**Final Syllabus**

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**Green House Effect**

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**History of the greenhouse effect**

Svante Arrhenius (1859-1927) was a Swedish scientist that was the first to claim in 1896 that fossil fuel combustion may eventually result in enhanced global warming. He proposed a relation between atmospheric carbon dioxide concentrations and temperature. He found that the average surface temperature of the earth is about 15oC because of the infrared absorption capacity of water vapor and carbon dioxide. This is called the natural greenhouse effect. Arrhenius suggested a doubling of the CO2 concentration would lead to a 5oC temperature rise. He and Thomas Chamberlin calculated that human activities could warm the earth by adding carbon dioxide to the atmosphere. This research was a by-product of research of whether carbon dioxide would explain the causes of the great Ice Ages. This was not actually verified until 1987.

**INTRODUCTION**

The Sun powers Earth’s climate, radiating energy at very short wavelengths, predominately in the visible or near-visible (e.g., ultraviolet) part of the spectrum. Roughly one-third of the solar energy that reaches the top of Earth’s atmosphere is reflected directly back to space. The remaining two-thirds is absorbed by the surface and, to a lesser extent, by the atmosphere. To balance the absorbed incoming energy, the Earth must, on average, radiate the same amount of energy back to space. Because the Earth is much colder than the Sun, it radiates at much longer wavelengths, primarily in the infrared part of the spectrum. Much of this thermal radiation emitted by the land and ocean is absorbed by the atmosphere, including clouds, and reradiated back to Earth. This is called the **greenhouse effect**.

The glass walls in a greenhouse reduce airflow and increase the temperature of the air inside. Analogously, but through a different physical process, the Earth’s greenhouse effect warms the surface of the planet. Without the natural greenhouse effect, the average temperature at Earth’s surface would be below the freezing point of water.

Thus Earth’s natural greenhouse effect makes life as we know it possible. However, human activities, primarily the burning of fossil fuels and clearing of forests, have greatly intensified the natural greenhouse effect, causing global warming.

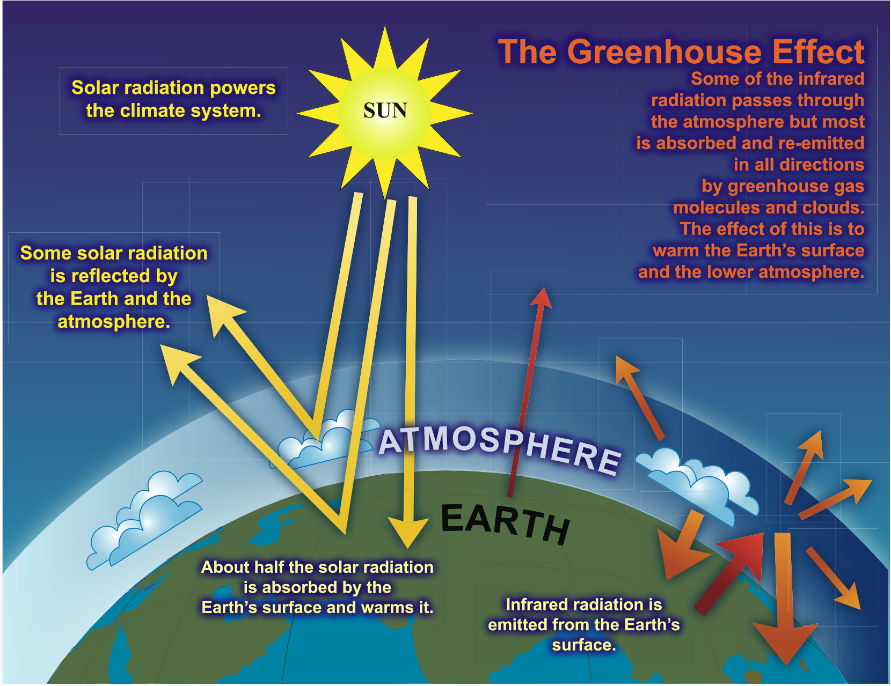
**GASES OF GREENHOUSE:**

The two most abundant gases in the atmosphere, nitrogen (comprising 78% of the dry atmosphere) and oxygen (comprising 21%), exert almost no greenhouse effect. Instead, the greenhou se effect comes from molecules that are more complex and much less common. Water vapour is the most important greenhouse gas, and carbon dioxide (CO2) is the second-most important one. Methane, nitrous oxide, ozone and several other gases present in the atmosphere in small amounts also contribute to the greenhouse effect.

In the humid equatorial regions, where there is so much water vapour in the air that the greenhouse effect is very large, adding a small additional amount of CO2 or water vapour has only a small direct impact on downward infrared radiation. However, in the cold, dry Polar Regions, the effect of a small increase in CO2 or water vapour is much greater. The same is true for the cold, dry upper atmosphere where a small increase in water vapour has a greater influence on the greenhouse effect than the same change in water vapour would have near the surface. Several components of the climate system, notably the oceans and living things, affect atmospheric concentrations of green-house gases.

* **EXAMPLES:**  
   A prime example of this is plants taking CO2 out of the atmosphere and converting it (and water) into carbohydrates via photosynthesis.
* In the industrial era, human activities have added greenhouse gases to the atmosphere, primarily through the burning of fossil fuels and clearing of forests.

Adding more of a greenhouse gas, such as CO2, to the atmosphere intensifies the greenhouse effect, thus warming Earth’s climate. The amount of warming depends on various feedback mechanisms. For example, as the atmosphere warms due to rising levels of greenhouse gases, its concentration of water vapour increases further intensifying the greenhouse effect. This in turn causes more warming, which causes an additional increase in water vapour, in a self-reinforcing cycle. This water vapour feed-back may be strong enough to approximately double the increase in the greenhouse effect due to the added CO2 alone.



