International Strategy for Disaster Reduction (ISDR) (n.d). Change and Disaster Risk Reduction. Briefing Note 01]

Slide 13

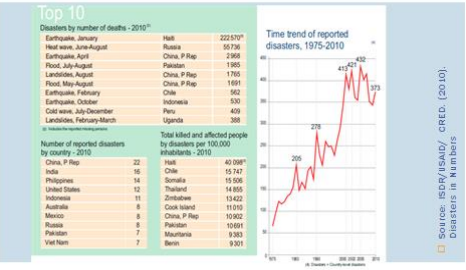
DISASTER RISK CALCULATION

- Disaster risks multiply with the intensity of the hazard and with social and environmental vulnerabilities of the society and the environment. In turn, they may be reduced by society's ability to cope with the hazard, as shown in the following equation:

$$\text{Disaster Risk} = \frac{\text{Natural Hazard x Vulnerability}}{\text{Capacity of Societal System}}$$

Slide 14

DISASTERS: NUMBERS AND TRENDS



Slide 15

CATEGORIES OF RISK REDUCTION STRATEGIES

- Awareness-raising in the community
- Setting up early warning systems
- Putting emergency preparedness plans in place
- Developing coping mechanisms
- Building personal and community resilience
- Dissemination and advocacy (communicating and sharing good practice)

Slide 16

SCHOOL LEARNERS' CONTRIBUTIONS TO DISASTER RISK REDUCTION

- As **analyzers** of risk and risk reduction activities
- As **designers** and **implementers** of DRR interventions at community level
- As **communicators** of risks and risk management options (especially communications to parents, adults or those outside of community)
  - *Creative and performance arts (including street theatre, puppetry, art displays, song and dance)*
  - *Writing pamphlets, notices, newspaper pieces*
  - *Using photography and video to illustrate risks*
- As **mobilisers** of resources and action for community-based resilience
  - *Campaigning, petitioning, writing to local and national leaders*
- As **constructors** of social networks and capital
  - *Using the Internet to connect with youth around the world and share ideas on climate change DRR*
  - *Working with community-based organizations*

Module 1 References

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Module 2

Using action-oriented learning outside the classroom to understand the past and prepare for the future at the local level

Module 2 Overview

Module 2 introduces the Sandwatch approach through which school students, teachers and local communities work together to monitor their coastal environments; identify and evaluate the threats, problems and conflicts facing them; and develop sustainable approaches to address these issues. Climate change is one of the threats facing beach and coastal environments.

One of the key components of this module is a field trip to the beach during which participants explore how the beach environment has changed in the past and how it might change in the future as a result of climate change.

This module builds on the key ideas introduced in Module 1. Sandwatch is a practical example of education for sustainable development. With its practical hand-on approach Sandwatch represents an approach to teaching and learning that seeks to empower and encourage people of all ages to assume responsibility for creating and enjoying a sustainable future. Sandwatch is science in action, applied in the real world in an interdisciplinary manner with applications ranging from geography to art, and from poetry to mathematics. It teaches students to apply their school-based learning to everyday life situations.

The impacts of climate change, ranging from rising sea levels to increasing temperatures will affect beach and coastal environments in the future, and the field trip, which is a key activity of this module, demonstrates some of these impacts at the local level.

Module 2 Detailed Agenda

Day 2

1.30-3.00 Exploring Sandwatch

- 2.1 Presentation: Exploring Sandwatch
- 2.2 Activity: Exploring Sandwatch Small Group Discussion

3.00-4.15 Field Trip Preparations

- 2.3 Notes: Field Trip Logistical Guidelines
- 2.4 Presentation: Field Trip Preparations (this includes information about the activities to be undertaken during the field trip)
- 2.5 Activity: Field Trip Preparatory Work

7.30-9.00 Evening Activity (Optional)

- Online demonstration of Sandwatch International Database
- Review selected Sandwatch training videos that cover different types of measurements
- Participants share other beach-related and environmental activities in which they have been involved.

Day 3

8.00-2.00pm Field trip: Travel to/from beach location, complete field activities, picnic lunch
In small groups and at different sections of the beach:

- Observation, record taking, preparation of a group sketch map and discussion of issues at the beach section (~1.5 hours)
- Conduct the pre-prepared survey of residents/beach users' views of how the beach has changed (~1 hour)
- Conduct beach width measurements at 3 places along the selected beach length (~30 minutes)
- Picnic time (~1 hour)

2.30-4.30 Reviewing Past Changes & Building Future Scenarios

- 2.6 Presentation: Reviewing Past Changes & Building Future Scenarios
- 2.7 Activity: Reviewing Past Changes & Building Future Scenarios Small Group Discussion

4.30-5.00 Using the Sandwatch International Database

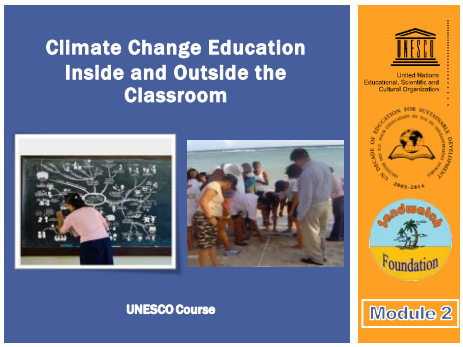
- 2.8 Presentation: Sandwatch International Database

End of Module 2

2.1 Presentation: Exploring Sandwatch

* The PowerPoint file for this presentation contains facilitator notes, only the slides are shown here.

Slide 1



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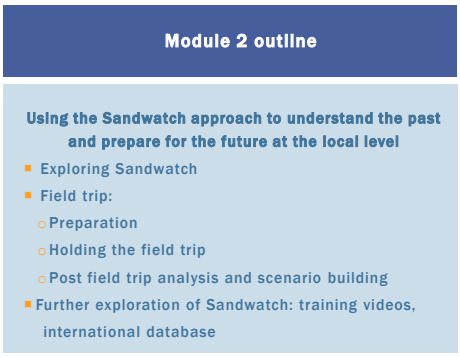

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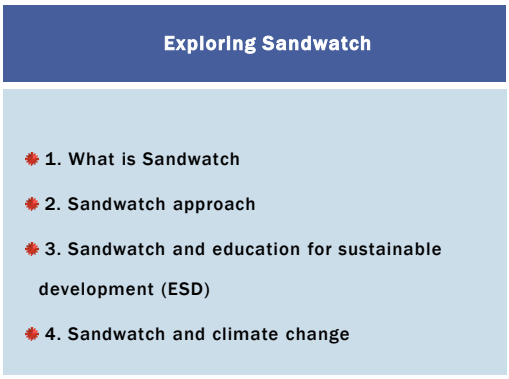

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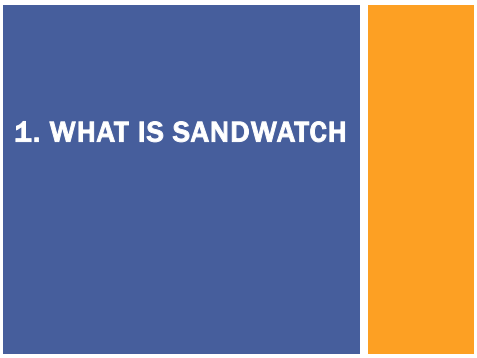


Slide 5

Slide 6

Slide 7

WHO CONDUCTS SANDWATCH?

