



Module 1: What is Sustainability?

Introduction

In this module, we will learn about sustainability. We will analyze how the basic life system works, explore the different time periods of the planet, and understand the advances man has made.

Human beings depend on the Earth to live. As we examine the relationship between the planet and its inhabitants, we will begin to understand how to change and improve our lives, taking care of the land so that it can sustain future generations.

Objectives

The teacher will learn the basic concepts related to sustainable development; will explain the interrelations and history behind the topic; will understand what the meaning and achievements are about sustainable development.

Themes

1. *The Earth*
2. *Mankind*
3. *The Current Situation*
4. *Consequences of Our Lifestyle*
5. *Climate Change*
6. *Sustainable Development*

1. *The Earth*

The Earth was formed 4.6 billion years ago. Humans appeared 3 million years ago, although it would be an additional 1 million years before they would look as we do today. Two indispensable things had to happen in order to yield the environmental conditions necessary for life: The Greenhouse Effect and the Carbon Cycle.

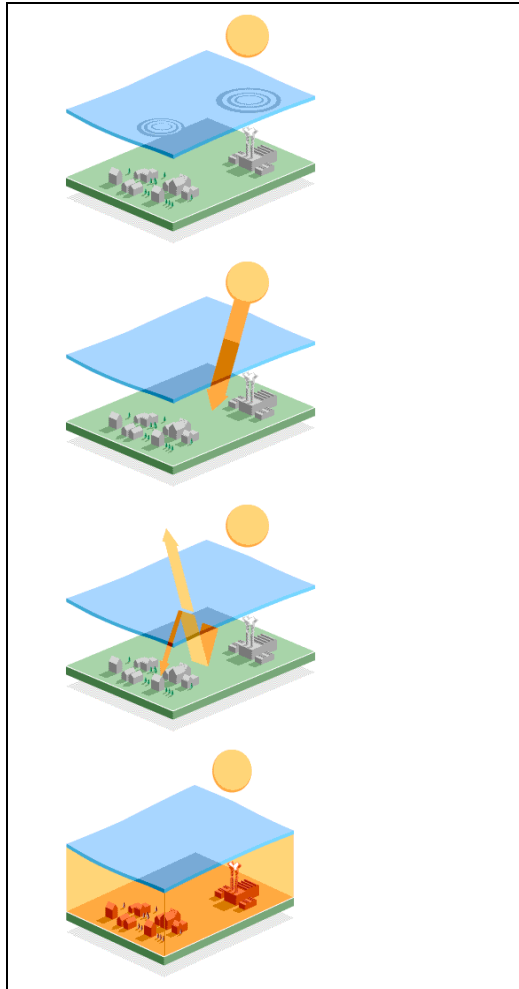
1.1 The Greenhouse Effect

The Earth has its own temperature control: the Greenhouse Effect. Approximately one third of the solar radiation that reaches Earth is reflected into space.

Most of the remaining radiation is absorbed by the Earth and the oceans: the surface of the Earth heats up and so the atmosphere heats up as well.

There are atmospheric gases that occur in their natural form as a vapor: carbon dioxide (CO₂), the ozone, methane, nitrous oxide, and others created by man, like chlorofluorocarbons that are found in refrigerants and aerosols. These prevent the departure of heat into space, thus creating the exact temperature that we need on Earth in order to live. However, human activities (principally industry, transportation, and energy) are forcing the levels of these Greenhouse Gases to increase in the

atmosphere: principally, the concentration level of CO₂, which acts as a greenhouse glass, prevents solar radiation heat from escaping to the exterior and provokes a rise in temperature.



The Greenhouse Effect:
http://www.bbc.co.uk/spanish/especiales/clima/ghouse_4.shtml

[TEXT BOX] “Imagine that the history of the Universe was compressed into only one year and that the Big Bang occurred in the first second of the first day of January. Using this scale, each month represents a little more than one billion years and all the history of humanity would occur in only a few seconds at the end of December 31st: The Earth would be forming until September 14, the first life would appear on September 25. The dinosaurs would appear on December 24th and the first humans wouldn’t appear until December 31st at 10:30 p.m. The Mayan Civilization would appear at 11:59:58 p.m. and the technological advances of the Industrial Age would begin at 11:59:59 p.m....” Carl Sagan’s Cosmic Calendar

1.2 The Carbon Cycle

Carbon dioxide (CO₂) is found in great quantities in the atmosphere and is cycled through plants during photosynthesis in order to create glucose molecules. Animals and human beings do the opposite of plants: they ingest glucose through the food chain, and release CO₂ as a product of respiration. Decomposition is an important part of the cycle that also releases CO₂ into the atmosphere when organic material decomposes, permitting the return of carbon through the food chain.