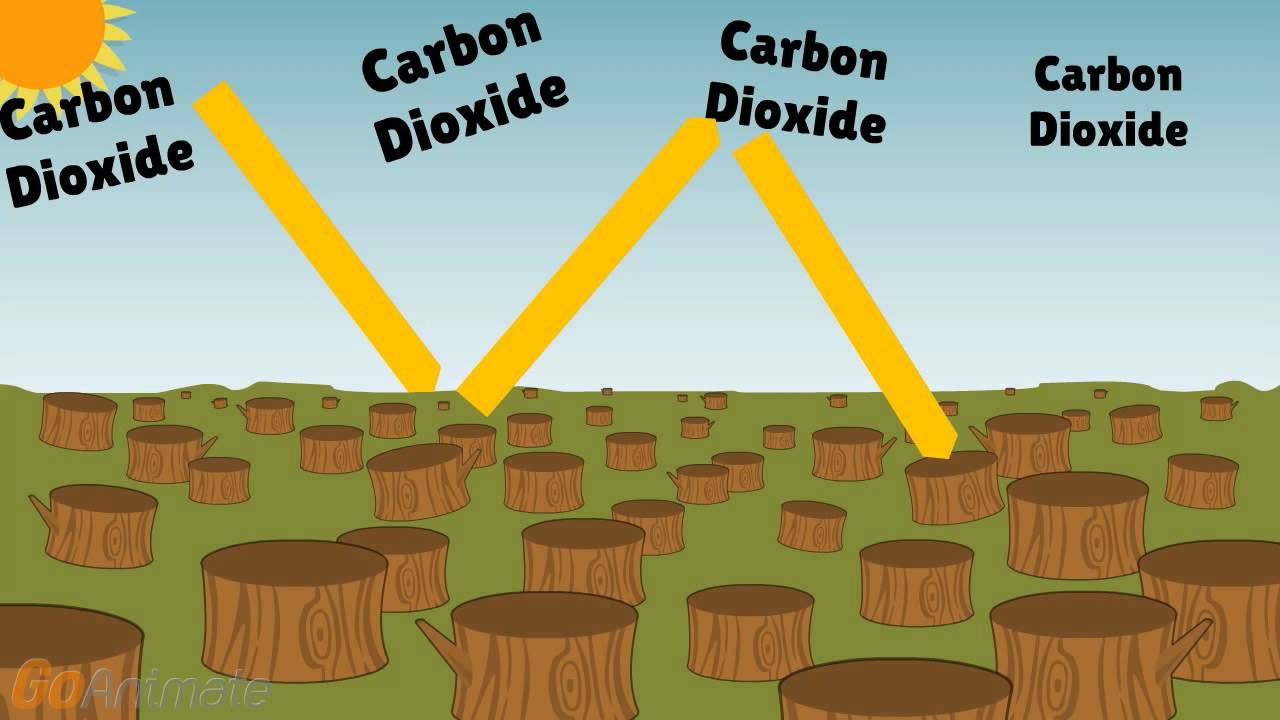
**Causes of the Greenhouse Effect**

1. **Burning of Fossil Fuels**:

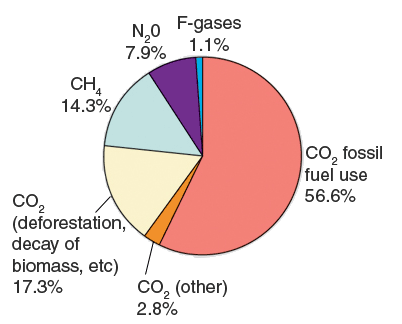
Fossil fuels like coal, oil and natural gas have become an integral part of our life. They are used on large basis to produce electricity and for transportation. When they are burnt, the carbon stored inside them is released which combines with oxygen in the air to create carbon dioxide. With the increase in the population, the number of vehicles have also increased and this has resulted in increase in the pollution in the atmosphere. When these vehicles run, they release carbon dioxide, which is one the main gas responsible for increase in greenhouse effect.

Apart from that, electricity-related emissions are high because we are still dependent on coal for electricity generation which releases large amount of CO2 into the atmosphere and is still the primary source of fuel for generating electricity. Although, renewable sources are catching up, but it may take a while before we can reduce our dependance on coal for electricity generation.

1. **Deforestation:**

Forests hold a major green area on the planet Earth. Plants and trees intake carbon dioxide and release oxygen, through the process of photosynthesis, which is required by humans and animals to survive. Large scale development has resulted in cutting down of trees and forests which has forced people to look for alternate places for living. When the wood is burnt, the stored carbon in converted back into carbon dioxide.  


1. **Increase in Population**:

Over the last few decades, there have been huge increase in the population. Now, this has resulted in increased demand for food, cloth and shelter. New manufacturing hubs have come up cities and towns that release some harmful gases into the atmosphere which increases the greenhouse effect. Also, more people means more usage of fossil fuels which in turn has aggravated the problem.  


1. **Farming:**

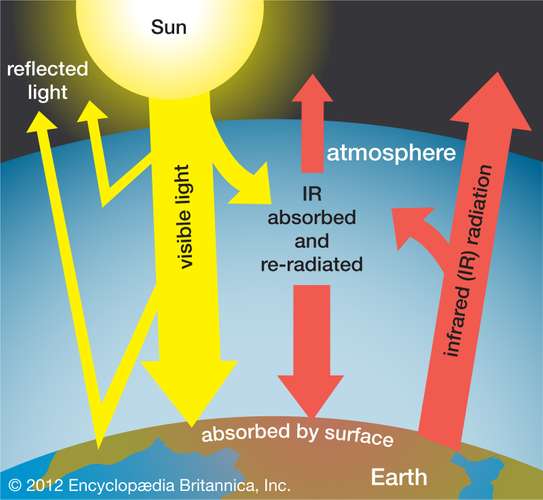
Nitrous oxide is one the greenhouse gas that is used in fertilizer and contributes to greenhouse effect which in turn leads to global warming.

1. **Industrial Waste and Landfills:**

Industries which are involved in cement production, fertilizers, coal mining activities, oil extraction produce harmful greenhouse gases. Also, landfills filled with garbage produce carbon dioxide and methane gas contributing significantly to greenhouse effect.  
  


**Green House Effect**

**Greenhouse effect**, a warming of Earth’s surface and troposphere (the lowest layer of the atmosphere) caused by the presence of water vapour, carbon dioxide, methane, and certain other gases in the air. Of those gases, known as **greenhouse gases**, water vapour has the largest effect.



**Greenhouse Gases and Temperature:**



A greenhouse gas (GHG) is any gas in the atmosphere that absorbs and emits radiation in the thermal infrared range. These are the fundamental cause of the greenhouse effect, which results in increased temperatures on Earth.

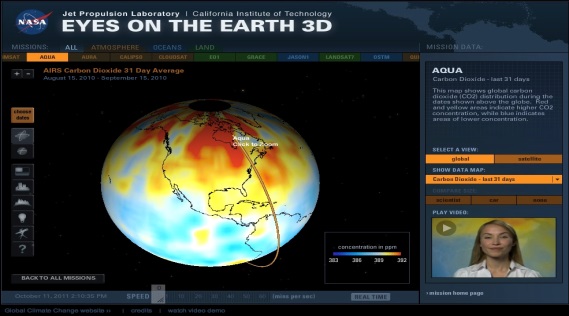
The greenhouse effect occurs as the gases reach Earth’s surface. As the short wave energy heats the surface, some of the longer wave energy radiates back into the atmosphere and back into space. Greenhouse gases absorb some of the energy and trap it in the lower atmosphere. Less heat radiates into space, and Earth is warmer.

Many greenhouse gases occur naturally. Carbon dioxide, methane, water vapor, and nitrous oxide are naturally present in Earth's atmosphere. Others, such as chorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6), are human made.



Because of the Industrial Revolution atmospheric greenhouse gas concentrations have been rising over the last few centuries. Increasing population and dependence on fossil fuels for energy have resulted in a sharp rise in GHG emissions. While some GHGs do occur naturally, other human activity has interfered with the natural cycles that can moderate the effect of the increasing emissions

**Carbon Dioxide:**

[](http://www.cotf.edu/ete/gcc/?/resourcecenter/slideshow/3/100)  
Carbon dioxide is perhaps the most widely studied greenhouse gas. Dr. Charles Keeling, an American scientist, began recording atmospheric carbon dioxide measurements at the Mauna Loa Observatory in 1958. His studies were the first to warn the world of the anthropogenic (human-caused) contributions to global warming. The famous “Keeling Curve,” a result of his extended studies, measured the ongoing buildup of carbon dioxide in Earth’s atmosphere.

Keeling's data also showed a strong seasonal variation in carbon dioxide levels. Peak levels occur in late winter in the Northern Hemisphere. Lowest levels occur in spring and early summer. Notice that the variations can be explained by considering what is happening to plant growth during those times. Plant growth in spring and early summer reduces atmospheric CO2 through the process of photosynthesis; during winter plants cannot have the same mediating effects.