Sandwatch is a volunteer network of schools, youth groups, non-governmental organizations and other groups, coordinated by the non-profit Sandwatch Foundation, and supported by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and many other organizations.

Slide 8

2. SANDWATCH APPROACH

Slide 9

Slide 10

LEARNING BY DOING: MAST

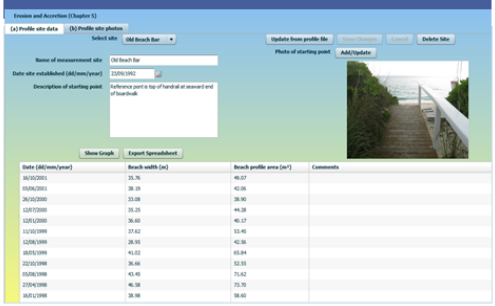
Slide 11

SANDWATCH MANUAL

- Describes the MAST approach;
- Methods for: observing and recording; erosion and accretion, beach composition, human activities, beach debris, water quality, waves, longshore currents, plants and animals;
- Guidelines for establishing a Sandwatch communications network;
- Designing a project and taking action.

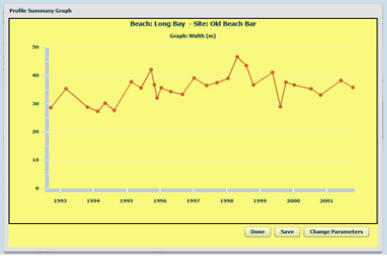
Slide 12

ANALYSIS WITH SANDWATCH DATABASE



Slide 13

GRAPH OF BEACH CHANGES OVER TIME



Slide 14

SANDWATCH IN THE BAHAMAS

Slide 15

COASTAL DAMAGE RESULTING FROM A NATURAL HAZARD

After Hurricane Floyd, 2005, the beach was badly eroded

Slide 16

MEASURING AND ANALYSING

Sandwatch group measured the sand loss and observed Government efforts to rebuild the beach

Slide 17

COMMUNICATION AND TAKING ACTION

(a) Planting

(b) Dune vegetation four years after planting

Slide 18

AND MORE ACTION

2009 - Dune stabilised with sea oats

2011 - post H. Irene – the sea oats worked to hold the dune in place

Photo credit: Candace Key

Slide 19

3. SANDWATCH & EDUCATION FOR SUSTAINABLE DEVELOPMENT

Slide 20

EDUCATION FOR SUSTAINABLE DEVELOPMENT

Education for sustainable development is an approach to teaching and learning that seeks to empower people of all ages to assume responsibility for creating and enjoying a sustainable future.

Slide 21

OR IN OTHER WORDS.....

- Learning to know
- Learning to do
- Learning to live together
- Learning to be
- Learning to transform oneself and one's society

Slide 22

WAYS IN WHICH SANDWATCH CONTRIBUTES TO ESD

- Taking education outside the classroom
- Learning about real problems and seeking solutions
- Learning by doing
- Critical thinking
- Sharing information with others and learning to listen
- Responsible citizenship

Slide 23

SANDWATCH AND THE SCHOOL CURRICULUM

- Sandwatch has been integrated into lessons on science, social science, mathematics, information technology, language skills, creative arts, woodworking and practical skills.
- Sandwatch activities have been used by students for their school based assessments for external examination councils.
- In the Cook Islands, parts of Sandwatch has been formally integrated into the science and social science curriculum for 6-14 year olds, and similar efforts are underway in Kiribati.
- Children with special needs such as autism have been involved in Sandwatch.

Slide 24

A TEACHER'S PERSPECTIVE

"Sandwatch takes you places you never dreamed of going and knowledge that will not be acquired on ordinary occasions"

Marsha Gregg, IT teacher, St. Vincent and the Grenadines

Slide 25

A STUDENT'S PERSPECTIVE

"Sandwatch has made me wiser. When my Geography teacher comes to class, and he asks me questions, he is amazed that I can give such a quality reply. When he asks how I know that, my simple answer is: Sandwatch." Allana Stanley, Mayaro School, Trinidad

Slide 26

4. SANDWATCH AND CLIMATE CHANGE

Slide 27

SOME IMPACTS OF CLIMATE CHANGE ON BEACHES

- Rising sea levels and more intense storms causing increased beach erosion
- Rising sea levels causing salt water contamination of underground fresh water supplies in the coastal zone
- Changing rainfall affecting river discharges and the amount of sediment being carried to the coast
- Rising temperatures affecting plants and animals e.g. sea turtles
- Ocean acidification affecting organisms that use calcium carbonate

Slide 28

DEMONSTRATING OCEAN ACIDIFICATION

- Students in Australia collected samples of rocks, sand, shells from the beach
- Samples placed in seawater containers to which vinegar (acetic acid) was added
- Observations showed bubbles rising from shell samples (which contain $CaCO_3$) as CO_2 was released

Slide 29

BUILDING CLIMATE RESILIENCE

A beach in trouble

A healthy beach

Slide 30

THANK YOU

Youth and Climate Change

Cool youth leading the way.

2.2 Activity: Exploring Sandwatch Small Group Discussion

Materials:

- Sandwatch Manual
- Most recent version of Sandwatch newsletter "*The Sandwatcher"*
- 5 minute video on Chapter 1 of the Sandwatch Manual

Procedure:

In small groups (approximately 5 people), and using the materials and the preceding presentation, discuss and select 2 ways for each of the following questions:

- How does Sandwatch address ESD?
- How does Sandwatch contribute to climate change adaptation?
- Do you know of other programmes similar to Sandwatch?

Groups report back briefly.

If there are people familiar with Sandwatch they should spread themselves around the groups to provide more information.

2.3 Notes: Field Trip Logistical Guidelines

1. Select the beach site for the field trip (See also pages 23-24 of the Sandwatch Manual)

(a) Identify a suitable beach that can be reached during the course. Ideally travel time to the selected beach should be less than 1 hour.
(b) Ensure that the beach is safe for the participants e.g. a site where the only beach access is via a steep and dangerous slope/cliff should be avoided.
(c) A suitable beach for the field visit will have the following characteristics:
- A community lives close by and uses the beach for recreation, exercise, fishing, and other purposes
- There are some environmental issues at the site, e.g. the beach has a lot of garbage, there is poor water quality or the beach is being eroded
- The beach is often visited by people living a long distance (more than 1 hour's travel time) away (optional)

(d) Particularly in areas where there is a high tidal range (more than 1m between high and low tide) e.g. the Pacific, ensure the field visit will coincide with low tide conditions.
(e) A **prior visit to the beach before the course** is always recommended

2. Check arrangements are in place for the field trip

(a) Transportation
(b) Food and drink
(c) Equipment (notebooks, pencils, chart paper and markers for preparing the sketch map, tape measures, cameras/phones)
(d) First aid kit

3. Research information about the beach (these activities will also be undertaken by the participants – it is recommended for the facilitator to know what is available before the session)

(a) Topographical map showing the coastal area and the selected beach
(b) Access the beach site via Google Earth (go to earth.google.com to download the free software) and print out map and satellite views of the beach
(c) Use a search engine such as Google.com to find out information about the beach e.g. newspaper articles, academic papers, tourist information, photos
(d) Consult with work colleagues to find out other local information about the beach site
(e) If possible arrange for a local beach expert to join the field trip or talk to the group in advance of the field trip

4. At the beach:

(a) Divide the participants into groups, each group about 5 persons.
(b) Select a specific length of beach for each group to work on – suggested length for each group is about 1km
(c) Ensure each group has separate residents/beach users to interview

2.4 Presentation: Field Trip Preparations

* The PowerPoint file for this presentation contains facilitator notes, only the slides are shown here.