In the past, some animals and plants died and were buried in conditions

perfect for the creation of fossil fuels, and these take hundreds of thousands of years to form. When these fossil fuels are burned, the CO₂ is released again into the atmosphere, creating pollution. CO₂ dissolves in water, just as it is released into the atmosphere; the rest is converted to calcium carbonate which is trapped in shells and sedimentary rocks at the bottom of the oceans.

Also known as carbon, this gas is captured by ocean water in very cold temperatures and places close to the poles and is released from the water in warm, tropical zones.

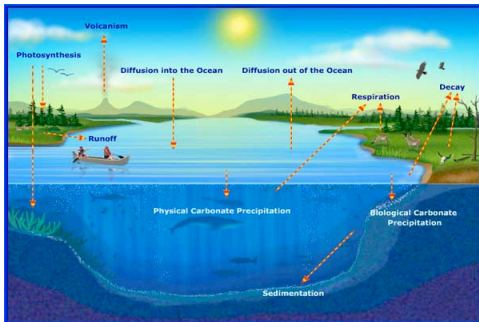


Image: Carbon Cycle Without Human Intervention.

http://www.seed.slb.com/en/scictr/watch/climate_change/carbon.htm

2. Mankind

The first people who populated the Earth collected fruits and nuts in order to feed themselves. In this way, they lived for 10,000 years, until they manufactured the first tools in order to hunt animals, which were incorporated into their food chain. Agriculture was also a big advancement for human beings;

thus, they could control the foods they ate and produce protein reserves. Since then, populations have been growing, and as the population has expanded over the Earth, more raw materials have been used for their survival.

Up until 200 years ago, the consumption of raw materials used by Man didn't pose a big threat: they utilized wood for burning, heating and using light at night; they ate what the agriculturalists/hunters provided for them; and they took shelter in man-made houses from materials they found in the vicinity of the population.

[TEXT BOX] We entered the 20th century with a population of 1.6 billion.

We entered the 21st century with a population of 6.1 trillion.

Until 2007, the world population was 6.6 billion.

It is expected that that population will rise to 9 billion before the year 2050.

--Population Reference Bureau, "World Population Highlights," Population Bulletin62, no. 3 (2007.)

Around the middle of the nineteenth century, the population began to grow immeasurably while many technological advances were being made in order to supply food and infrastructure to the population. The first industries appeared, the first

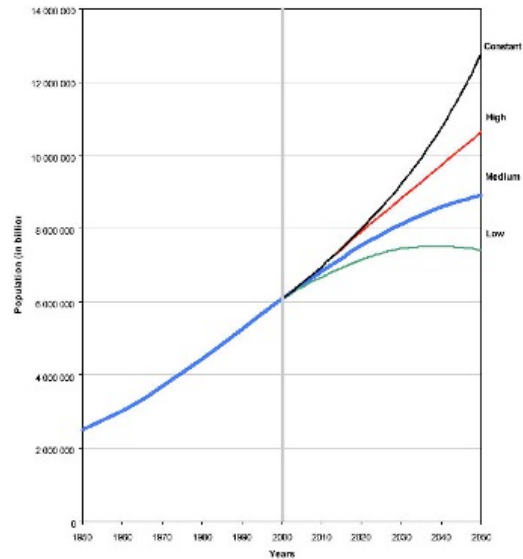
automobiles, and in the 20th century, we had already found ourselves submerged in the Industrial Era and in a totally different way of life.

3. The Present-Day Situation

Today we find ourselves facing a serious problem. The population has quadrupled in the last hundred years, an increase without precedence in the life of the planet, and we are consuming too many nonrenewable resources.

[TEXT BOX]: “Each day, Planet Earth loses 18668 square kilometers of the desert because of negligence and overpopulation. 40-100 species are lost, and nobody knows if it’s 40 or 100. Today the population will increase by 250 thousand people and they will add 2700 tons of chlorofluorocarbons to the atmosphere. Tonight, the Earth will be a little hotter, its waters will be a little more acidic, and the tissue of life will be a little more fragile....What purpose does education serve?” David Orr (1991).

In the last 100 years, we have consumed more raw materials than in all the history of the Earth. The planet has lost half the surface area of the forests due to irresponsible use of the land.



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2003). *World Population Prospects: The 2002 Revision, Highlights*. New York: United Nations.