**Methane**: it is released into the atmosphere by both natural and anthropogenic sources. It is released in low oxygen environments such as swamps and bogs and through the roots of some plants. Anthropogenic sources have increased methane emissions through increased use of natural gas and through mining.Direct measurement of methane in the atmosphere began in the late 1970s. Concentrations were shown to increase slowly with fluctuations until 1990. It is unclear why there has been little sustained increase since then.

**Nitrous Oxide:**

Nitrous oxide is produced by microbial (bacterial) processes in soil and water. The use of fertilizers with nitrogen and some industrial processes also contribute to atmospheric N2O.

**Chlorofluorcarbons:**

Chlorofluorocarbons (CFCs) are human made gases used as refrigerants, aerosol propellants, and cleaning solutions. They can destroy stratospheric ozone, and a global effort to stop their production has been very successful. Levels of some of the major CFCs are now declining. Because of their long atmospheric lifetimes, some concentrations will stay in the atmosphere for more than 100 years. They comprise quite a few of the synthetic gases known to be greenhouse gases—gases capable of increasing Earth’s temperatures. Other synthetic gases such as CF4 (carbontetrafluoride), SF6 (sulfurhexafluoride), and the hydrofluorocarbons (HFCs) are also problematic for mitigating effects of greenhouse gases.

**Aerosols:**

Although not greenhouse gases, aerosols can have an effect on climate temperatures. Aerosols are small particles in the atmosphere from smoke, dust, industry, and other sources. Aerosols can absorb and scatter radiation. This causes either warming OR cooling, depending on the aerosol. Aerosols are also important in the formation of clouds and can therefore affect the water cycle and precipitation.

  
Rush hour smog

Of course, some mechanisms are accepted. As temperatures in the atmosphere increase, evaporation of water increases. Evaporation increases at all water reservoir sites—groundwater, rivers, streams, oceans, soils. Because the air is warm, the water can hold more moisture. The increased amounts of water vapor in the atmosphere can then absorb more thermal energy radiated from Earth, and this further warms the atmosphere. (This is called a positive feedback loop because the effect increases with each part of the cycle.) The water vapor eventually condenses and forms clouds. Clouds can reflect some solar radiation, resultsing in a cooling effect. How much of a cooling effect this can have varies and difficult to measure accurately.

**Control:**

**Reduce Carbon Footprint Tips.**

1. Begin composting instead of discarding vegetable and fruit debris.
2. Avoid purchasing products that require a lot of wasteful packaging materials.
3. Add weatherstripping to windows and doors to conserve energy.
4. Turn down the water heater temperature to use less energy.
5. Complete a home energy audit, which has a dual effect: energy and money savings.

**Conserve Energy**

Almost half of the greenhouse gas emissions in the U.S. come from the production of electricity and other industrial process that rely on fossil fuel consumption. Turn off lights when you leave the room. Buy a programmable thermostat and wear a sweater instead of turning up the heat. Buy appliances with the Department of Energy’s Energy Star label.

**Public Transportation.**

Since transportation accounts for nearly 30 percent of the greenhouse gas emissions, instead of driving, try carpooling with coworkers. You can also use public transportation, buses, trains and trams, walk or ride to reduce air pollutants. Reduce plane travel as much as possible, as airplane exhaust adds pollutants to the atmosphere.

**Plant a Tree.**

Except at night, green plants and trees absorb carbon dioxide from the air, convert it to sugar for growth, and release oxygen back into the atmosphere. Deforestation releases stored carbon back into the atmosphere, so using wood and paper products sparingly can help to reduce the greenhouse effect.

**Global warming**

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**History**

**Introduction.**

**Causes of global warming.**

**Effects of global warming.**

**History:**

Over the past 50 years, the average global temperature has increased at the fastest rate in recorded history. And experts see the trend is accelerating: All but one of the 16 hottest years in NASA’s 134-year record have occurred since 2000.Climate change deniers have argued that there has been a “pause” or a “slowdown” in rising global temperatures, but several recent studies, including a 2015 paper published in the journal Science, have disproved this claim. And scientists say that unless we curb global-warming emissions, average U.S. temperatures could increase by up to 10 degrees Fahrenheit over the next century.

**Definition:**

Global warming is the long-term rise in the average temperature of the Earth's climate system. It is a major aspect of climate change and has been demonstrated by direct temperature measurements and by measurements of various effects of the warming. Global warming and climate change are often used interchangeably.

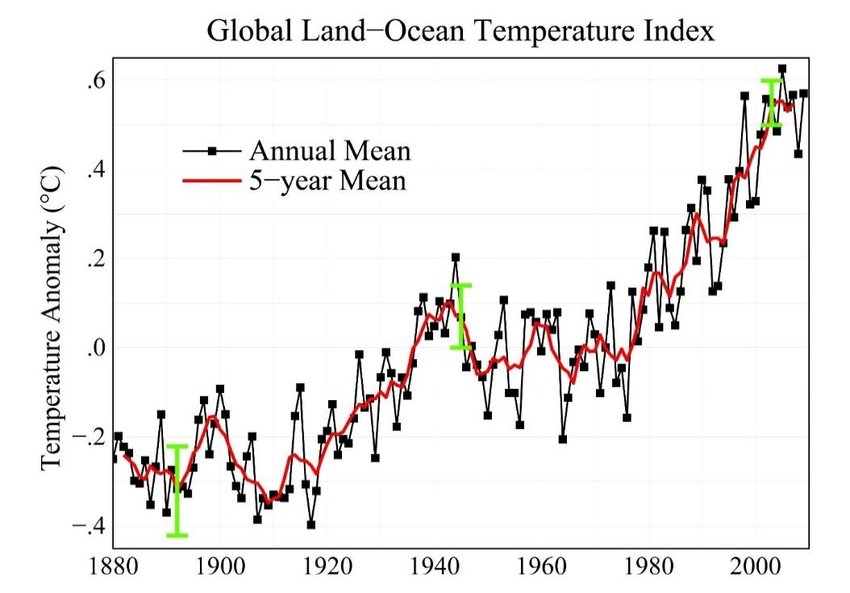
**Introduction:**

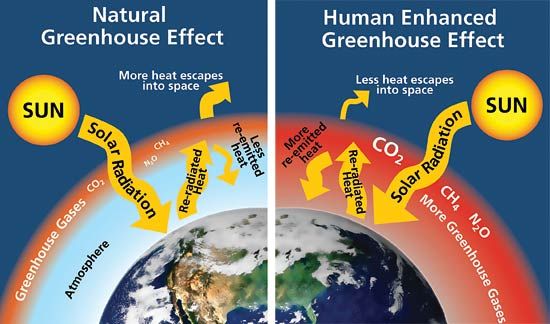
Global warming occurs when carbon dioxide (CO2) and other air pollutants and greenhouse gases collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth’s surface. Normally, this radiation would escape into space—but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter. That's what's known as the greenhouse effect.

Global warming is the slow increase in the average temperature of the earth’s atmosphere because an increased amount of the energy (heat) striking the earth from the sun is being trapped in the atmosphere and not radiated out into space.The earth’s atmosphere has always acted like a greenhouse to capture the sun’s heat, ensuring that the earth has enjoyed temperatures that permitted the emergence of life forms as we know them, including humans.

Without our atmospheric greenhouse the earth would be very cold. Global warming, however, is the equivalent of a greenhouse with high efficiency reflective glass installed the wrong way around.