Slide 1

PREPARATIONS FOR THE FIELD TRIP

Slide 2

FIELD TRIP OBJECTIVES

- Learning about the beach site as it is now and how it has changed in the past
- Understanding how the beach will likely change in the future as a result of climate change and climate variability

Slide 3

Advance preparation and activities to be done at the beach

- 1. Location and research into the beach
- 2. Observing and recording everything about the beach and making a sketch map
- 3. Setting up sites where changes in beach size can be measured (erosion and accretion) and making the baseline measurements
- 4. Conducting a survey about residents' and beach users observations of how the beach has changed over time

Slide 4

On return from the beach

- Review past changes: the results from the observations, measurements and questionnaire; and prepare **2 key statements about past changes in the beach and the level of confidence in your statements**
- Review projections for climate change for this location and prepare **1 key statement about how this beach will be in 20 years time and the level of confidence in your statement**
- Prepare **1 key statement on what can be done to make the beach more healthy**

Slide 5

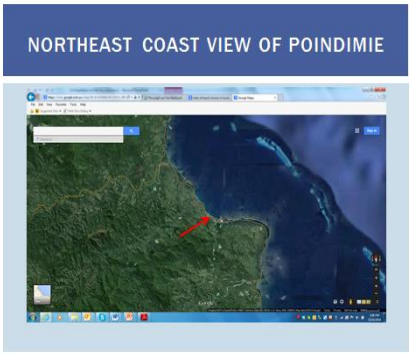
1. LOCATION AND RESEARCH INTO THE BEACH

Slide 6

RESEARCH INFORMATION ABOUT THE BEACH SITE

- Research will have to be undertaken for the particular beach site
- Use sources such as the Internet, Google Earth and local experts to find out information about the beach site and how it has changed in the past. Old photographs are another useful source of information
- It is always helpful if a local expert can talk to the course participants either before or during the field trip.
- The following slides give an **example** of the type of information that was researched for the course when it was conducted in Poindimie, New Caledonia.

Slide 7



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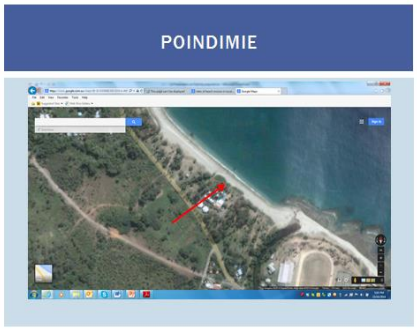

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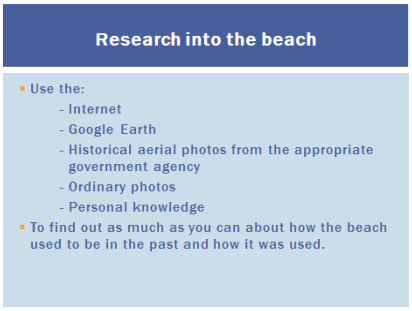

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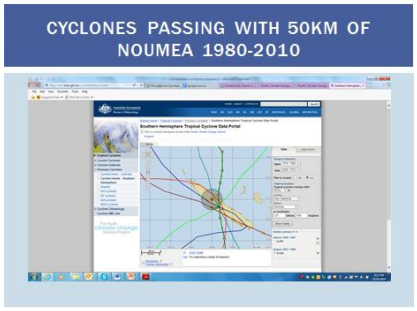

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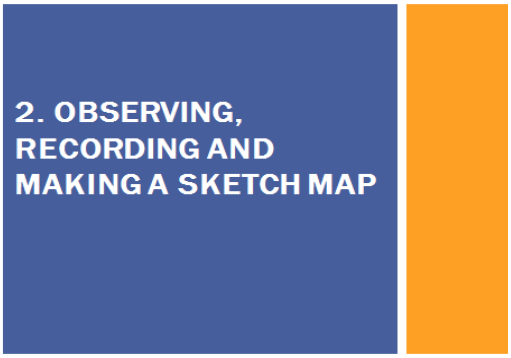


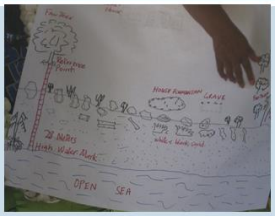
Slide 12

Slide 13

Man-made structures

Slide 14

Example of a sketch map



Slide 15

3. MEASURING EROSION AND ACCRETION

Slide 16

Measuring beach width

- Select a stable point behind the beach to act as the reference point
- Take a photo of the reference point
- Using a tape measure to record the distance from the reference point to the high water mark
- Repeat the measurement as often as possible (See Chapter 5 of the Sandwatch Manual)

Slide 17

PROJECTING FUTURE BEACH CHANGES

- Each beach is a complex individual system
- Long term measurements of beach changes over time are very sparse in many parts of Africa and SIDS
- **Overall as sea level rises it is most likely that rates of erosion will increase.**
- Atoll islands may behave differently to high islands
- Information about atoll islands is conflicting, some studies indicate the reefs may keep growing upwards with sea level rise; other studies indicate that sparsely populated atoll islands may be inundated with sea water more frequently but may actually grow in size

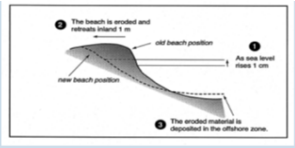
Slide 18

PROJECTING FUTURE BEACH CHANGES (2)

- To project where the average high water mark may be in 20 years time, use existing erosion (or accretion) rates (if they exist). Erosion/accretion rates are usually measured in metres (or fractions of metres) per year, so just multiply the rate by the number of years.
- If measurements of past changes do not exist for your beach, then use a mathematical model such as the Bruun Rule (see next slide) to provide an estimate. (Note that this model was designed for continental coasts with wide shelves and may not always be appropriate for small islands which often have complex offshore topography)
- The 5th Assessment Report of the IPCC (2013) estimates that sea levels will rise globally between 0.26 – 0.98 m by 2100 (0.26 to 0.98 cm/year)

Slide 19

MATHEMATICAL MODELS: 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.

Slide 20

FIELD EXERCISE: MEASURE POSITION OF HIGH WATER MARK IN THE FUTURE

- Use either the erosion rate based on historical beach change measurements, or the rate based on model projections (Bruun Rule)
- Multiply the yearly erosion rate by 20, then by 40 and then by 60.
- Using a tape measure mark out the position of average high water mark in 20 years time, 40 years time, and 60 years time (see next slide)
- Discuss with your group how will this impact the land (dunes, coastal forest, buildings, road, car parking areas etc.) behind the beach?

