CLIMATE CHANGE CURRICULUM GUIDE FOR THE TOURISM SECTOR

TEACHERS' GUIDE

sustainability for seychelles

Foreword

Climate change is now recognised as one of the major problems that the globe faces today. With the pace at which climate on our planet is changing, humans will not have the time to evolve in order to survive the change. Human beings, as a species, is being threatened, and unless we seek out ways to mitigate climate change, or adapt to its consequences, we, and the whole planet, stand to suffer. Underlying the need to mitigate and adapt, is a need to be informed, and be conscious of our contribution to the issue. From there, we can work towards a more sustainable future, for the human species, and other beings that live on Planet Earth.

As such, the reality of global climate change lends increasing urgency to the need for effective education on earth system science, as well as on the human dimensions of climate change. Interwoven with this fact is an urgent need for education to become an essential component of the Seychelles' response to climate change. As a result, local NGO, Sustainability for Seychelles, in collaboration with the British Foreign Office and the European Union, have produced a curriculum guide for post- secondary students and teachers.

This curriculum guide is designed to draw attention to the themes expressed above. It is divided into five sections, in which students learn about climate change itself, how it affects agriculture as well as how agriculture contributes to it. Students will also acquire knowledge and skill as to how the agriculture sector can mitigate and adapt to a changing climate. Some of the ways in which the sector can become more sustainable is also explored. Finally, the guide presents several different examples of activities that could be used to engage students in learning about these different themes.

The document is focused on developing educational materials for students and lecturers of the Seychelles Tourism Academy. The elements of this curriculum have been tailored to meet the specific needs of the academy and that of the tourism industry in general. I hope that much can be drawn from it.

Acknowledgements

I wish to thank the NGO Sustainability for Seychelles (S4S), the Ministry of Education and all lectures who contributed in one way or another to make the guide a success.

Produced by Sustainability for Seychelles

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SECTION 1:
WHAT IS CLIMATE CHANGE?

The average pattern of weather, called climate, usually stays pretty much the same for centuries if it is left to itself. Climate patterns play a fundamental role in shaping natural ecosystems, and the human economies and cultures that depend on them. But the climate we've come to expect is not what it used to be, because our climate is rapidly changing with disruptive impacts and that change is progressing faster than any seen in the last 2,000 years.

Scientists have pieced together a picture of Earth's climate, dating back hundreds of thousands of years. The historical record shows that the climate system varies naturally over a wide range of time scales. So, Climate change itself is not new.

Annually, more than 60 percent of global industrial carbon dioxide emissions originate from industrialized countries.

In terms of historical emissions, industrialized countries account for roughly 80% of the carbon dioxide build up in the atmosphere to date.

The Earth is some 4.5 billion years old and during those years there have been significant changes in climate. The causes of these changes were decidedly natural and not caused by humans since the influence of early people was very small at that stage. In general, climate changes prior to the Industrial Revolution in the 1700s can be explained by natural causes, such as changes in solar energy, volcanic eruptions, and natural changes in greenhouse gas (GHG) concentrations.

Photo: Volcanic eruption
Source: http://desktop.freewallpaper4.me

Photo: Sand storm
source: http://images1 wikia.nocookie.net

Anthropogenic climate change and global warming

Recent climate changes, however, cannot be explained by natural causes alone. Research indicates that natural causes are very unlikely to explain most observed warming, especially warming since the mid-20th century. Rather, human activities can very likely explain most of that warming. In other words, up until the last century, humans have been accelerating the rate at which the Earth's climate changes and this is known as **anthropogenic climate change.**

Anthropogenic climate change is caused by the release of extra greenhouse gases by humans at rates with which the Earth's atmosphere cannot keep up. As a result, these greenhouse gases built up in the Earth's atmosphere, and act as insulation around the earth's atmosphere.

In this way, the gases prevent much of the Earth's heat from escaping, leading to a gradual increase in the Earth's temperatures. This is called the **enhanced greenhouse effect,** more commonly referred to as **global warming.**

Photo: Deforestation
source: www.blog-solutions-stores.ca

Photo: Processing factory
source: http://media-1.web.britannica.com

Photo: Vehicle exhaust fumes
source: autoextract.co.uk

Why do we use the term 'enhanced' when talking of the greenhouse effect?

This is because greenhouse gases are also released naturally through the eruption of volcanoes or the decomposition of vegetation matters. This natural greenhouse effect has been beneficial, allowing temperatures to remain high enough for the Earth's current life forms to develop.