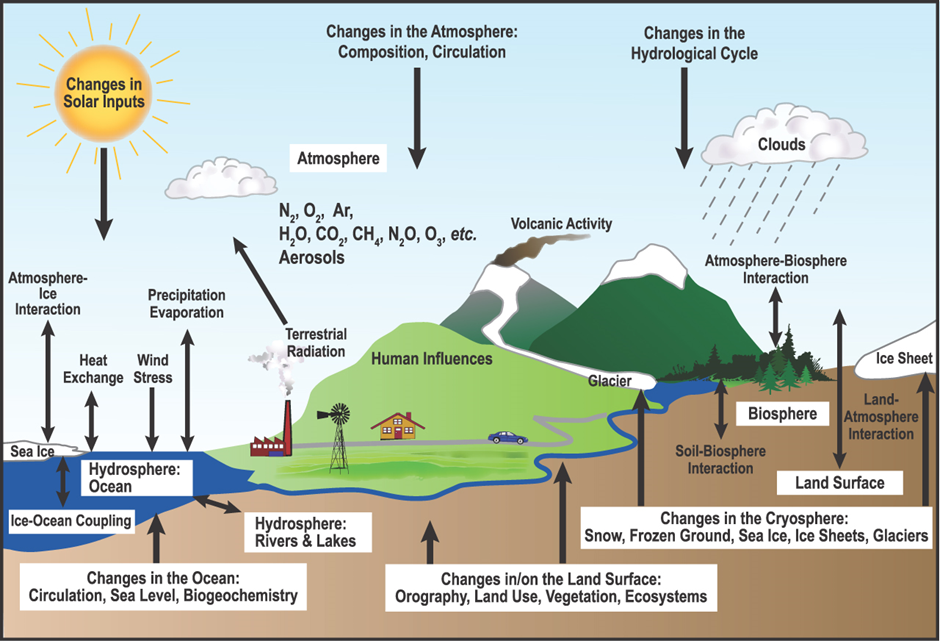
Ionically, the best evidence of this may come from a terrible cooling event that took place some 1,500 years ago. Two massive volcanic eruptions, one year after another placed so much black dust into the upper atmosphere that little sunlight could penetrate. Temperatures plummeted. Crops failed. People died of starvation and the Black Death started its march. As the dust slowly fell to earth, the sun was again able to warn the world and life returned to normal.Today, we have the opposite problem. Today, the problem is not that too little sun warmth is reaching the earth, but that too much is being trapped in our atmosphere.So much heat is being kept inside greenhouse earth that the temperature of the earth is going up faster than at any previous time in history. NASA provides an excellent course module on the science of global warming.





**Climate changes:**

Climate change refers to significant, long-term changes in the global climate.The global climate is the connected system of sun, earth and oceans, wind, rain and snow, forests, deserts and savannas, and everything people do, too. The climate of a place, say New York, can be described as its rainfall, changing temperatures during the year and so on. But the global climate is more than the “average” of the climates of specific places.

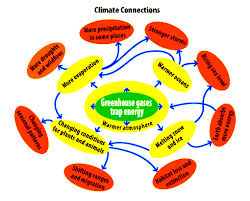


A description of the global climate includes how, for example, the rising temperature of the Pacific feeds typhoons which blow harder, drop more rain and cause more damage, but also shifts global ocean currents that melt Antarctica ice which slowly makes sea level rise until New York will be under water.It is this systemic connectedness that makes global climate change so important and so complicated.

**How does Global Warming drive Climate Change?**

Heat is energy and when you add energy to any system changes occur.Because all systems in the global climate system are connected, adding heat energy causes the global climate as a whole to change.Much of the world is covered with ocean which heats up. When the ocean heats up, more water evaporates into clouds.

Where storms like hurricanes and typhoons are forming, the result is more energy-intensive storms. A warmer atmosphere makes glaciers and mountain snow packs, the Polar ice cap, and the great ice shield jutting off of Antarctica melt raising sea levels.



Changes in temperature change the great patterns of wind that bring the monsoons in Asia and rain and snow around the world, making drought and unpredictable weather more common. This is why scientists have stopped focusing just on global warming and now focus on the larger topic of climate change.

**Causes of Global Warming:**

**There are two major causes of global warming:**

**1) Natural 2) Man-made**

**1) Natural:**

**Naturally global warming is caused by the following factors:**

**i) Climate change:**

Climate change describes a change in the average conditions such as temperature and rainfall. Increase in temperature causes global warming. Global climate change refers to the average long-term changes over the entire Earth.

**ii) Volcanoes:**

The gases and dust particles thrown into the atmosphere during volcanic eruptions have influences on climate. Volcanoes have also caused global warming over millions of years during times in Earth’s history when extreme amount of volcanism occurred, releasing greenhouse gases into the atmosphere.

**2) Man-made:**

As we know human’s activities have been the main part of global warming. Here are some biggest human causes of global warming.

**i) Travel and transportation:**

The vast majority of vehicles on the road (and in the air and water) are powered via fossil fuels, such as gasoline. As they burn this fuel to power their engines, these vehicles release carbon and other pollutants, affecting both air and water quality. In fact, transportation was a huge contributor to U.S. greenhouse gas emissions in 2016.Greenhouse gases trap heat within the atmosphere, which causes global temperatures to rise. It’s not hard to understand why transportation is such a huge contributor to global warming once you understand just how much we drive.

**Industrialization**

The transition of economies from primarily farming-based to primarily industrial is likely to have been the earliest cause of the rampant global warming we see today. Research suggests global warming was kicked off partly by the Industrial Revolution in the U.S. and other countries, which occurred in the mid-19th century.

**Deforestation**

Millions of acres of forest are cleared every year, whether to harvest wood for making lumber or paper, to clear land for farming and ranching or to make way for residential and industrial areas.

Forests store enormous amounts of carbon, essentially removing it from the air and preventing it from being absorbed into the atmosphere, and this is especially true of rainforests, which are even more endangered than other areas. In addition to losing the natural air-scrubbing function of trees, deforestation decreases biodiversity, which can cause ripple effects throughout entire ecosystems, putting whole species at risk.

**Livestock Production**

Ranching contributes to climate change in a few ways. In addition to clearing trees to make room for large areas adequate for the care and feeding of animals for food, these animals create a huge amount of waste, which produces methane, a very harmful greenhouse gas. Consumption of meat and meat products is expected to continue growing, even doubling by 2050, according to one projection.

**Factory Farming**

The industrialization of agriculture takes the potential negative effects of livestock production and amplifies them. While organic farming can have a positive impact on global warming by reducing carbon through the growth of crops, large-scale, industrialized farming negates the positive impact of organic food and animal production.

These large-scale animal-producing farms, known as concentrated animal feeding operations (CAFOs) have risen sharply in recent years.

**Use of Aerosols**

Though some forms of aerosols have been banned in many countries, other forms of them still are in wide use. These products are loaded with greenhouse gases, including CO2 and methane, as well as chlorofluorocarbons, which erode the ozone layer.

Production of aerosols has actually increased throughout the world, with most aerosols being produced in Europe.

**Inability to Change**

Even if we addressed every single other issue on this list today, the impact of human-caused global warming will remain for decades, if not centuries. The magnitude of the issue is, quite simply, too difficult for many of us to comprehend. So, many of us think, if we can’t truly fix this issue, what’s the point of even trying? After all, it’s our very inaction that has caused or worsened many of these issues.