Slide 21

- Using the erosion rate for your beach, estimate where the beach will be in the future.

Slide 22

4. SURVEY OF RESIDENTS AND BEACH USERS ABOUT HOW THE BEACH HAS CHANGED

Slide 23

Finding out the views of beach residents and users

- Observing and recording human activities at the beach at different times
- Finding out the views of beach users using questionnaires
- Analyzing the results

See Chapter 7 of the Sandwatch Manual for more information.

Slide 24

Sample questionnaire on why people use a particular beach

SAMPLE QUESTIONNAIRE

Objective: To find out why people use a particular beach

1.	Is the bay safe for swimming?	Yes	No	Sometimes
2.	Is the water clean?	Yes	No	Sometimes
3.	Is the beach clean?	Yes	No	Sometimes
4.	Is there good access to the beach?	Yes	No	
5.	Are the parking facilities adequate?	Yes	No	Sometimes
6.	Are the bathroom facilities well maintained?	Yes	No	Sometimes
7.	Is the beach crowded?	Yes	No	Sometimes
8.	Is there sufficient shade on the beach?	Yes	No	Sometimes

9. How would you like to improve the beach?

2.5 Activity: Field Trip Preparatory Work

Materials:

- Sandwatch Manual
- 5 minute videos on Chapter 5 and 7 of the Sandwatch Manual
- Topographical map of the field visit beach, Google Earth views of the beach, any other information about the beach

Procedure:

In small groups (approximately 5 people), and using the materials and the preceding presentation:

1. Build a picture of the beach location and its characteristics

- Discuss and examine the topographical map showing the coastal area and the selected beach
- Use Google Earth to view a map and satellite view
- What information does this tell you about the beach e.g. is it a sandy beach, is there a settlement or village nearby, is there road access, are there trees or buildings behind the beach, is this a small beach or is this part of a long stretch of coast, etc.
- Use a search engine such as Google.com to find out information about the beach e.g. newspaper articles, academic papers, tourist information, photos
- Are there people in the group familiar with the beach – what information do they have

2. Beach width measurements

- Refer to Chapter 5 of the Sandwatch Manual and the accompanying video if required.
- Each group checks they are familiar with procedures to select and record a reference point, and measure beach width.

3. Prepare a questionnaire designed to find out how the beach has changed in the past

- Refer to Chapter 7 of the Sandwatch Manual.
- Prepare up to 10 questions at least 2 of them should be open ended questions (requiring more than a ‘yes’ or ‘no’).

Groups report back briefly, particularly on items 1 and 3.

If there are people familiar with Sandwatch they should spread themselves around the groups to provide more information.

2.6 Presentation: Reviewing Past Changes & Building Future Scenarios

* The PowerPoint file for this presentation contains facilitator notes, only the slides are shown here.

Slide 1

REVIEWING PAST CHANGES AND BUILDING FUTURE SCENARIOS

Slide 2

1. REVIEW OF THE FIELD TRIP

Slide 3

FIELD TRIP OBJECTIVES

- Learning about the beach site as it is now and how it has changed in the past
- Understanding how the beach will likely change in the future as a result of climate change and climate variability

Slide 4

Advance preparation and activities done at the beach

- 1. Location and research into the beach
- 2. Observing and recording everything about the beach and making a sketch map
- 3. Setting up sites where changes in beach size can be measured (erosion and accretion) and making the baseline measurements
- 4. Conducting a survey about residents' and beach users observations of how the beach has changed over time

Slide 5

On return from the beach

- Prepare a sketch map showing key features of the beach, the beach width measurements & where the beach will likely be in 20/40/60 years' time
- Review past changes: the results from the observations, measurements and questionnaire; and prepare 2 key statements about past changes in the beach and the level of confidence in your statements
- Review projections for climate change for this location and prepare 1 key statement about how this beach will be in 20 years time and the level of confidence in your statement
- Prepare 1 key statement on what can be done to make the beach more healthy

Slide 6

2. CLIMATE CHANGE PROJECTIONS AND HOW THESE WILL AFFECT BEACHES

Slide 7

Climate change projections

Parameter	Change	Confidence level relating to direction of the change
Temperature	Increasing temperature 1.5 - 4.0°C	High
Sea level rise	Rise of 0.26 – 0.98 cm	High
Ocean acidification	Decrease 0.14-0.35 pH units resulting in more acidic oceans	High
Extremes	More heat waves and extreme rainfall events	High
Tropical cyclones	Less frequent, but more extreme cyclones (Cat 4-5) possible by 2100 (projections vary according to ocean basin)	Low - moderate
Precipitation	Varies regionally, some areas to get wetter, some drier	Low-moderate

Slide 8

Beach changes

Beaches have changed in the past as a result of:

- **Wave energy: storm waves, ocean swells, cyclones**
- **Man's activities: Mining sand and aggregate from beaches, building houses and other structures in the active beach zone, poorly planned sea defence structures (e.g. jetties, sea walls), damaging (dynamiting) the reef, and others.**

Climate change now and in the future will result in:

- **1. more sea level rise**
- **2. more acidic oceans**
- **3. stormier weather**
- **4. rising temperatures**
- **5. changing precipitation**

Slide 9

1. Sea level rise

- Generally as sea level rises it is expected there will be more beach erosion, but this will vary from beach to beach and place to place depending on past changes, man's activities, the presence or absence of healthy coral reefs and many other factors.

Slide 10

Sea level rise (continued)

On high islands, and continental coasts, especially where beaches are already experiencing erosion, the average position of high water mark will likely move inland.

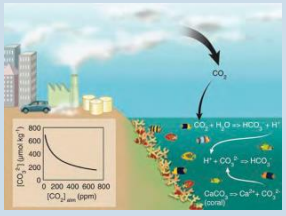
Slide 11

Sea level rise (continued)

- On atolls and islands protected by coral reefs, the picture is less clear and will likely depend on other factors such as the health of the coral reef

Slide 12

2. Ocean acidification

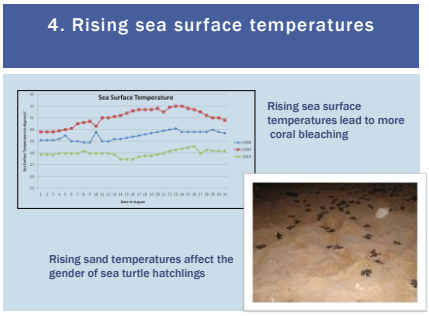


Source: Hoegh- Guldberg et al. 2007

Much of the CO_2 gets absorbed by the ocean resulting in more acidic conditions which impacts all animals with $CACO_3$ in their shells or skeletons.