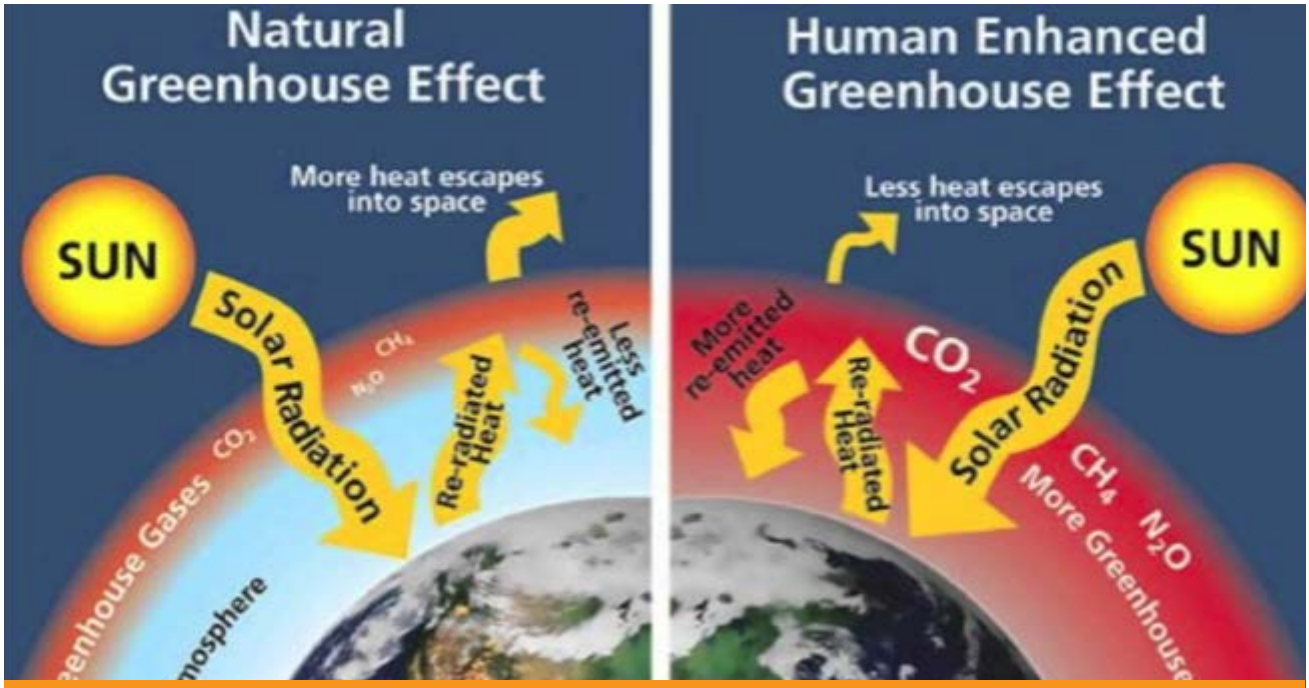


Diagram: The Natural and Enhanced Greenhouse Effect

As a result of the increasing concentration of these gases, more longwave radiation from the Earth is absorbed, thus reducing the energy lost to space and so altering the natural balance between incoming and outgoing radiation. Continued use of carbon-based fuels will further increase the atmospheric concentrations of carbon dioxide and other greenhouse gases.

Rising levels of carbon dioxide and other greenhouse gases in the atmosphere have warmed the Earth and are causing wide-ranging impacts, including rising sea levels; melting snow and ice; more extreme heat events, fires and drought; and more extreme storms, rainfall and floods. These are what constitute a changing climate!!

Scientists project that these trends will continue and in some cases accelerate, posing significant risks to human health, our forests, agriculture, freshwater supplies, coastlines, and other natural resources that are vital to state economy, the environment, and our quality of life.

Since the start of the industrial revolution vast quantities of carbon dioxide and other so-called greenhouse gases have been released into the atmosphere by the burning of fossil fuels, most notably coal and oil, and to a lesser extent, gas. This has led to an increase in the atmospheric concentration of carbon dioxide from 280ppm (parts per million) to its present level of 355ppm. Carbon Dioxide is one of the main greenhouse gases, along with water vapour and methane.

Effects of climate change

Some effects of the warming planet are already being felt, and further consequences are on their way. These changes will vary from region to region, but general trends include:

- changing precipitation patterns and heavier downpours, even in areas where overall precipitation will decline;
- longer, hotter, and more frequent heat waves;
- rising sea levels due to melting glaciers and land-based ice sheets;
- loss of both sea ice and protective snowpack in coastal areas;
- stressed water sources due to drought and decreased alpine snowfall;
- "positive feedback loops"—consequences of warming that cause further warming, such as melting sea ice decreasing the capacity of the northern oceans to reflect solar radiation back out of the atmosphere.

Whilst we have no control over the natural causes of climate change, we have direct influence over the human causes of climate change.

Greenhouse gases are produced by human activity, including:

- burning fossil fuels
- using energy generated by burning fossil fuels
- some aspects of farming, such as raising cattle and sheep, using fertilisers and growing some crops
- clearing land, including logging
- breakdown of food and plant wastes and sewerage
- some industrial processes

The main greenhouse gases generated by human activity are carbon dioxide, methane and nitrous oxide and some manufactured gases such as chlorofluorocarbons (CFCs), halocarbons and some of their replacements. Water vapour is also a powerful greenhouse gas but the amount in the atmosphere is not directly linked to human activity.

TOO MUCH OF THE GREENHOUSE GASES CAUSE THE EARTH'S TEMPERATURES TO RISE FURTHER TO LEVELS THAT MAY BE POTENTIALLY DANGEROUS FOR EARTH'S LIFE FORMS.

Almost 100% of the observed temperature increase over the last 50 years has been due to the increase in the atmosphere of greenhouse gas concentrations like water vapour, carbon dioxide (CO2), methane and ozone. The drastic increase in the emission of CO2 (carbon dioxide) within the last 30 years caused by burning fossil fuels has been identified as the major reason for the change of temperature in the atmosphere.

Reducing Climate change and the Carbon Footprint

More than 80% of the world-wide energy demand is currently supplied by the fossil fuels coal, oil or gas. 72% of the totally emitted greenhouse gases is carbon dioxide (CO2). When you drive a car, the engine burns fuel which creates a certain amount of CO2, depending on its fuel consumption and the driving distance. When you buy food and goods, the production of the food and goods also emitted some quantities of CO2.

Climate change concerns all of us. Scientists believe that the rate at which the Earth's climate is changing can be slowed down, if each of us can make an effort to reduce the amount of carbon dioxide gas we directly and indirectly release into the atmosphere.

Your carbon footprint is the sum of all emissions of CO2 (carbon dioxide), which are induced by your activities in a given time frame. Usually a carbon footprint is calculated for the time period of a year.

Basically, a carbon footprint is a measure of the impact that human activities have on the environment in terms of the amount of greenhouse gases (GHG) produced, measured in units of CO2.

What goes into calculating the carbon footprint? Required data typically includes: on-site energy use of oil and gas, vehicles usage, electricity usage, how much recycling you do etc.