But humans are capable of change, as shown by the reduction in fuel combustion emissions seen in many countries since the early 2000s, including the United States, and by evolving public attitudes toward climate change and our role

**GLOBAL WARMING EFFECT**

Global warming has emerged as one of the biggest threats to our planet in this century. It has been proved that due to the increase of the GHG‟s in our outer atmosphere, the earth’s temperature has warmed by 0.74 degree Celsius over the last 100 years. This has resulted in a devastating disruption of the earth’s climatic processes, leading to floods, famines, droughts and cyclones among other natural disasters. Global warming is the hot new topic of this century as catastrophic climatic events keep on ravaging the whole planet, annihilating entire villages and towns, and financially crippling the affected regimes. However, most of the people are not even familiar with the term “Green House Effect”.

The following figure shows the impacts of the Global warming on the world‟s climate.

**RECENT CLIMATIC CATASTROPHES IN PAKISTAN**

Pakistan ranks 16th on the Climate Change Vulnerability Index(CCVI) by Maple Croft, jumping up 13 positions in one year. German watch also places Pakistan as the “most affected” country for 2010 and in top 10 for 1990-2010 by climatic changes. Climate changes are costing the economy $14 billion a year, which is almost 5% of the GDP. According to the Asian Development Bank, more than 10 million people have been displaced in Pakistan over the last 2 years due to these climates related disasters.

1. **FLOODS**

Pakistan’s economy has been crippled heavily by devastating and repetitive floods during the last decade. In the past 10 years, Pakistan has been hit by floods almost every y ear. However, the floods of 2010 and 2011 have emerged as the biggest catastrophes in the country‟s history.

**2010 floods**

The flood of 2010 remains as one of the biggest tragedies in the world‟s history, with 20 million people affected by it. The floods resulted in approximately 1,781 deaths, injured 2,966 people and destroyed more than 1.89 million homes.

**2011 floods**

Although nowhere near the 2010 floods, the 2011 floods also wrecked havoc and affected 5.3 million people and 1.2 million homes in Sind, as well as inundating 1.7 million acres of arable land.



1. **DROUGHTS**

A Drought is a period of abnormally dry weather due to the lack of rainfall. The chief characteristic of a drought is a decrease of water availability in a particular period and over a particular area.

Pakistan‟s economy has been punched heavily by the continuous spell of droughts for the last many years, particularly in the provinces of Baluchistan and Sind. The drought in these areas has reduced the river flows, resulting in drying up of the irrigation canals, leading to a severe agricultural deprivation. It has also been responsible for causing immense losses to poultry and other animals, causing a general deficiency of food and water for people. The increased temperatures because of the increased GHGs as well as a mismanagement of the water reservoirs need to be blamed for the condition.



1. **INCREASING FREQUENCY OF CYCLONES**

Tropical cyclones are also a dreaded characteristic of the climate in various parts of Pakistan. As a result of global warming, the frequency of Cyclones has increased over the Arabian Sea during the last 50 years. Moreover, the intensity of these cyclones has also increased during the last quarter of the 20th century. Strong tropical activity in the Arabian sea in 2001, 2004, 2007, 2010 and 2011 shows an increasing trend towards more cyclones, indicating that there are bright chances that future cyclones can directly strike mega metropolis cities like Karachi and kill thousands of people and may change the way these cities used to live.

1. **RISING TEMPERATURES**

One of the most immediate and obvious effects of global warming is the increase in temperatures around the world. The average global temperature has increased by about 1.4 degrees Fahrenheit (0.8 degrees Celsius) over the past 100 years, according to the National Oceanic and Atmospheric Administration (NOAA). As an ill effect of global warming, the annual mean surface temperatures in Pakistan have been steadily increasing during the past century. A rise in mean temperature of 0.6-1°C in the coastal areas along with a 0.5 to 0.7% increase in solar radiation over southern half of country has been observed. In central Pakistan, a 3-5% decrease in cloud cover with increasing hours of sunshine have also been responsible for increasing the temperatures.



1. **RISING SEA LEVELS**

The increasing temperatures due to global warming have resulted in a progressive melting of glaciers, which has resulted in a gradual increase in the sea levels. According to the Karachi Tidal Station, an increase in the mean sea level at a rate of 1.1 mm/yr has been recorded during the past 100 years. The ravaging sea continues to engulf the surrounding land, and consumes 80 acres a day on an average. Six subdivisions of Thatta, which were previously considered extremely prosperous due to extensive agriculture, are now amongst the poorest parts of the country due to the engulfment by the sea.

1. **Extreme weather events**

Extreme weather is another effect of global warming. While experiencing some of the hottest summers on record, much of the United States has also been experiencing colder-than-normal winters. Changes in climate can cause the polar jet stream — the boundary between the cold North Pole air and the warm equatorial air — to migrate south, bringing with it cold, Arctic air. This is why some states can have a sudden cold snap or colder-than-normal winter, even during the long-term trend of global warming, Werne explained.

1. **Lightening**

Lightening is another weather feature that is being affected by global warming. According to a [2014 study](https://www.livescience.com/48751-global-warming-more-us-lightning.html), a 50 percent increase in the number of lightning strikes within the United States is expected by 2100 if global temperatures continue to rise. The researchers of the study found a 12 percent increase in lightning activity for every 1.8 degree F (1 degree C) of warming in the atmosphere.



1. **Ice melt**

One of the primary manifestations of climate change so far is melt. North America, Europe and Asia have all seen a trend toward less snow cover between 1960 and 2015, according to 2016 research [published in the journal Current Climate Change Reports.](http://climate.rutgers.edu/stateclim_v1/robinson_pubs/refereed/Kunkel_et_al_2016.pdf) According to the National Snow and Ice Data Center, there is now [10 percent less permafrost](https://nsidc.org/cryosphere/frozenground/climate.html), or permanently frozen ground, in the Northern Hemisphere than there was in the early 1900s. The thawing of permafrost can cause landslides and [other sudden land collapses](https://www.livescience.com/58436-are-methane-explosions-causing-siberia-craters.html). It can also release long-buried microbes, as in a 2016 case when a cache of buried reindeer carcasses thawed and [caused an outbreak of anthrax](https://www.livescience.com/55621-zombie-anthrax-kills-in-siberia.html).

One of the most dramatic effects of global warming is the reduction in Arctic sea ice. Sea ice hit record-low extents in both the fall and winter of 2015 and 2016, meaning that at the time when the ice is supposed to be at its peak, it was lagging. The melt means there is less thick sea ice that persists for multiple years. That means less heat is reflected back into the atmosphere by the shiny surface of the ice and more is absorbed by the comparatively darker ocean, creating a feedback loop that causes even more melt, [according to NASA's Operation Ice Bridge](https://www.sciencedaily.com/releases/2017/07/170724133153.htm).

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1. **Sea levels and ocean acidification**

Melting polar ice in the Arctic and Antarctic regions, coupled with melting ice sheets and glaciers across Greenland, North America, South America, Europe and Asia, are expected to raise sea levels significantly. Sea level isn't the only thing changing for the oceans due to global warming. As levels of CO2 increase, the oceans absorb some of that gas, which increases the acidity of seawater. Werne explains it this way: "When you dissolved CO2 in water, you get carbonic acid. This is the same exact thing that happens in cans of soda. When you pop the top on a can of Dr Pepper, the pH is 2 — quite acidic." Since the Industrial Revolution began in the early 1700s, the acidity of the oceans has increased about 25 percent, according to the EPA.