Slide 13

Slide 14



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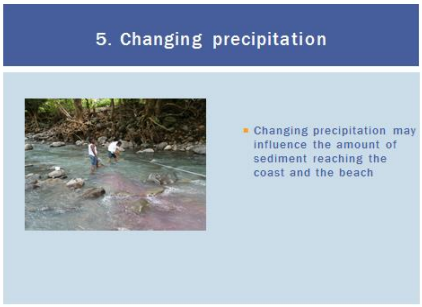

Slide 16

2.7 Activity: Reviewing Past Changes & Building Future Scenarios Small Group Discussion

Materials:

- Research information
- Sketch maps from field trip
- Beach measurements
- Questionnaire results
- Projected climate changes for this country and region for 2030 and 2050. (If none are available use the 5th Assessment report of the Intergovernmental Panel on Climate Change 2014). If these are not available use the table in slide 7 of presentation 2.6.

Procedure:

In the same small groups as for the field trip and using the materials listed above:

1. Build a picture of the how the beach has changed in the past

Using the results from your research, observations, sketch map, beach measurements and questionnaire, discuss and answer the following questions (not all of these questions will be relevant to the particular beach).

1. Was the beach bigger or smaller (wider or narrower) in the past?
2. Was the beach composed of the same type of sediment in the past?
3. Were there any severe storms in the past and how did they cause the beach to change?
4. Are there sand dunes or cliffs behind the beach? If so, are the sand dunes stable (i.e. covered with vegetation)? Is there any evidence of cliff falls?
5. Was the vegetation (e.g. trees, shrubs) behind the beach the same in the past?
6. Did you find out anything about coral reefs or the abundance of marine life in the past?
7. Has there been a lot of development along the beach front or on the land behind the beach in the last decades?
8. Have any sea defences (e.g. sea walls, boulder walls, jetties or groynes) been built on the beach or nearby in the past?
9. Have stones or sand been removed from the beach?

Based on your work, put together 2 key statements about beach changes and state your level of confidence (high, medium, low). Be prepared to justify your statements and why you give the statement a particular confidence level.

Two examples might be:

- The beach used to be much wider but a big storm in 1998 and sand mining by the local community has resulted in erosion and today the beach is very narrow (today it is only 25 m from the vegetation line to the high water mark). Medium confidence.

- There used to many trees behind the beach, now there are only vines and low bushes. High confidence.

2. Project how the beach will look in 20/40 years time

Using the information on climate change projections for your area, discuss and answer the following questions (not all the questions will be relevant to the particular beach).

1. How will sea level rise affect the beach – will the water level and waves reach higher up the beach and will this make the beach narrower?
2. Are there coral reefs near this beach? If so how will ocean acidification affect the coral reefs? And will this in turn affect how the coral reefs protect the beach?
3. Will increasing storms affect the beach? If so how?
4. Will rising temperatures affect the plants and animals on the beach?
5. How is the rainfall expected to change in your area, and how might this affect the amount of sediment reaching the beach and the plants and animals on the beach?

Use your answers to build a picture of whether climate change will adversely affect the beach or whether the beach will be able to cope with the climate changes.

Prepare one key statement on how climate change will impact the beach and state your level of confidence (high, medium, low). Be prepared to justify your statements and why you give the statement a particular confidence level.

Two examples might be:

- This beach has shown little change in the past and it is expected that the coral reef will grow upwards as sea level rises and so the coral reef will continue to protect the beach. Low confidence.

- This beach has eroded in the past and sea level rise is expected to make the beach narrower. Medium confidence.

3. Discuss how to make the beach more healthy and resilient to climate change

Prepare one key statement on what can be done to make the beach healthy and more resilient to climate change.

2.8 Presentation: Sandwatch International Database

* The PowerPoint file for this presentation contains facilitator notes, only the slides are shown here.

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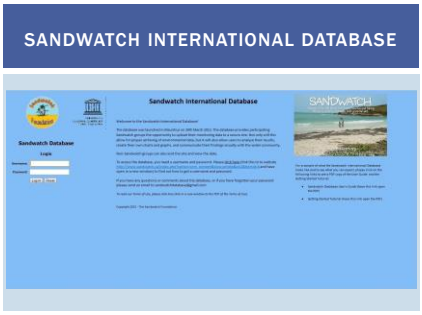

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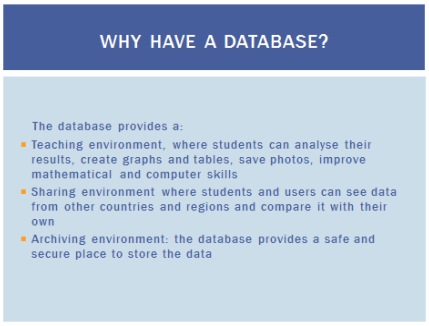

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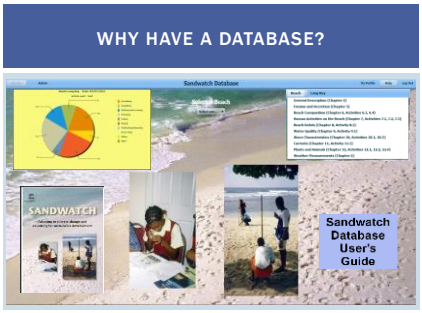

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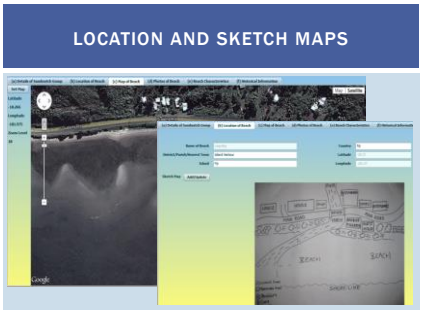

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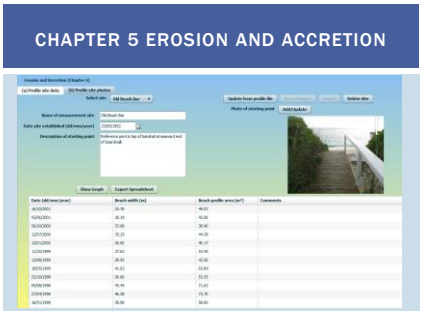

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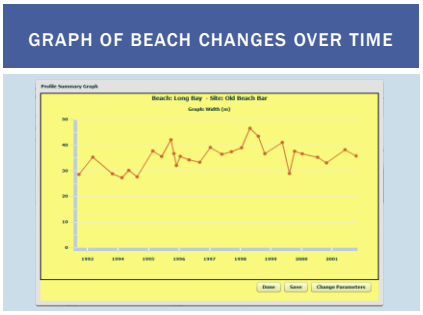

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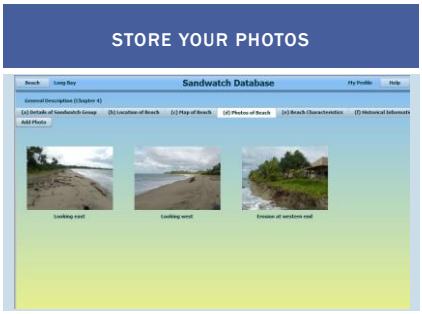

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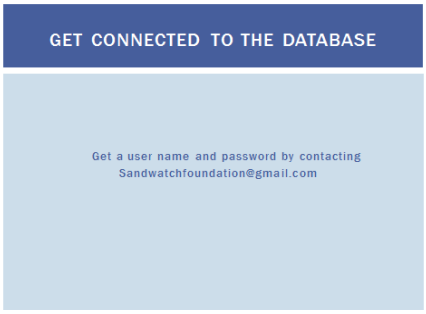

Module 2 References

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UNESCO. 2010 *Sandwatch: adapting to climate change and educating for sustainable development.* Paris: UNESCO. 136pp.