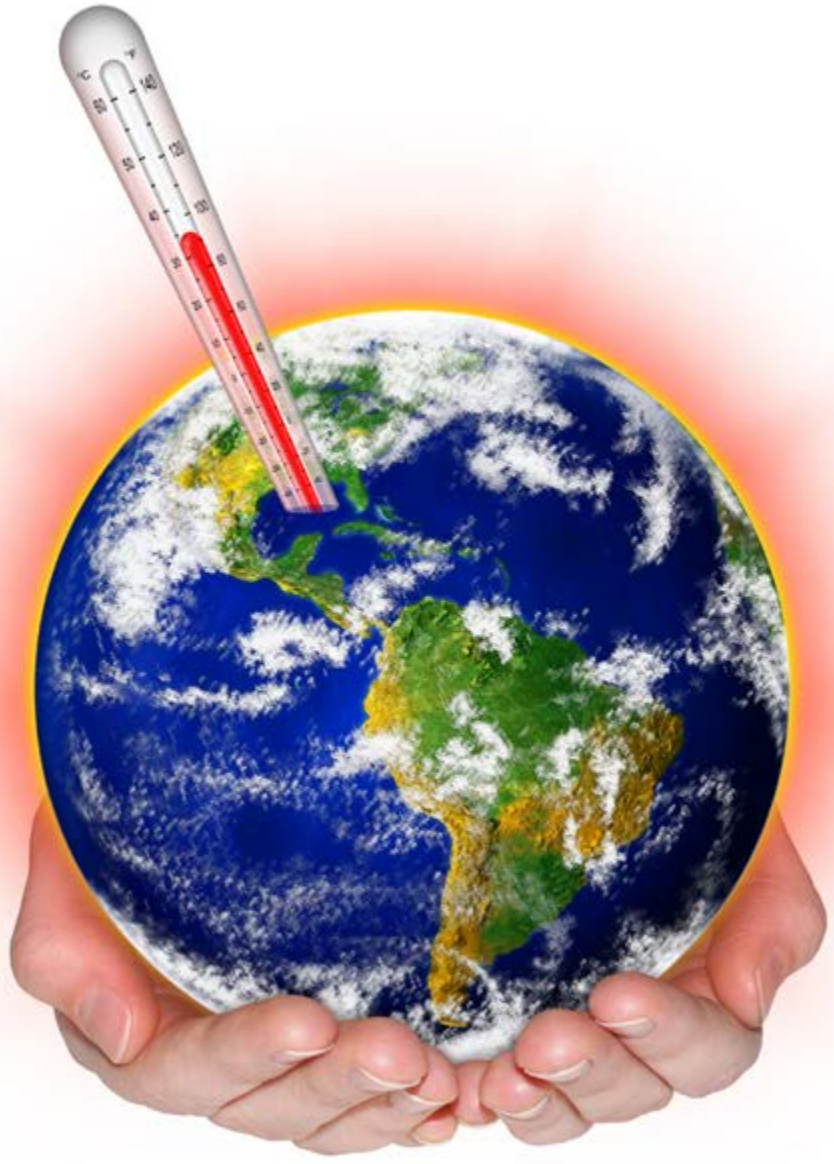
Sustainable living……..

Climate change concerns all of us. The rate at which the Earth's climate is changing is alarming, and according to climate scientists, if it does not slow down, every human being's future will be jeopardised.

Sustainable living rests on the fact that each and every individual can engage in reducing the amount of GHG-emitting activities that they are involved in, in order to prolong the life of planet Earth, so that in the end, future generations can have a planet to call home.

SUMMARY

- Our climate is rapidly changing with disruptive impacts, but Climate change itself is not new.
- Climate changes prior to the Industrial Revolution in the 1700s can be explained by natural causes, however, up until the last century, humans have been accelerating the rate at which the Earth's climate is changing.
- The release of extra greenhouse gases by humans act as insulation and trap heat near the Earth's surface, causing temperatures to rise: Global warming.
- Some effects of the warming planet are already being felt. They constitute a changing climate and include changing precipitation patterns and heavier downpours, even in areas where overall precipitation will decline; longer, hotter, and more frequent heat waves; rising sea levels due to melting glaciers and land-based ice sheets, etc.
- Your carbon footprint is the sum of all emissions of CO2 (carbon dioxide), which are induced by your activities in a given time frame.
- Mitigating and adapting to climate change relies on each individual person adopting a more sustainable way of living.



SECTION 2:

THE IMPACTS OF TOURISM ON CLIMATE CHANGE

1. INTRODUCTION

For the human population, never before in our history, have a majority of us been so well off. Never before have humans had the ability to travel from continent to continent with relative ease. This has happened not only due to the increased prosperity of most of the human race but also the rate of invention that has ripped through our world.

International tourism is one of the most important and rapidly growing service industries in the world. Holidays have become an essential part of our lives in the latter stages of the twentieth century. They account for one of our most costly items of expenditure.

source: http://blog.websitetemplates.bz

2. AIR AND SEA TRAVEL AND THEIR CONTRIBUTION TO THE PROBLEM

Tourism is increasingly being identified globally and locally as an energy (and emissions) intensive activity. It involves transportation (both air and surface) that inevitably burns a lot of fossil fuels. Tourism, as other sectors too, contributes to global emissions. With large groups of people being able to travel regularly, the earth is facing an issue of humongous proportions.

Source: planespotters.net

source: http://seebtm.com

3. WESTERN DIETS FOR WESTERN MARKETS, AND GHG EMMISSIONS.

The people who travel bring with them their dietary preferences and customs to the countries they visit. Most of the travellers belong to the first world countries and are brought up on a staple diet of beef, chicken and other non vegetarian foods. These foods are not the staple diet in many third world countries. To encourage visitors from the western world, these previously vegetarian countries have slowly started offering non vegetarian dishes in hotels and restaurants mainly to please their foreign visitors. Livestock farming has gotten out of control and contributes a large percentage of green house gas emissions.

4. THE GARBAGE GENERATED AND THE EMISSION OF METHANE GAS

Tourists to all parts of the world contribute significantly in the garbage of that country. Most of this garbage is non recyclable and a large portion of this is electronic and plastic items. Landfills are the largest anthropogenic emitters of the greenhouse gas (GHG) methane (CH4), a very potent GHG.

5. MORE HOTELS, LESS CARBON SINKS

Forests, through the biological process of photosynthesis, acts as the fundamental control over the level of carbon dioxide in the atmosphere. The potential of the biosphere to absorb carbon dioxide is an important factor in considering climate change. When forests are cut down, not only does carbon absorption cease, but also the carbon stored in the trees is released into the atmosphere as CO2 if the wood is burned or even if it is left to rot after the deforestation process.

Tourism is a significant contributor to climate change through the greenhouse gas emissions produced by transporting and accommodating tourists and the services and products that are provided to support tourism in a destination.

source: http://www.geo.fr

source: http://withfriendship.com

6. The pitfall of luxury

According to Macao's Statistics and Census Service, the commerce, the restaurant and hotel sectors consume 16,995 thousand litres of gas oil & diesel, 4,794 thousand litres of fuel oil, 12,640 tonnes of liquefied petroleum gas (LPG) and 526 million kWh of electricity. The energy used in Macao is mostly derived from fossil fuels such as petroleum and natural gas, etc.

The process of converting fossil fuels into energy contributes greatly to climate change because when using coal to produce electricity (fuel oil, gas oil and diesel are used to produce electricity) it generates greenhouse gases that eventually lead to global warming.

SECTION 3:

CLIMATE CHANGE AND ITS IMPACT ON TOURISM

Tourism not only contributes to climate change, but is affected by it as well. Climate change is likely to increase the severity and frequency of storms and severe weather events, which can have disastrous effects on tourism in the affected regions. Climate change will have a significant impact on global tourism. Climate defines the length and quality of the tourism season, and it plays a major role in the choice of destination and tourist spending. In many destinations, tourism is closely linked with the natural environment.