1. **Plants and animals**

The effects of global warming on the Earth's ecosystems are expected to be profound and widespread. Many species of plants and animals are already moving their range northward or to higher altitudes as a result of warming temperatures, according to a report from the National Academy of Sciences. Additionally, migratory birds and insects are now arriving in their summer feeding and nesting grounds several days or weeks earlier than they did in the 20th century, according to the EPA.



1. **Social effects**

As dramatic as the effects of climate change are expected to be on the natural world, the projected changes to human society may be even more devastating. Agricultural systems will likely be dealt a crippling blow. Though growing seasons in some areas will expand, the combined impacts of drought, severe weather, lack of accumulated snowmelt, greater number and diversity of pests, lower groundwater tables and a loss of arable land could cause severe crop failures and livestock shortages worldwide. This loss of food security may, in turn, create havoc in international food markets and could spark famines, food riots, political instability and civil unrest worldwide.

In addition to less nutritious food, the effect of global warming on human health is also expected to be serious. The American Medical Association has reported an increase in mosquito-borne diseases like malaria and dengue fever, as well as a rise in cases of chronic conditions like asthma, most likely as a direct result of global warming.

**Space Biology**

**Definition:-**

The branch of biology that concerned with the effect of outer space on living organisms and the search for extra-terrestrial life is known as space biology.

**Synonyms:**

Astrobiology, exobiology. We need to study the origin, evolution, distribution and future of life in the universe, extra-terrestrial life and life on Earth. The term exobiology covers the search for life beyond Earth and effect of extra-terrestrial environment on living things. We study space to have understanding of what makes the universe, where it come from and where we came from.

To have an idea about possibility of life on mass either currently or in the past is an active area of research. Some organic molecules found in asteroids, which suggest that life on Earth from other planets.

**Life supported in space:**

Environmental control and life support system provided controlled atmospheric pressure, fire, oxygen level, waste management and water supply in the space shuttle. The highest priority was the station’s atmosphere, but the system also processed and stored the waste and water produced and used by the crew by the process that recycle the fluid from the skin, toilet and condensation from the air.

**Exercise:**

The most significant adverse effect of long-term weightlessness, muscle atrophy and deterioration of skeleton. Other significant effects include fluid redistribution, slowing of cardiovascular system, decreased production of RBCs and balanced disorders to reverse.

These effects begin quickly so upon return to the Earth for prevention of some of these adverse physiological effects, station was equipped with two treadmills and a stationary bicycle. Astronauts used ------------ to stop themselves to the treadmills. Research believe that exercise is a good counter-measure for the bone and muscle density loss that occur when human life was remain for a long term without gravity.

**Hygiene:**

There are two space toilets located in there. Astronauts first fastened themselves to the toilet seat, which was equipped with spring loaded restraining bars to ensure a good seat. A lever operate a powerful fan and suction hole in side, air stream carried the waste away. Solid waste collected in individual bags, which were stored in aluminum containers. Full containers transferred to the progress space careful for disposal.

**Food and Drink:**

Most of the food eaten by the station crews are frozen, refrigerated and canned. The diet was designed to provide around 100g of proteins, 130g of fats and 330g of carbohydrates per day. In addition to appropriate minerals and vitamin-supplement usually crew drink coffee and fruit juices.

**Space biology elements:**

1. **Microbiology:**

Study space flight effects on microbial life processes and community diagnosis.

1. **Cell and molecular biology:**

Determine space flight effects on life at the cellular and molecular level.

1. **Plant biology:**

Understand how plants respond and grow in space flight.

**4 -Animal Biology:-**

Determine basic mechanisms flight animals use to adopt to and to alteration in gravity in particular.

**5- Evolutionary Biology:-**

Determine how space effects development , reproduction and evolutionary process.

**EFFECTS OF SPACE ON BODY:-**

**HEART:-**

One of the effect of the microgravity noted earlier was pooling of fluids in the upper body.This pooling of fluids tricks the kidneys into preceving there is too much fluid and so they increase their functioning.Liters of fluids including blood,the dropping fluid level gives the heart less and blood less to pump and it respond by shrinking in size.

**DECOMPRESSION SICKNESS(DCS):-**

Decompressuion sickness is the injury to the tissues of the body resulting from the presence of Nitrogen bubbles in the tissues and the blood.This occur due to a rapid reduction in ambient pressure causing the dissolved Nitrogen to come out of the solution as a gas Bubbles.In space trhe risk of DCS reduce by using a technique to wash out the Nitrogen in the body’s tissues.

**Symptoms:-**

Symptoms of DCS in space may Include Chest pain,shortness of breath,cough,pain with deep breath,unusual fatigue,dizziness,headache,unexplained muscularskeletal pain and visual Abnormalties.

**Treatment:-**

Hydration to improve the circulation to injured tissues.Hyper barrier oxygen treatment consist of chamber to remove the Nitrogen Bubbles.

**DECREASED IMMUNE SYSTEM FUNCTIONING:-**

Astronuts in space have weakened immune system which mean that viruses already present in the body which would normally be supressed become active.In space T-Cells not produced properly.T-Cells which already present are less able to fight against infections.

**LOSS OF BALANCE:-**

By studying that changes in space affects balance in human body involving the sense,the brain,the inner ear,the blood pressure .NASA develop treatment that can be used on Earth and Space to control balance Disorders.Untill the NASA astronuts must rely on a medication called midodrine (An anti dizzness pills that temporarily increases the blood pressure) which used to carry any task.

**LOSS OF EYESIGHT:-**

Because wieghtlessness,increase the amount of fluid in the upper part of the body,astronauts experience increase intracranial pressure.This appear to increase pressure on back of the eyeballs,affecting their shape and slightly crushing the optic nerve.Such eyesight problems may be a major concern for future deep space flight including a manned mission to the planet MARS

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**LOSS OF MENTAL ABALITIES:-**

On December 31,2012 NASA supported study reported that manned space flight may harm the brain of the astronauts due to intracranial fluid pressure.

SLEEP DISORDERS:-

Fifty percent of space shuttle astronauts take sleeping pills and still get two are less hours of sleep.NASA is researching two areas which may provide the keys to a better night sleep as improved sleep decreases fatigue and increases daytime productivity.A variety of methods for combating this phenomenon are constantly under discussion.

**Space Law Treaties & Principles:-**

The Committee on the peaceful uses of outer space is the forum for the development of international space law. The committee has concluded five international sets of principles on space related activities.

These five treaties issues such as the non appropriation of outer space by any one country, arms control , the freedom of exploration , liability for damage caused by space objects, the safety and rescue of spacecraft and astronauts, the prevention of harmful interference with space activities and the environment , notification and scientific investigation and the exploitation of natural resources in outer space and the settlement of disputes.

Each of the treaties stresses the notion that outer space and whatever benefits might be accrued from outer space should be devoted to enhancing the well-being of all countries and humankind, with an emphasis on promoting international cooperation.

**Environmental Laws:-**

Our five most effective pieces of environmental legislation are the clean air act, the endangered species act, the montreal protocol, the clean water act, and reformation plan no.3 of 1970.

Because of these laws, the health of Americans and the environmental they inhabit have dramatically improved.