Module 3

Designing Climate Change Teaching elements inside and outside the classroom

Module 3 Overview

During Module 3, participants use the elements from ESD, climate change and Sandwatch in Modules 1 and 2 to review the school curriculum and select one topic where elements of ESD/climate change/Sandwatch could enhance understandings of that topic. Participants then work in small topic or country groups to develop a lesson plan or educational project activities.

At the end of the course, participants will be asked to evaluate the course.

Two to three months after the course, participants will be asked to report back to UNESCO via the course co-ordinators on their experiences with implementing their educational project.

Module 3 Detailed Agenda

Day 4

8.30 - 10.00 Preparing a classroom activity

- 3.1 Presentation: Lesson Planning for Climate Change
- 3.2 Handout: Case Studies of Classroom-based Climate Change and Environmental Interventions

10.00 - 10.20 Morning Tea

10.20 - 11.00 Choosing an Educational Intervention

- 3.3 Activity: Choosing an Environmental Intervention

11.00 – 12.00 Developing your educational intervention

- 3.4 Activity: Developing your education intervention
- 3.5 Handout: Planning template

12.00 - 1.00 Lunch

1.00 - 3.30 Developing your educational intervention continued

- 3.6 Handout: Guidelines for Post – Course Feedback

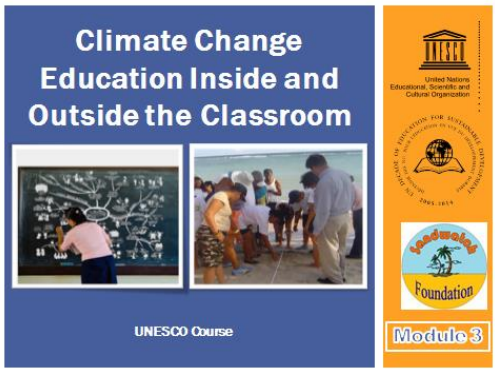
3.30 - 3.45 Evaluation

3.45 – 4.00 Closing

End of Module 3

3.1 Presentation: Lesson Planning for Climate Change

Slide 1



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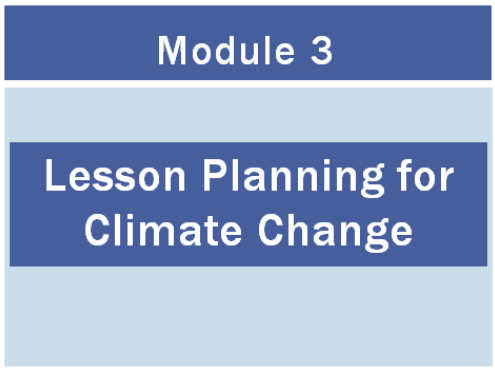

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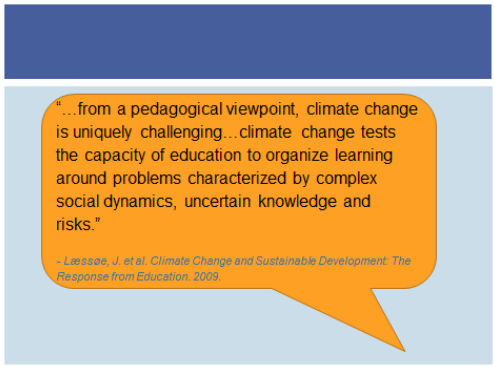

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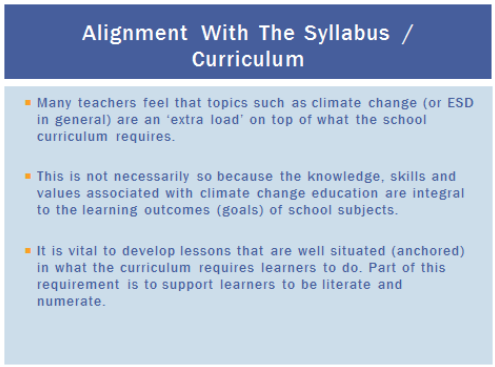

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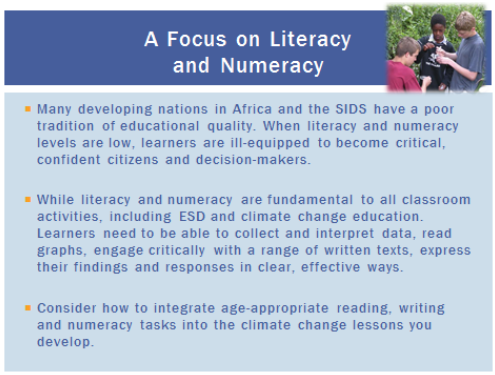


Slide 6

Slide 7

A Focus on Critical Thinking and Creativity

- The scope and complexity of climate change can feel overwhelming for educators and learners:
  - Media and other advocacy groups often misrepresent or exaggerate the causes or predicted impacts of climate change;
  - Climate change knowledge itself is often characterised by uncertainty;
  - As a global threat, it can be difficult to know what can be done at a small, local level.
- Secondary school teachers can respond by developing their learners' ability to engage CRITICALLY and CREATIVELY with climate change.
- Climate change education is not just about 'studying the topic of climate change'. As explored through this course, schools can stimulate new ways of thinking and doing in response to climate change. But this requires critical thinking, confident, informed and creative young citizens. How might your lesson plans support this?

Slide 8

A Focus on Values and Responsible Citizenship

- Many drivers of climate change are associated with values that underpin modern, consumerist and individualised lifestyles.
- Similarly, many of the ways that communities (local and global) can mitigate and adapt to climate change are dependent on new ways of valuing and acting in terms of our relationships with places, people and other species.
- The school curriculum can stimulate young people (future citizens) to consider their values and what they mean for people and planet. For example:
  - Do we value the freedom and wellbeing of current AND future generations?
  - Is it only human wellbeing that we value? Or what else?
  - How might we enact these values at the local community level (local citizenry) and the international level (global citizenry)?

Slide 9

A Focus on Local, Achievable, Worthwhile Learning and Action!

- RELEVANCE: As you plan your lessons, consider how the knowledge, skills and values gained will be relevant to your learners' local context and lives.
- FEASIBILITY: If you are planning an action-based response, think carefully about how feasible (achievable) it is. Avoid the risk of setting learners up to feel overwhelmed by the scale of problems that they can never realistically address! Develop learning outcomes and action goals that are appropriate and achievable for the age group, the available time and resources, and the type of follow-up and support that is needed. It is more important for learners to develop their potential to become future responsible citizens, than it is for them to feel burdened with fixing all the problems in their community.