Industrial practices contaminate water. Irresponsible agricultural practices have been using up land minerals, converting fertile land into desert zones. The consumption of energy is depleting natural resources like petroleum or carbon, fossil fuels that contaminate the air. We see that this is happening in many ways:

3.1 Energy

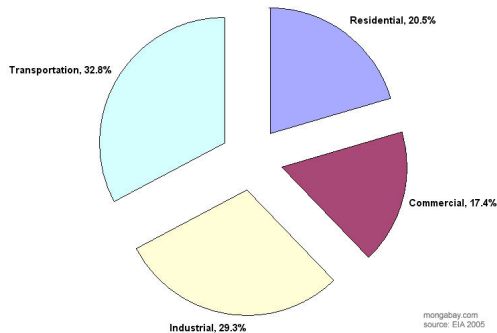
The consumption of energy is distributed throughout industry, infrastructure, and transportation. In Mexico’s case, the consumed energy is divided in the following manner:

- Industry consumes 30% of the total energy. It is utilized in processes that require steam to melt steel and to work on motors, machines, and ovens, among others.
- Buildings consume 23% of the total energy. It is utilized in

construction, demolition, its daily operational use (air conditioning and lighting, etc), building maintenance and renovation.

- Transportation consumes 44% of the total energy. It is utilized in the transport of people and products within and between cities.

U.S. Energy Use by End-Use Sector for 2004



U.S. Energy Consumption, 2004.
http://www.mongabay.com/images/2006/graphs/end-use_sector_2004.jpg

In 2005, more than 3/4 of total world energy consumption was through the use of fossil fuels. Petroleum led with over 43.4 percent of the world's total energy consumption, followed by natural gas (15.6 percent) and coal (8.3 percent). North America is the largest consumer of fossil fuels, utilizing nearly 25 percent of the world's resources (<http://www.enviroliteracy.org/subcategory.php/21.html>). The use of fossil fuels causes the emission of greenhouse gases which contribute to global warming and are not sustainable.

Fortunately, cleaner energies exist: solar energy, wind power, and

hydroelectric power. These forms of energy are more sustainable and do not contribute to contamination/pollution. It is difficult not to utilize petroleum in our daily lives, but little by little we can make changes to shift our consumption towards alternative energy sources and thus diminish the effects of pollution.

[TEXT BOX]:

- Paper and cardboard are made by trees. Imagine the amount of paper we use: paper, books, newspapers, boxes, cards, propaganda...
- Materials and fabrics that we use to dress ourselves are made from plants and skins. The cotton of our shirts comes from the cotton plant, we use sheep's wool to make sweaters, plants to make baskets and some plants are converted into rope.
- With petroleum we make fuels and plastics. The plastic is a derivative of petroleum: plastic bags, telephones, computers, games, televisions, car parts, utensils, and tools, plates, furniture, and decorations.
- With metals and minerals from deep in the Earth we make bridges, buildings, and highways. Precious stones like diamonds, rubies, amethysts or lapis lazuli, and gold, that are worn as earrings. The steel with which we make casserole

dishes, cooking utensils, screws and nuts. Our materials, the bodywork of our cars, the handle of the door to our homes, the brand of our windows.

The extraction of these materials is as harmful to the planet as the waste from raw materials. We extract much more than we need; furthermore, the use and waste of materials is very inefficient. A rise in recycling practices would enormously benefit the environment: we could learn important lessons by studying the natural world. For example, when the leaves of the trees fall to the ground, they decompose and are converted into an organic material that is absorbed by the roots of the trees, in turn creating the oxygen that we breathe, creating an efficient natural recycling system.

3.2 Water

Water is indispensable to life: without water, we wouldn't have plants, animals, or any of the living creatures that inhabit the planet, including us. Of all the water on the planet, only 2.53% is fresh water, and hardly 0.003% is potable water. The potable water is found in rivers and subterranean aquifers. A large part is contaminated due to industrial activities that release chemicals into the air and underground. Due to climate change, there are extreme water situations, which mean there are more and more droughts and flooding.

3.3 Food

In efforts to feed the current population, large extensions of areas used for cultivation and livestock farming cause deforestation and force natural animals to leave their habitat, which often results in their extinction. Also, large quantities of chemicals are utilized when the nutrients in the Earth's surface are used up and have to be replaced with artificial fertilizers.

These epidemics exist because of a lack of predators, and we attack them with toxic pesticides which kill or harm other human beings, including ourselves. All of these chemicals are filtered into our soil and also contaminate the water.

One possible solution to this would be organic or permacultural agricultural practices in which neither pesticides nor artificial fertilizers are utilized. The diversity of plants and animals complement some of these methods.

4. *Consequences of Our Lifestyle*

The most harmful effects on the planet from our lifestyle include the exhaustion of natural resources and the contamination of water, air, and soil. Non-renewable resources don't replenish themselves at the same pace that we consume them. Fossil fuels, for example, take millions of years to form; we utilize them to create energy and to manufacture



thousands of supplies. How can we replace them?

Another example is the density of forests. Fifty percent has been lost in only 100 years, when it took thousands of years for them to grow. How long will it take to recuperate those trees already lost if we don't implement reforestation projects? They are the lungs of the planet, and only we can head efforts to reforest and buy only articles of certified wood.