Climate affects a wide range of the environmental resources that are critical attractions for tourism, such as wildlife productivity and biodiversity, water levels and quality. Climate also has an important influence on environmental conditions than can deter tourists, including infectious disease, bushfires, insect and water-borne pests and extreme weather events such as tropical cyclones.

Internationally, Seychelles is perceived as a clean, green destination. The natural environment is a key element of our global tourism appeal, and part of what differentiates Seychelles from competing destinations. Seychelles is considered to be exceptionally vulnerable to the adverse impacts of climate change. Physical impacts of climate change for Seychelles, all of which have direct tourism impacts, include:

1. increase in extreme weather events
2. droughts
3. marine and terrestrial biodiversity loss
4. sea level rise
5. increase in disease outbreaks.

Indirect impacts of climate change on Seychelles tourism include:

1. Increasing costs of travel both to and within Seychelles from governments around the world implementing policies to reduce emissions, such as carbon taxes and emissions trading schemes
2. Increasing operational costs for tourism businesses resulting from government regulation to reduce carbon emissions in Seychelles;
3. Increasing consumer concern about the vast distance required to travel to Seychelles as a result of powerful lobbying against aviation, which may lead to a decrease in visitors number to Seychelles over time.

1. CONCERN ABOUT LONG HAUL TRAVEL

Consumers are increasingly concerned about the environment and climate change and the impact of their daily activities on this growing problem. In particular, concern has been raised over the emissions produced by air travel, and what travellers can do to reduce the negative impact this has on climate change.

With a heightened awareness of environmental issues, consumers who travel to Seychelles will be more likely to choose a tour operator or accommodation provider who is actively trying to reduce their impact on the environment. Travel intermediaries around the globe have started to respond to the increasing awareness and demands of the consumer for environmentally positive travel options.

2. EXTREME WEATHER EVENTS

Extreme weather events will impose costs on the tourism industry. This is in part due to tourism's dependence on natural assets and the built environment, both of which are vulnerable to the physical impacts of climate change. However, the impacts of these costs will also flow through in the form of financial risks with rising insurance premiums, changes to business financing and the need for business to manage the potential risks of climate change.

3. MARINE AND TERRESTRIAL BIODIVERSITY LOSS

Climate change alone threatens the existence of approximately one quarter or more of all species on land by the year 2050, surpassing even habitat loss as the biggest threat to life on land. Species in the oceans and in fresh water are also at great risk from climate change, especially those that live in ecosystems like coral reefs that are highly sensitive to warming temperatures.

Climate change is a threat because species have evolved to live within certain temperature ranges, and when these are exceeded and a species cannot adapt to the new temperatures, or when the other species it depends on to live cannot adapt, for example its food supply, its survival is threatened. Seychelles is advertised as a snorkelling destination. However, being so sensitive to temperature changes, climate change will and does have an impact on the coral reefs of the islands.

FOCUS: THE LOSS OF OUR CORAL REEFS...

Coral reefs have a vital role to play in the environment. Not only do they support a treasure trove of biodiversity, but they also play a very important role on the conservation and protection of our shorelines.

A healthy reef ecosystem literally buzzes with sounds, activity and colours and is populated by incredibly dense aggregations of fish and invertebrates. Unfortunately, very few remaining coral reefs resemble this pristine condition; on most of them, corals and fishes are much less abundant than they were only a few decades ago.

source: http://images.sciencedaily.com

source: http://www.greeniacs.com

source: http://plaza.ufl.edu

source: http://notexactlyrocketscience.files.wordpress.com

Colourful, vibrant,vivacious,bubbly, cheerful.....full of life!

Dead coral reefs...

source: http://www.photolib.noaa.gov

Depressing, void, ugly, disheartening, gloomy……empty.

There are many causes of local and global coral loss but human-induced climate change is one of the main and undeniable threats. Climate change is having negative ffects on coral populations via at least three mechanisms.

First, ocean warming is directly reducing coral cover through coral bleaching. Coral bleaching is caused by the

source: http://s3.amazonaws.com

loss of algal pigmentation. Any stressful environmental condition such as an increase in water temperature will cause corals to lose their pigmentation.

Second, the increase in ocean temperature can also indirectly kill corals by magnifying the effects of infectious diseases, which are one of the primary causes of coral loss.

The third and in many respects the greatest concern in the longer term, is that global change is causing the world's oceans to become more acidic. By burning immense amounts of fossil fuels, humans, are rapidly increasing the concentration of carbon dioxide (CO_2) in the atmosphere. A quarter of the CO_2 produced by the burning of fossil fuels enters the ocean and reacts with water to form carbonic acid, acidifying the ocean. With increased acidity, the limestone skeletons of the reef literally dissolve.

Harm to vulnerable ecosystems such as rainforests and coral reefs because of rising temperatures and less rainfall is also a major concern. A major risk to coral reefs is bleaching, which occurs when coral is stressed by temperature increases, high or low levels of salinity, lower water quality, and an increase in suspended sediments.

These conditions cause the zooxanthallae (the single-celled algae which forms the colours within the coral) to leave the coral. Without the algae, the coral appears white, or "bleached" - and rapidly dies. The Great Barrier Reef, which supports a US$ 640 million tourism industry, has been experiencing coral bleaching events for the last 20 years.

4. SEA LEVEL RISE

The two major causes of global sea level rise are thermal expansion of the oceans (water expands as it warms) and the loss of land-based ice due to increased melting. Global sea level is projected to rise during the 21st century at a greater rate than during 1961 to 2003. Thermal expansion is projected to contribute more than half of the average rise, but land ice will lose mass increasingly rapidly as the century progresses.

Rising sea levels can lead to the inundation of low lying coastal areas, and the tourist industries found along them. In the tropics, it is popular to find tourist establishments near the coast, as most destinations in this part of the world are beach destinations.

source: http://www.vanuatuweather.com

Rising sea levels and tourism….a case study of the Maldives. Known for its white sand beaches and extensive coral reefs, the Republic of Maldives, in the Indian Ocean, consists of 1,190 islands and draws over 600,000 tourists annually. The combined land mass of all the island is 115 square miles.

Climate change and rising sea levels are of great concern to the Maldives, which is only 8 feet above sea level at its highest point. As global warming causes the polar ice caps to melt and sea levels to rise, the Maldives' entire existence is in jeopardy.