**Clean Air Act:-**

By the time president Lyndon Johnson signed into law the first clean air act in December 1963. It was later amended in 1966,1970,1977, and 1990. Americans air had been under siege for decades.

Its safe to say that our air was bad and getting worse,” says frank O’Donnell**,** president of clean air watch, a non-profit environmental organization.”Many cities were choking in smog.”

Environmentalist: clean air act meant to be a work in progress there was the 1948 incident in Donora, Pennsylvania. On Halloween night, an unseasonable temperature inversion blocked emission from a zinc best furnace. A week later, the “Donora Death fog,”as it would come to be known, had finally vanished but not before 20 people were killed and more than 600 were diagnosed with serious illness.

There was the entire month of October 1954 in Los Angeles , when the worst in a string of smog attacks blanketed the region. Planes were diverted from airports. Children stayed home from school. Over 2,000 automobile accidents occurred in a single day. Two years later, a survey of L.A. doctors found that almost 95 percent had treated the “ smog complex” irritated eyes, cough, nausea, and headaches. Americas air needed a shower.

It got one with the clean air act, the principle law addressing air pollution , including carbon dioxide emission.

“Climate change aside, it can be documented that air today is considerably cleaner, “ says O, Donnell.

“ The clean air act is still a work in progress, but there is no doubt that it has saved lives.”

One of the major provision of the 1970 amendment was the phase out of lead based gasoline. By 1995, the percentage of U.S. children with elevated levels of lead in their blood had dropped from 88 percent to 4 percent, according to data compiled by the centers for disease control and prevention.

The good news did not stop there.

In 2002, a report by the Journal of American medical association credited the acts automobile emission regulations with reducing carbon monoxide related deaths, saving 11,700 lives between 1968 and 1998.

**Marine Mammal protection Act:-**

Marine mammal protection act was first law to mandate ecosystem approach. The environmental protection agencys sister law, the marine mammal protection act, was signed in 1972, and was the worlds first law that mandated an ecosystem approach to marine resource management.

Today, the primary threat to ESA has been there from its inception pushback from well-funded land development and property rights activities.

“ The future is better funding, more adequate enforcement, and more proactive efforts to get ahead of the curve,” says Galvin.

**Montreal Protocol Act:-**

Signed in 1987, revised seven times , and ratified by 196 nations, the Montreal Protocol officially known as the Montreal Protocol on substances that deplete the ozone layer has been hailed as “perhaps the single most successful international agreement to date, “by Kofi Anan, the former secretary general of the united nations.

In scientific terms, it phased out ozone depleting substances namely chlorofluorocarbons and hydrochlorofluorocarbons.

This in, turn , prevents harmful ultraviolet radiation invisible rays that are part of the suns energy from entering earths atmosphere.

Reference:- Log in course navigator.Introduction to Hospitality.

**Desertification and deforestation**

**Desertification:**

Desertification is defined as a process of [land degradation](https://www.conserve-energy-future.com/causes-effects-solutions-of-land-pollution.php) in arid, semi-arid and sub-humid areas due to various factors including climatic variations and human activities. Or, to put it in another way, desertification results in persistent degradation of dryland and fragile [ecosystems](https://www.conserve-energy-future.com/what-is-an-ecosystem.php) due to man-made activities and variations in climate. Desertification, in short, is when land that was originally of another type of biome turns into a desert biome because of changes of all sorts. A huge issue that many countries have is the fact that there are large pockets of land that are going through a process that is known as desertification.

According to [UNESCO](https://www.un.org/press/en/2012/gaef3352.doc.htm), one third of world’s land surface is threatened by desertification and across the world it affects livelihood of millions of people who depend on the benefits of ecosystems that drylands provides. Desertification is another [major environmental concern](https://www.conserve-energy-future.com/top-25-environmental-concerns.php) and a major barrier to meeting human basic needs in drylands and are being constantly threatened by increases in human pressures and climatic variability.

**Causes of desertification:**

**Overgrazing:**

Animal grazing is a huge problem for many areas that are starting to become desert biomes. If there are too many animals that are overgrazing in certain spots, it makes it difficult for the plants to grow back, which hurts the [biome](https://www.conserve-energy-future.com/major-biomes-of-the-world.php) and makes it lose its former green glory.

**Deforestation:**

When people are looking to move into an area, or they need trees in order to make houses and do other tasks, then they are contributing to the problems related to desertification. Without the plants (especially the trees) around, the [rest of the biome](https://www.conserve-energy-future.com/what-is-a-biome.php) cannot thrive.

**Farming Practices:**

Some farmers do not know how to use the land effectively. They may essentially strip the land of everything that it has before moving on to another plot of land. By stripping the [soil of its nutrients](https://www.conserve-energy-future.com/causes-and-effects-of-soil-pollution.php), desertification becomes more and more of a reality for the area that is being used for farming.

**Urbanization and other types of land development:**

As mentioned above, development can cause people to go through and kill the plant life. It can also cause issues with the soil due to chemicals and other things that may harm the ground. As areas become more urbanized, there are less places for plants to grow, thus causing desertification.

**Climate Change:**

[Climate change](https://www.conserve-energy-future.com/ClimateChangeEffects.php) plays a huge role in desertification. As the days get warmer and periods of drought become more frequent, desertification becomes more and more eminent. Unless climate change is slowed down, huge areas of land will become desert; some of those areas may even become uninhabitable as time goes on.

**Stripping the land of resources:**

If an area of land has [natural resources](https://www.conserve-energy-future.com/list-10-natural-resources.php) like natural gas, oil, or minerals, people will come in and mine it or take it out. This usually strips the soil of nutrients, which in turn kills the plant life, which in turn starts the process toward becoming a desert biome as time goes on.

**Natural Disasters:**

There are some cases where the land gets damaged because of [natural disasters](https://www.conserve-energy-future.com/10-worst-natural-disasters.php), including drought. In those cases, there isn’t a lot that people can do except work to try and help rehabilitate the land after it has already been damaged by nature.

**Effects of desertification:**

**Farming becomes next to impossible:**

If an area becomes a desert, then it’s almost impossible to grow substantial crops there without special technologies. This can cost a lot of money to try and do, so many farmers will have to sell their land and leave the desert areas.

**Hunger:**

Without farms in these areas, the food that those farms produce will become much scarcer, and

the people who live in those local areas will be a lot more likely to try and deal with hunger problems. Animals will also go hungry, which will cause even more of a food shortage.

**Flooding:**

Without the plant life in an area, flooding is a lot more eminent. Not all deserts are dry; those that are wet could experience a lot of flooding because there is nothing to stop the water from gathering and going all over the place. Flooding can also negatively affect the water supply, which we will discuss next.

**Poor Water Quality:**

If an area becomes a desert, the water quality is going to become a lot worse than it would have been otherwise. This is because the plant life plays a significant role in keeping the water clean and clear; without its presence, it becomes a lot more difficult for you to be able to do that.

**Overpopulation:**

When areas start to become desert, animals and people will go to other areas where they can actually thrive. This causes [crowding and overpopulation](https://www.conserve-energy-future.com/causes-effects-solutions-of-overpopulation.php), which will, in the long run, end up continuing the cycle of desertification that started this whole thing anyway.

**Poverty:**

All of the issues that we’ve talked about above (related to the problem of desertification) can lead to poverty if it is not kept in check. Without food and water, it becomes harder for people to thrive, and they take a lot of time to try and get the things that they need.