Slide 10

Some Case Studies of Classroom-based Climate Change and Environmental Interventions

- **Handprints for Change**
- **Using Sandwatch to teach English**
- **Stepping Up to Sustainability**
- **Sustainable environmental actions by Bequia Community High School**

3.2 Handout: Case Studies of Classroom-based Climate Change and Environmental Interventions

An environmental voice using a cellphone to report an environmental crisis

This story shows how simple technologies like photographic evidence on cellphones can monitor and respond to environmental disasters in Africa. The majority of South Africans have cell phones or at least access to someone who has one – and so, like Siboniso, everyone has an environmental voice. Recognising that he COULD do something and acting on that recognition is the change that happened in Siboniso's life. Community members monitoring environmental conditions play their part in actively caring for the environment.

Partnerships work well when people have good relationships. This case story shows how relationships can be strengthened through working together with support of social media. SMS messaging and mobile phone photographs and video, shared through blue-tooth, was used to communicate a serious health risk in a local community, Siphumelele. By reporting issues as and when they occur, acknowledging what is going wrong and seeking solutions through partnerships at a community, NGO and local government level effective solutions can be found.

A serious health hazard at Siphumele

Siboniso Hlela lives in Siphumelele Township near Howick in KwaZulu-Natal. His house is situated near a small stream at the bottom of the valley, this stream is a tributary of the Umgeni River. Since his house is at the lower end of Siphumelele, whenever there is a sewage breakdown, the sewage flows to his house. This was so bad towards the end of 2010 that for six months a pool of sewage, prevented him from opening the door of his tool shed. The sewage problem was so bad that during last Christmas and January 2011some of his friends did not want to visit Siboniso, at his house, because of the bad smell. During a sewage spill the raw sewage flows straight into the small stream and then into the Umgeni River which is 600 metres from Siboniso's house. The Umgeni River is the major water supply river in KwaZulu-Natal and supplies both Pietermaritzburg and Durban, South Africa's second largest city, with drinking water.

Partnerships: Working together to solve the problem

For many months Siboniso tried to speak to authorities to ask for help, without success. One day Siboniso heard about the Duzi Umngeni Conservation Trust (DUCT) who, he was told, care about the state of our rivers. The next time he had a bad sewage spill he took a video of the problem with his mobile phone. He then phoned Liz Taylor, a DUCT volunteer, and using sms messaging they made a plan to meet at his house. When Liz arrived at the house she took some photographs of the problem with her mobile phone. Unfortunately, videos are too big in memory to transfer with sms, so Siboniso taught Liz how to use blue-tooth and together they managed to transfer the video of the sewage spill from his mobile phone to hers.

Liz and Siboniso at the sewerage spill

For a number of years Liz had been working with officials in the Umngeni Municipality and the UMgungundlovu District Municipality. Through Liz, Siboniso also met Jim Taylor who works with Londiwe Msomi, also from WESSA, an environmental organisation that is based at Umngeni Valley near Howick.

Londiwe and Jim, like Liz, are committed to environmental education processes that make a difference to the lives people live and aim to care for the life-support systems, like fresh, clean water, that all people need to live a healthy life-style.

DUCT and WESSA are also encouraging members of the public to note any serious health hazards or environmental issues by taking a photograph of the problem with their cell phones. This way they can record the time, date and geographical co-ordinates, if their phone has this feature, and these records are very important to ensure that something is done about the problem. A network of people, who care about the environmental wellbeing of township areas, is starting to develop. In fact people are becoming quite skilled at sharing issues with local authorities, in some cases politicians or even NGO's when things go wrong.

The incident on 12 February 2011

On Saturday, 12 February, Siboniso phoned Liz again – a bad sewage out-flow was again flooding past his house. A nearby man-hole on the main sewage line was spilling and a pipe was broken. Liz and Jim went round to the house and, with Siboniso, they investigated the sewage outflow.

Once Jim and Liz had the photo's, and had seen how serious the problem was, they didn't know what to do. It was during the weekend and the municipal offices were closed. At 11am on Sunday, 13 February, Liz forwarded an e-mail with the photos of the totally unacceptable and unhygienic conditions to Sbu Khuzwayo, the District Municipal Manager of UMgungundlovu Municipality. Fortunately Sbu was monitoring his e-mails – even though it was a Sunday! After a few minutes he responded and said he would appoint a task team to deal with the matter. The task team met on Monday, 14 February.

The first step of the task team was to investigate the issues and set about solving the problems. They discovered that the main issue is the grit, rubbish and rags that block the pumps. An extra amount of waste milk had also been allowed to flow into the sewage system due to a system break-down at a nearby dairy.

The Task Team goes to work

On Monday, 14 February, Liz met Rob Kepplar from the Kanty and Templer civil engineering company that had designed and built the RDP housing. There were also presentations from the UMgungundlovu District Municipality, UMngeni water and David Ziqua, an active community member also affected by the sewage. He represents the community on days when Siboniso is working.

At the meeting the main people in charge of the sewage system promised to have it fixed. It is not an easy job, as the six lowest houses in the township have been built in the wrong place. The pipes are also too small and become blocked easily with silt and rubbish. The pumping station that is supposed to pump sewage also often breaks down. Clearly the sewage problem at Siphumelele is a complex and complicated problem that is going to be difficult to sort out in the longer term. Nonetheless, the team developed a plan to fix the pipes and within a week or so the main broken pipes were repaired.

Siboniso will continue to monitor the situation because if the main sewage pipe gets blocked with silt, again, and is not cleaned at the pumping station we could again have a problem where the manhole in Siboniso's garden spills sewage.

Compiled by **Londi Msomi**. A WESSA Share-Net resource, funded through the USAID 'Stepping Up to Sustainability' project. WESSA Share-Net. People, Places and Publications for Environmental Education, PO Box 394, Howick, 3290, South Africa.
Tel (033) 330 3931 ext. 124, e-mail sharenet@wessa.co.za ; website www.wessa.org.za

Using Sandwatch to teach English as a foreign language

These examples are based on using Sandwatch to teach English to French-speaking students in Mayotte, Indian Ocean, and can be used by teachers of other foreign languages.

Learning to use the words What, Where and How

Before the first visit to the beach prepare a list of titles: date, time, weather, name of beach, shape and size, length and width, wave height, water and air temperature. Ask the students to prepare questions starting with the words: what, when and how, under each title, e.g. What is the date? What is the weather like? What is the name of the beach? How big is the beach? How long is the beach? How wide is the beach? Where do the waves break? What is the colour of the water? The students bring their list of questions to the beach and work in pairs or groups to pose their questions to the others and write down the answers. Back in the classroom the students use the questions and answers to write a description of the beach.

Use the Sandwatcher Newsletter as a teaching tool

In the Sandwatcher Newsletter (December, 2006), there was an article on the reactions of people in Sri Lanka to the Indian Ocean tsunami of December 2004. The article was used a reading and comprehension exercise and different activities included:

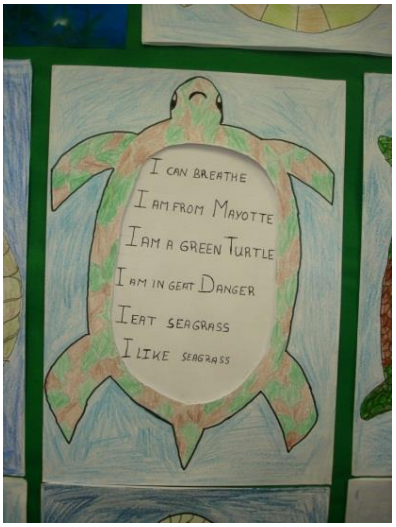
- Answering questions on the text;
- Matching beginnings of sentences to the correct ends of sentences;
- Identifying right and wrong sentences;
- Underlining key words and asking questions;
- Writing exercises using topics such as: Where were you on the day of the tsunami? What happened to the sea?