Every year, hundreds of thousands of tourists flock to the Maldives' beautiful resorts and beaches. Tourism accounts for 28 percent of the country's GDP and for more than 60 percent of the Maldives' foreign exchange. The vast majority of government revenue (approximately 90 percent) comes from import duties and tourism-related taxes.

SUMMARY:

- Population: 294,000
- Capital: Male
- Area: 298 Km2
- Language: Maldivian Dhivehi, English
- Currency: Rufiyaa
- Life Expectancy: 67
- GDP per Capita: US$ 3900
- Literacy: 97%

As the flattest country on Earth, the Republic of Maldives is extremely vulnerable to rising sea level and faces the very real possibility that the majority of its land area will be underwater by the end of this century. With no ground surface higher than 9.9 feet (3 meters), and 80 percent of the land area lying below 3.3 feet (1 meter) above average sea level, the Maldives is the flattest country on Earth. Since the 1950s, sea level in and around the Maldives has been rising at a rate of 0.03–0.06 inches (0.8–1.6 millimetres) per year.

Rising sea levels threaten the country's tourism-dependent economy and the very existence of the country. With rising sea levels, most, if not all of the **tourist establishments** may be **flooded**. In addition, the ocean threatens the habitat of every human, plant, and land animal in the country. Humans could be easily relocated to other neighbouring countries, but preventing **bio-diversity and species loss** would be difficult.

5. CHANGE IN DEMAND FOR SUNNY DESTINATIONS

Seychelles boasts of a sunny, tropical climate. It serves as the ideal getaway for many Europeans and Americans. However, recent surveys have shown that, these tourists prefer an optimal range of temperature, ranging from 27-32 degrees c. With the onset of global warming, and the consequent rise in temperatures, some tourists may find that beach destinations such as the Seychelles, are essentially too hot. On the other side of the coin, global warming might imply warmer winter temperatures in most northern countries, so the need for a winter get-away will decline. This might spell economic disaster for countries whose economy relies heavily on tourism. http://www.unwto.org/pdf/pr071046.pdf

SECTION 4:
MITIGATION AND ADAPTATION

Climate change management actions are often described in terms of adaptation and mitigation. Adaptation to climate change consists of initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Climate change adaptations are those strategies that can be implemented to build resilience and resistance in systems, whether they are environmental, social, economical or business systems.

Mitigation of climate change involves taking actions to reduce greenhouse gas emissions and to enhance sinks aimed at reducing the extent of global warming. Energy and other resource efficiencies, along with long-term changing patterns of tourist behaviour fit within this category. While linked mitigation is distinct from adaptation to climate change which involves taking action to minimise the effects of climate change.

Adaptation is seen as a more immediate, necessary short term action, while mitigation mechanisms involve the development and deployment of new technologies, fuels and the like. Both are clearly linked – and may act for or against each other. For example, increased use of air conditioning may be an adaptation, but their use of energy (arising from fossil fuels) will act against mitigation.

Adaptation strategies can be effective at varying time scales, from the immediate to medium, from medium to long-term planning horizons. Furthermore, adaptation strategies are not necessarily costly to businesses, communities, the environment or people and may in fact yield substantial economic and non-economic benefits.

There is an urgent need for the tourism industry to adapt to the global climate change, as tourism is sensitive to climate conditions. However, adaptation activities have to be carefully planned and assessed as they require a multidimensional approach.

ADAPTATING AND MITIGATING CLIMATE CHANGE IN THE TOURISM SECTOR.

1. ECO-TOURISM

Ecotourism is a form of tourism involving visiting fragile, pristine, and relatively undisturbed natural areas, intended as a low-impact and often small scale alternative to standard commercial (mass) tourism. Ecotourism is good at promoting local cultures and enhance the livelihoods of indigenous people as well as visitors' experience. Ecotourism development strives to protect and conserve natural resources on which it largely depends.

ECOTOURISM AND THE PROTECTION OF FORESTS AS CARBON SINKS

The promotion of ecotourism is a very effective way of mitigating climate change. Specifically, ecotourism contributes to protection of forest, which is important for climate stabilization. It is a form of nature-based tourism that aims to conserve natural environment.

ECOTOURISM AND THE REDUCTION OF GREENHOUSE GAS EMISSIONS

In addition, Ecotourism calls for the tourism industry to reduce CO2 emission by using local resources where it is appropriate, saving energy and recycling. Regarding this point, ecotourism would be a good solution for climate change. By its nature, eco-tourists may like to walk along a trail rather than riding vehicles on a paved road. They may stay in a simple accommodation or even with open windows and not in a room using air-con. Many ecotourism sites use solar power rather than diesel engine.

source: http://travelfoodguru.files.wordpress.com

source: http://kayakutila.files.wordpress.com

2. EDUCATION

Visitors coming into Seychelles on an Air Seychelles flight have since August 2010, been able to see how they can contribute towards preserving the country's environment. This has come through the screening by Air Seychelles of an eco tourism video entitled Footprints on all its incoming flights.

In so doing, the airline, in collaboration with local NGO, S4S, is also helping to raise awareness about the impact of tourism on our country's environment and, on its vulnerability to climate change. In addition, the video is imparting to visitors, practical tips on how to reduce their personal impact (carbon footprint) on Seychelles' environment. As such tourists are made more aware of their actions and are encouraged to engage in tourism activities in Seychelles that are more responsible and sustainable.

3. ENVIRONMENTALLY-FRIENDLY AEROPLANES WHERE LONG HAUL CANNOT BE AVOIDED.

A green airplane or environmentally friendly airplane is any type of aircraft, whether commercial or private, which has less negative effect on the environment than the current basic passenger and cargo jets that have gone several decades without major changes in design or efficiency. The term is used to describe any aircraft that has taken the expensive gamble of redesigning the aerodynamic features of the plane as well as increasing engine efficiency to decrease fuel consumption and environmental impact.

Globally, the world's 16,000 commercial jet aircraft generate more than 600 million tons of carbon dioxide per year. Commercial aircraft is second only to highway vehicles as consumers of motor fuels. At its' current rate of use the airline industry contribute over 3% to the world's greenhouse gas pollution.

Green airplanes can have one or several improvements which can limit their negative ecological effect. Improvements may include:

1. fixing plane design to decrease drag

The use of skinner wings and smaller tails helps reduce the drag and amount of fuel needed. Winglets are a vertical extension of the wing tips. Their intended effect is always to reduce the aircraft's drag by altering the airflow near the wingtips. This painless modification to the end of each wing converts some of the other-wise wasted energy from a process known as wingtip vortex, and turns it into a thrust.