In terms of fossil fuels, the first hybrid and hydrogen cars are already for available for sale. Solar panels, which create electricity and heat water, are already on the market. In Mexico, some wind-powered parks already exist, in Oaxaca there is a significant one called The Sail.

4.2 Contamination

The three most common forms of contamination are:

Air Contamination. This contributes to the Greenhouse Effect and is basically generated by burning fossil fuels and industrial processes.

Water Contamination. The chemical waste left over from industrial processes is disposed of in rivers and aquifer springs. This is due, in large part, to a lack of government environmental regulations, a lack of other methods for disposing of them

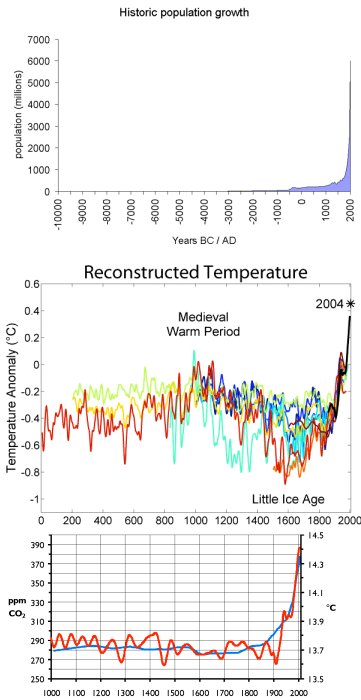
and negligence on behalf of the population.

Land Contamination. This contributes to toxicity; already there are many wastes containing toxic elements that not only harm the land, but also the air, water, and health of people. Non-biodegradable waste accumulates and can take hundreds of years to decompose.

5. Climate Change

Climate change is the global consequence of human activities over the last 150 years, and it is important to remember that this has occurred in a very short time considering the Earth's age.

Global Warming. It is known that the Earth's temperature has increased by 0.6 degrees in the last century. This is a considerable rise for the natural cycles of the Earth.



Population Growth: Temperature Rise: Levels of Carbon Dioxide and Temperatures in the Last 2000 Years. (Top left and in counterclockwise order).
<http://es.wikipedia.org/wiki/Imagen:CO2-Temp.png>

In these images we can see that the population increase is a direct correlation to carbon dioxide emissions (CO₂) in the atmosphere, and that these correlate with the rise of the temperature of the planet. Deforestation diminishes the absorption of CO₂, worsening the effect.

Climate change has been related, for some years, to the rise in extreme climate conditions, as exemplified in the following information:

- The number of hurricanes has doubled in the last 100 years and their strength has increased.
- Forest fires destroy kilometers of forests in the world due to this rise in temperature. This releases large quantities of CO₂ into the atmosphere while at the same time destroys the forests necessary to control it.
- There are already coastal zones that are flooded due to the rise in the level of the sea resulting from polar icecaps melting.

6. Sustainable Development

In 1987, the World Environmental Commission and the ONU Development presented a report entitled "Our Common Future" (also known as "Brundtland Report"). It documented the independence of nations and the necessity of uniting the three pillars of development: "economics, environment, and society."

This report introduced the term "sustainable development," which was defined in the following way: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

By applying sustainable development on a global scale and to all the areas of present day society, we hope to stabilize, or at least curb, global warming. This ambitious goal requires the effort of all the members



of our society: the government, industry, and civil population.

[TEXT BOX] Since the Brundtland Report of 1987, several world events have occurred such as:

- 1992. Río de Janeiro Earth Summit, where more than 175 governments and 2400 non-governmental organizations gathered.
- 1992. Establishment of the UN Commission of Sustainable Development.
- 1992. Implementation of Agenda 21, a plan of action to promote sustainability at a global level.
- 1997. Creation of the Kyoto Protocol to reduce greenhouse effect gases.
- 2002. Johannesburg Earth Summit on sustainable development and follow-up to the implementation of Agenda 21.
- 2007 Live Earth – Global Concert of Pop and Rock Music for a Climate in Crisis.

One of the more important aspects of this challenge is education. Children can learn to live for the future.

Today we are educating children to be adults in 2020. The world, in 2020, will be a world with better ecological equilibrium, and we can help the planet recover itself. This is our world, our land, our Gaia.

Web Pages of Interest:

<http://www.eia.doe.gov/>
U.S. Department of Energy

<http://www.enviroliteracy.org/index.php>
Environmental Literacy Council

<http://www.worldwildlife.org/>
World Wildlife Foundation

<http://www.geocities.com/edu112ve>

<http://www.managenergy.net/kidscorner/es/o11/o11.html>

Recommended Readings:

- *The Gaia Theory* (1979), James Lovelock
- *Our Common Future* (1987), Gro Harlem Brundtland