Use beach flora and fauna to practise writing skills

Young students beginning English fold a sheet of paper in two, draw a beach animal on one side, cut out around the animal and on the inside of the paper write some sentences introducing the animal using the present tense.

For example in Mayotte, students drew green turtles and after three months tuition in English were able to write simple sentences, e.g.

- My name is the Green turtle.
- I am from Mayotte.
- I swim in the Indian Ocean, I travel a lot.
- I am in great danger from poachers.



Contributed by Pascale Gabriel
(Source: Sandwatch Manual Page 28)

High School Learners Take Sustainable Environmental Action

On the island of Bequia, in the St. Vincent' Grenadines, a past history of airport development, land reclamation and poor planning resulted in a narrow drain on the south coast becoming a final resting place for marine and-land based debris.

As part of their Sandwatch project students from the Bequia Community High School set about making a difference:

- They **analyzed** the water which settles in the drain to establish the levels of coliform bacteria, oxygen, biochemical oxygen demand, pH, nitrogen and phosphates.

- They **advised** people of the community about corrective measures through one-on-one discussions and radio and television programmes.
- They cleared the area of debris and erected debris traps that are easy to clean.
- They **excavated** the silt and trees, to allow the water to flow freely, thus controlling the mosquito population.
- They **landscaped** the area, erecting park benches and planting flowering plants.

- They encouraged the **use of the area** for relaxation and recreation instead of dumping.
- And most importantly they involved a local community organization in the project who agreed to maintain the area after the project was finished – there ensuring **sustainability**.

3.3 Activity: Choosing an Educational Intervention

This brainstorming activity requires you to work in small groups of 2 – 4 educators. The aim is for you to decide what educational intervention you can make in response to climate change. By working on your individual project in a group, you will be able to draw on other people's creativity and experience to strengthen your own plans. You should choose your group according to the kinds of networks, experience and common concerns that you would like to share. Some ideas for possible groupings include:

- **Subject/ topic groups** (if, for example, you are wondering what can you do as English/ Maths/ Geography teachers)
- **Country/ regional groups** (If, for example, your interest is in developing a co-ordinated, national or regional response to climate change)
- **Sectoral groups** (if, for example, you would like to work with people who do similar work to you in the non-governmental sector, through faith-based communiites etc.)

Once in your chosen groups:

1) Each individual should make a list of the main climate change concerns in his/ her context and consider what kind of educational responses might be appropriate for each one.

2) Take turns to discuss these concerns briefly with the rest of your group.

3) Through this informal brainstorming and constructive critique of one another's ideas, you should be able to narrow down your options and decide on a specific educational intervention. Ensure that your choice is achievable, contextually relevant and supportive of quality learning for your learners.

4) Are there any existing projects/ networks/ programmes/ resources to which this educational intervention could be linked?

5) Conclude this activity by rejoining the plenary group and going quickly around the room to hear (in a few concise sentences) what each person plans to do.

3.4 Activity: Developing your Educational Intervention

This is the main activity of Module 3 and an opportunity for you to apply what you have learned during this course to your educational work. By the end of this activity, you should have a well-prepared educational intervention (such as a classroom lesson plan) that you can take home and implement.

- Use the **planning template** (see 3.5 Planning Template) to guide your planning
- You will be requested to leave a **photocopy or scan** of your educational planning (plus any related handouts etc.) with the course tutors for record purposes.
- Please note that you will be asked to **report back to the course co-ordinators** in two or three months, describing your experiences and insights after implementing your educational project. The feedback guidelines are included in this pack.

3.5 Handout: Planning Template

Title / very brief outline of your educational intervention (details to follow below, so limit this to 40 words)	
Broad focus	*Climate change*
More specific focus	
Who are the intended learners?	
What specific climate change risk or issue (local or global) does this educational intervention aim to address?	
Purpose/ aims of this educational intervention	
When and where?	
What are the key concepts contained in the educational intervention	

Teaching methods and strategies to be used	
Educational resources / materials to support teaching and learning	
What **knowledge** about climate change will learners gain?	
What **skills** in relation to climate change will learners develop?	
What **values** in relation to climate change will learners explore?	

Partners/ networks/ resource persons etc. available to support the project	
Are any other resources needed (e.g. transport, catering, equipment)? If so, how will this be secured?	
How will learning be assessed?	
How will the project be monitored and evaluated?	
Write a short narrative in which you try to describe how the educational intervention will unfold. Describe the sequence of planned activities etc.	

3.6 Handout: Guidelines for Post Course Feedback

In two to three months after this course, you will be asked to report back to UNESCO via the course co-ordinators on your experiences and lessons learned from imlementing your educational project. Your feedback will be guided by the following questions, so it will be good to familiarise yourself with them now and bear them in mind during implementation. Consider ways in which your learners and/ or their work can form part of the feedback on this course. Also remember that it will be helpful to include a few carefully selected photographs in your report if possible.

1. Describe how you implemented your educational project, with whom, and when.
2. What was your reason for developing this educational project?
3. To what extent to you feel it was successful? Give reasons.
4. Was there any evidence of learning taking place about climate change mitigation and/or adaptation?
5. Would you describe this educational intervention as an example of Education for Sustainable Development? Give detailed reasons for your response.
6. Did your educational intervention incorporate any of the following? If so, please give a brief explanation and/or example:
    - Local / traditional knowledge:
    - Scientific knowledge
    - Consideration of values and ethics
    - Development of critical thinking skills
    - Futures-oriented activities
    - Artistic expression
7. If you did this educational work again, is there anything you would do differently? Or something you would definitely want to do in the same way? Please explain.
8. Summarise in a sentence or two how relevant and succesful you feel this educational intervention has been in responding to climate change in your school and community.

Conclusion

Evaluation

The course was well structured	☐	☐	☐	☐	☐	☐	☐	The course was poorly structured
The activities gave me the confidence that I can apply the knowledge in my work	☐	☐	☐	☐	☐	☐	☐	The activities did not give me confidence that I can apply the knowledge in my work
I found the Sandwatch Manual useful	☐	☐	☐	☐	☐	☐	☐	I did not find the Sandwatch Manual useful
I learnt things that will be useful to my classroom	☐	☐	☐	☐	☐	☐	☐	I did not learn things that will be useful to my classroom
The facilitators made the material enjoyable	☐	☐	☐	☐	☐	☐	☐	The facilitators did not make the material enjoyable
I am confident that I can implement the activity I planned in Module 3	☐	☐	☐	☐	☐	☐	☐	I am not confident that I implement the activity I planned in Module 3
I would recommend this course to my colleagues	☐	☐	☐	☐	☐	☐	☐	I would not recommend this course to my colleagues

Do you have any further comments or feedback about any aspects of the training?