2. Using bio fuels

These fuels are produced from living organisms and are considered more sustainable than the fossil fuels.

3. Improving the routes flown

Using more direct routes will improve on emissions by cutting down on unnecessary fuel use. In addition, flying at full passenger capacity may also help. Planes that do not fly at full passenger capacity can be considered more environmentally unsustainable since carbon dioxide emissions increase per passenger.

4. Using lighter materials to build the planes

Carbon fibre is a very light building material and is being used instead of aluminium. Making wings out of carbon fibre decreases fuel consumption up to 20%. The carbon fibre is both lighter and more durable and can make for enormous fuel efficiencies. Heavy structures and big planes mean planes have to carry a lot of fuel. The additional fuel needed contributes to an even heavier plane and more fuel consumption39. Reducing the weight of the structure of the plane will require less fuel.

BARRIERS TO ADAPTATION

- Limited understanding of climate risks and vulnerabilities
- Lack of supportive policies, standards, regulations, and design guidance
- Existing legal or regulatory restrictions
- Lack of availability or restricted access to appropriate technologies
- Costs of identified adaptation options when budgets are limited
- Lack of availability of resources such as in-house expertise
- Social/cultural/financial rigidity and conflicts
- Short-term nature of planning horizons – necessity of realising return on investment
- Level of uncertainty

SECTION 5:
SUSTAINABILITY IN ACTION

Sustainable hotels

Environmental sustainability is the ability to maintain rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely.

Sustainable tourism is tourism attempting to make as low impact on the environment and local culture as possible, while helping to generate future employment for local people. The aim of sustainable tourism is to ensure that development brings a positive experience for local people, tourism companies and the tourists themselves. Sustainable tourism is not the same as ecotourism.

Sustainable tourists can reduce the impact of tourism in many ways:

ADAPTATING AND MITIGATING CLIMATE CHANGE IN THE TOURISM SECTOR.

- informing themselves of the culture, politics, and economy of the communities visited
- anticipating and respecting local cultures, expectations and assumptions
- contributing to intercultural understanding and tolerance
- supporting the integrity of local cultures by favoring businesses which conserve cultural heritage and traditional values
- supporting local economies by purchasing local goods and participating with small, local businesses
- conserving resources by seeking out businesses that are environmentally conscious, and by using the least possible amount of non-renewable resources

Increasingly, destinations and tourism operations are endorsing and following “responsible tourism” as a pathway towards sustainable tourism. Responsible tourism and sustainable tourism have an identical goal, that of sustainable development. The pillars of responsible tourism are therefore the same as those of sustainable tourism – environmental integrity, social justice and economic development.

The major difference between the two is that, in responsible tourism, individuals, organisations and businesses are asked to take responsibility for their actions and the impacts of their actions. The emphasis on responsibility in responsible tourism means that everyone involved in tourism are responsible for achieving the goals of responsible tourism.

SUSTAINABLE TIPS FOR RESORTS

1. WATER EFFICIENCY

Resort, hotels and restaurants produce large quantities of grey water (discharge from washing machine, baths) and black water (from kitchen dishwashing and toilets).

- Minimize your wastewater discharge by reducing water use.
- Use biodegradable detergents and cleaning agents.
- Reuse treated gray water for washing floors, flushing toilets and irrigating gardens and golf courses.
- Promote water-saving practices.
- Identify the main areas of water consumption in your hotel where significant water savings can be achieved.
- Work with employees to identify water-saving practices, such as not leaving water running, or properly using toilets, faucets and showerheads.
- Install water saving devices, such as low-flush toilets and low-flow shower heads and faucets.
- Continually check for and respond to leaking faucets and toilets
- Switch to drought resistant native plants in garden areas.
- Start a linen (both towels and sheets) reuse program in all guest rooms.
- To reduce water use, consider rainwater harvesting.

Rainwater harvesting is the accumulation and deposition of rainwater for reuse. Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. It provides water when there is a drought. Seychelles has an annual rainfall of 350cm, providing ample opportunity for individual households to harvest rainwater.

Rainwater harvesting systems can be installed with minimal skills. The system could be as basic and simple as an open barrel well placed where the rainwater drains off a roof. It's a good idea to keep your barrel covered when it's full to stop mosquitoes breeding in it.

If you have gutters along your roof and want to go a little more high-tech, you can connect your roof to a downpipe leading straight into a covered tank with a tap installed somewhere down near the bottom. More high-tech options include pumping rainwater up to a tank in the attic or somewhere else high enough to provide good water pressure. If you are still building your house, you could incorporate an underground cistern.

2. HOTELS ALSO GENERATE LARGE QUANTITIES OF SOLID WASTE. THIS RANGES FROM PACKAGING AND FOOD SCRAPS TO CLEANING AND MAINTENANCE MATERIALS, MANY OF WHICH CAN BE TOXIC.

- Separate waste at the source, rather than having to go through all the trash after it is collected.
- Provide containers for recyclables in guest rooms and staff areas as well as compost bins in kitchen work areas.
- Recycle or reuse paper, plastic and glass products in your daily operations.

3. IN MOST CASES, THE HIGH ENERGY DEMAND OF RESORTS IS DUE TO THE USE OF ENERGY INTENSIVE TECHNOLOGY TO PROVIDE MODERN COMFORTS AND CONVENIENCE.

- Develop an energy team and assign responsibilities to pursue energy efficiency in all departments.
- Ensure that team members from every department are trained in the importance of energy management and basic energy-saving practices.
- Turn off lights and turn down heating/air conditioning in unoccupied rooms or employee-only areas.
- Close/open drapes to reduce the need for air conditioning.
- Continually check for and power down unused hotel equipment (i.e., kitchen exhaust fans) that have been left running.
- Use occupancy sensors and/or timers for areas of your hotel that are less frequently used such as hallways, outdoor areas, or public bathrooms.
- If the hotel has a pool and/or hot tub, install a solar water heating system and use pool and hot tub covers when the pool area is closed.

FOCUS:

THE SEYCHELLES SUSTAINABLE TOURISM LABEL

The SSTL is a sustainable tourism management and certification programme designed specifically for use in Seychelles. It is voluntary, user-friendly, and designed to inspire more efficient and sustainable ways of doing business. The SSTL is presently applicable to hotels of all sizes.

As tourism in Seychelles depends on the natural environment and pristine marine life, the importance of sustainable practices is very high in order to maintain the natural beauty of Seychelles and the preservation of its biodiversity.

Certified resorts in Seychelles include:

- Banyan Tree Seychelles
- Berjaya Beau Vallon Bay Resort & Casino
- Constance Ephelia Resort
- Hanneman Holiday Residence
- Kempinski Seychelles Resort

The Davos declaration

LESSON ACTIVITIES

SECTION 1:
WHAT IS CLIMATE CHANGE.

ACTIVITY 1

List some of the activities that humans undertake that may contribute to climate change.

a)

b)

c)

d)

e)

f)

ACTIVITY 2

Based on your knowledge, design a poster to show the activity you think is the number one contributor to climate change.

ACTIVITY 3

List some of the ways things humans may engage in to reduce their carbon footprint.

a)

b)

c)

d)

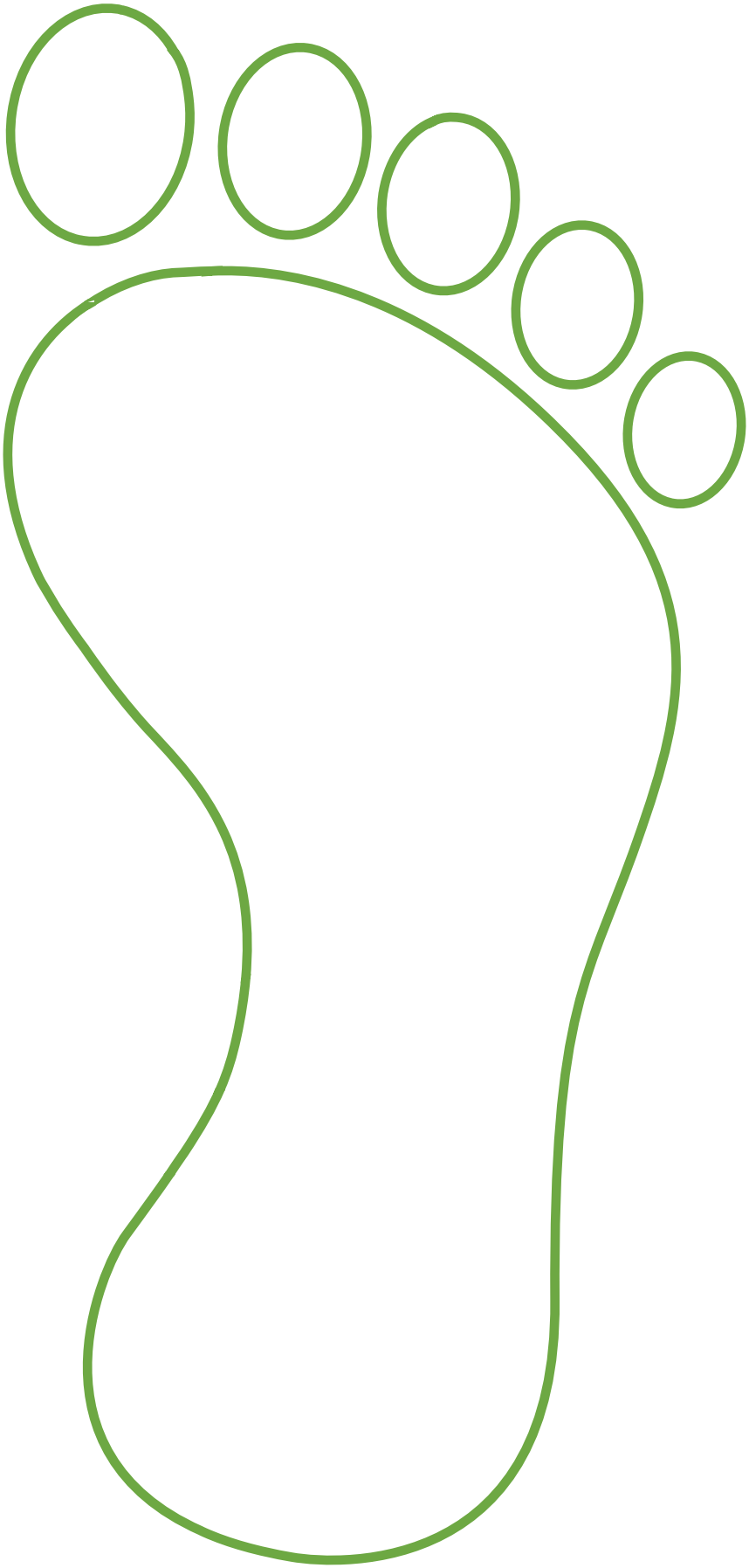
e)

f)

g)

ACTIVITY 4

Reflect closely on, and scrutinize your everyday activities. Which of these activities do you think are more climate unfriendly? Draw or write them down on the footprint provided. Brainstorm on possible ways of reducing your footprint.



ACTIVITY 5

Working in groups of 4, design and implement a small advert to educate your peers more on one chosen sustainable practice. For example, if you chose 'ride a bicycle to school' as an example, create an advert/promotion for the practice, putting emphasise on the activity's potential as a sustainable practice. The advert/promotion may be for TV/radio or newspaper

Present to your peers. Ideas:

- ✔ Ride a bicycle to school
- ✔ Ride the bus instead of taking your car
- ✔ Turn off electrical appliances when not in use
- ✔ Recycling and reusing
- ✔ Carry your own water bottle
- ✔ Buy locally produced goods

ACTIVITY 6 (PRINT)

Below is a climate-form that can be used to assess how climate-friendly your school is. Print off the form, and give to the students to complete as an activity.

1. Find 5 ways your school is contributing to climate change.
   (Remember that 3 of the biggest emitters include transportation, solid waste, and energy)

i.

ii.

iii.

iv.

v.

2. List the ways in which your school is helping to reduce the amount of carbon emitted from its premises.

1.

2.

3.

4.

5.

6.

3. Thinking of the same pollution issues as above, describe what could be done better.

4. Design a poster to educate others on the school premises on a more sustainable way of doing things.

ACTIVITY 7 (PRINT)

Footprint calculator: Assign points to each of the following activities. Be honest!!
Add up your score to see how climate friendly you are as an individual.

SCORING:

0 points- *Never do this*

1 point- *Sometimes do this*

3 points- *Usually do this*

5 points - *Always do this*

I recycle _
I take short showers _
I turn off lights/appliances when not in use_
I have and encourage the use of florescent light bulbs_
I have fruit trees/vegetable patches at home that I use_
I buy locally produced foods/items_
I carry my own water bottle_
I carry reusable lunchboxes_

SCORE:

0-10 you can do a lot more to help our planet

11-22 you've taken a few steps but you have some ways to go

23-35 you've got the idea but need to do just a little more

35-40 you are excellent, and an inspiration to others!!

ACTIVITY 8

Some people are still very sceptical about climate change. Research some of their most commonly used arguments and list them below.

i.

ii.

iii.

iv.

v.

vi.

ACTIVITY 9

Below is a worksheet that can be used on a field trip to a tourist establishment. It is composed of prepared questions and activities that will help students realise the impact that visitors to our islands have on climate change. In addition the activities will also help students appreciate the effort that many establishments are putting into being climate friendly.

1. Name of resort:

2. Number of rooms:

3. Number of visitors per annum:

4. Occupancy rate:

5. Where do most of the visitors come from?

   Europe:

   Asia:

   Africa:

   Regional (Indian Ocean):

6. Which activities do visitors engage in?

Activity	Tick if relevant
Stay in their room all day.	
Hang at the pool and bar	
Go snorkelling	
Go to town	
Go hiking	
Go to the beach only	
Order local dishes and beverages	

7. Does the establishment organise any climate-friendly orientated activity for its guests? Describe briefly.

8. Does the resort promote climate-friendly education/awareness for the guests on its premises? If yes, explain briefly what is being done. If the establishment is not promoting climate-friendly practices Suggest how it could do this.

ACTIVITY 10

List some of the effects of climate change.

i.

ii.

iii.

iv.

ACTIVITY 11

Flooding is a direct consequence of sea level rise. Briefly describe how this phenomenon may have an adverse impact on the coastal resorts of the Seychelles. Think about the actual flooding event and its direct consequences (loss of buildings and other infrastructure, loss of beaches) and some of the more indirect consequences

ACTIVITY 12

Choose one direct effect of climate change that may impact on the tourism sector. Using the internet, and other sources, produce a small case study of the likely (or actual) impact that your chosen effect will have/is having on a tropical destination of your choice (except the Maldives).

Suggested destinations: La Reunion, Mauritius, Madagasgar, Jamaica, Haiti, the Bahamas, the Seychelles etc

ACTIVITY 13

Define the terms mitigation and adaptation.

ACTIVITY 14

List examples of mitigative actions taken by resorts in Seychelles to help combat cliate change.

ACTIVITY 15

Work in groups and design a small poem/song/play to show how the tourism sector can help mitigate climate change.

ACTIVITY 16

List examples of mitigative actions taken by resorts in Seychelles to help combat cliate change.

a) Their water usage.

b) Their power usage

ACTIVITY 17

Choose a hotel near your school. Rate the activities listed on a scale of 1 to 5, 1 representing poor performance and 5 excellent performance.

Activity	**Tick if relevant**
KITCHEN	
Uses gas instead of electricity to cook	
Uses CFC-free refrigerators	
Buys organic produce from local farmers	
Composts kitchen waste	
GUEST BEDROOM	
Uses energy-saving lights	
Promotes use of showers instead of baths	
Have slow flowing faucets and shower heads	
Sensored shower	
Keycard operated lighting and air conditioning system	
Central preset air conditioning system	
OUTSIDE	
Uses native plants for the garden	
Uses solar powered lights to illuminate walkways	
Have their own sewage system	
Practices water harvesting	
Plants vegetation on the beach to minise erosion	
STAFF	
Reuses paper and envelopes	
Switches off lights, airconditioning, computers, printers, etc when not in use	
ECOTOURISM	
Encourage guests to go snorkelling/scuba diving	
Actively promotes hikes to natural areas	
Supports a local community project	
TOTAL	

Look at the total score of the sustainability audit. A good rating lies between 90 and 100 and indicates serious effort to be sustainable. A rating of 50-90 indicates conscious effort to be sustainable, but clearly there is room for improvement. A rating of less than 50 is not a very good one.

If you were to have a resort that scored less than 50, what would you suggest to them so that they can improve their rating? Write a letter, which should include the following:

Reasons why resorts should be sustainable.

A description of 2 or 3 things they could do to improve their rating.

ACTIVITY 18

Make copies of the article at http://givrapd.org/wp-content/uploads/2013/09/Seychelles_Blog.pdf .

Divide the classroom into two groups: a Pro-Tourism group and a Pro-Climate Change group. Question to guide the debate: Should we stop all further tourist development? Allow 20 minutes for the group debate. Note down the points that come up on the balckboard.

At the end of the debate, have a discussion of how the two different points fo views can strike a balance, so that the Seychelles Tourism sector can become more sustainable. Make a list. Divide the class into groups of 5 and Ask the students to develop the list into a poster.

ACTIVITY 19

Invite a guest speaker from the STB to talk about the Sustainble Tourism Label. Ask students to prepare questions for the guest speaker.

ACTIVITY 20

Visit a large hotel and go around to see how water is being used at the hotel. List those usages. Think about the possible ways in which these usage are wasting water. Design a Guideline for Best Practices for the hotel.

Work-attachment project (Make sure you have the permission of the hotel before you conduct this activity on your work attachment.)

How green is the tourist establishment you are working for? Use the table below to find out.

Point system (total 72)

Zero for doing nothing.

One point is allocated for a moderate amount of effort.

Two points for showing sisnificant effort significant effort .

Three points are for an outstanding level of effort.

0-34: not a very sustainable establishment.

35-60: an eco-friendly hotel, but more work is needed.

61-72: excellent!!!

Insert Table http://www.seychelles.travel/sstl/images/Manuals/operators%20manual.pdf Page 8

LIST OF USEFUL RESOURCES

Learning for sustainable living in Seychelles

a) www.eoearth.org/view/article/150926 carbon footprint

b) www.globalstewards.org/hotel.htm sustainable practices for resorts

c) www.s4seychelles.com sustainable practices in the tourism industry

d) www.tourism-climate.de/emissions.htm impacts of tourism on climate change, impacts of climate change on tourism

Foreign & Commonwealth Office

Sustainability for Seychelles (S4S) is a non-governmental environmnetal organisation (ENGO) based in the Seychelles, with the mission to promote sustainable. 'green' living in Seychelles, in collaboration with citizens, the Government, other NGOs and the private sector.

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