**Solutions of desertification:**

**Policy Changes Related to How People can Farm:**

In countries where policy change will actually be enforced on those in the country, policy change related to how often people can farm and how much they can farm on certain areas could be put into place to help reduce the problems that are often associated with farming and desertification.

**Policy Changes to Other Types of Land Use:**

If people are using land to get natural resources or they are developing it for people to live on, then the policies that govern them should be ones that will help the land to thrive instead of allowing them to harm the land further. The policy changes could be sweeping or they could be depending on the type of land use at hand.

**Education:**

In developing countries, education is an incredibly important tool that needs to be utilized in order to help people to understand the best way to use the land that they are farming on. By educating them on [sustainable practices](https://www.conserve-energy-future.com/sustainable-farming-practices.php), more land will be saved from becoming desert.

**Technology Advances:**

In some cases, it’s difficult to try and prevent desertification from happening. In those cases, there needs to be research and advancements in technology that push the limits of what we currently know. Advancements could help us find more ways to prevent the issue from becoming epidemic.

**Putting Together Rehabilitation Efforts:**

There are some ways that we can go back and rehabilitate the land that we’ve already pushed into desertification; it just takes some investment of time and money. By putting these together, we can prevent the issue from becoming even more widespread in the areas that have already been affected.

**Sustainable practices to prevent desertification from happening:**

There are plenty of [sustainable practices](https://www.conserve-energy-future.com/sustainable-practices-waste-management.php) that can be applied to those acts that may be causing desertification. By adding these to what we should be doing with land, we can ensure that we don’t turn the entire world into a desert.

**Deforestation:**

Deforestation is the permanent removal of trees to make room for something besides forest. This can include clearing the land for agriculture or grazing, or using the timber for fuel, construction or manufacturing.

Forests cover more than 30% of the Earth's land surface, according to the [World Wildlife Fund](https://www.worldwildlife.org/threats/deforestation-and-forest-degradation#causes). These forested areas can provide food, medicine and fuel for more than a billion people. Worldwide, forests provide 13.4 million people with jobs in the forest sector, and another 41 million people have jobs related to forests.

Forests are a resource, but they are also large, undeveloped swaths of land that can be converted for purposes such as agriculture and grazing. In North America, about half the forests in the eastern part of the continent were cut down for timber and farming between the 1600s and late 1800s, according to [National Geographic](https://www.nationalgeographic.org/encyclopedia/deforestation/).

Today, most deforestation is happening in the tropics. Areas that were inaccessible in the past are now within reach as new roads are constructed through the dense forests. A [2017 report](https://blog.globalforestwatch.org/data-and-research/2017-was-the-second-worst-year-on-record-for-tropical-tree-cover-loss) by scientists at the University of Maryland showed that the tropics lost about 61,000 square miles (158,000 square kilometers) of forest in 2017 — an area the size of Bangladesh.

**Causes of deforestation:**

Deforestation causes can either be direct or indirect.  
**Direct causes:**

* **Natural causes** as hurricanes, fires, parasites and floods
* **Human activities** as agricultural expansion, cattle breeding, timber extraction, mining, oil extraction, dam construction and infrastructure development.

**Indirect causes:**

* Insufficient political actions and governance failure as inadequate land tenure system, corruption, wrong public administration investments
* Political and socio-economic causes as population growth, military conflicts and climatic changes

The main causes of deforestation can actually be lead back especially to:

**Cultivation and livestock farming:**

We should consider, infact, that with regards to the substitution of forest areas with cultivations and livestock farms, the impact is much higher because after the extraction of the most precious trees which are destined for timber commercialization, forests are set on fire causing a great impact on local animals and plants. The most disastrous year for the Amazon forest has been 1991 when over 50,000 fires where registered by aerial views or satellite images.  
**Timber extraction**:

Centuries-old trees are cut down to make timber or cellulose for the furniture or paper industry. Any system employed for wood cutting causes serious damage to the ecosystem, and these damages are amplified by construction of roads required for vehicles and to trasport chopped timber to its destination. For this reason, also many other economically unattractive trees which have an important biological and ecological value are are cut down.  
**Firewood collection**:

This activity is undertaken especially by native populations, which due to recent population growth, must provide energy sources for their survival. This phenomenon adds to large-scale industrial timber exploitation.

**Road Construction:**

Besides the construction of roads to transport timber, also dam construction and industrial exploitation of mines contribute to massive deforestation.

**Effects of deforestation:**

### Loss of Habitat:

One of the most dangerous and unsettling effects of deforestation is the loss of animal and plant species due to their loss of habitat; not only do we lose those known to us, but also those unknown, potentially an even greater loss. [“Seventy percent of Earth’s land animals and plants live in forests, and many cannot survive the deforestation that destroys their homes.”](http://environment.nationalgeographic.com/environment/global-warming/deforestation-overview) The trees of the rainforest that provide shelter for some species also provide the canopy that regulates the temperature, a necessity for many others. Its removal through deforestation would allow a more drastic temperature variation from day to night, much like a desert, which could prove fatal for current inhabitants.

### Increased Greenhouse Gases:

In addition to the loss of habitat, the lack of trees also allows a greater amount of greenhouse gases to be released into the atmosphere. Presently, the tropical rainforests of South America are responsible for [20% of Earth’s oxygen](http://www.tmalliance.org/index.php?id=424) and they are disappearing at a rate of [4 hectares a decade](http://www.fao.org/news/story/pt/item/40893/icode). If these rates are not stopped and reversed, the consequences will become even more severe.

### Water in the Atmosphere:

The trees also help control the level of water in the atmosphere by helping to regulate the [water cycle](http://en.wikipedia.org/wiki/water_cycle). With fewer trees left, due to deforestation, there is less water in the air to be returned to the soil. In turn, this causes dryer soil and the inability to grow crops, an ironic twist when considered against the fact that [80% of deforestation comes from small-scale agriculture and cattle ranching](http://www.tmalliance.org/index.php?id=426).

### Soil Erosion and Flooding:

Further effects of deforestation include soil erosion and coastal flooding. In addition to their previously mentioned roles, trees also function to retain water and topsoil, which provides the rich nutrients to sustain additional forest life. Without them, the soil erodes and washes away, causing farmers to move on and [perpetuate the cycle](http://worldwildlife.org/threats/deforestation). The barren land which is left behind in the wake of these unsustainable agricultural practices is then more susceptible to flooding, specifically in coastal regions. [“Coastal vegetation lessens the impact of waves and winds associated with a storm surge. Without this vegetation, coastal villages are susceptible to damaging floods.”](http://science.howstuffworks.com/green-science/deforestation2.htm)

**Solutions of deforestation:**

**Green Business:**

Green business concerns re-use and recycling. Green methods of production and utilization of resources can immeasurably reduce deforestation. Particularly, it’s the focus on re-using items, reducing the use of artificial items, and recycling more items. Paper, plastics, and wood are linked to the destruction of forests and other natural resources.

By focusing on recycling paper, plastics, and wood products as well as adopting responsible consumerism, it means there will be less dependence on the natural resources and trees. It will also reduce government and company imports of raw-materials from forest regions in other parts of the world.

**Eco-forestry:**

Eco-forestry is a move on saving the worlds forest. It acknowledges that sometimes, the use of trees for various human activities or reasons can be inevitable. Per se, eco-forestry underscores the need of cutting down trees in an environmentally friendly manner. It is where only cautiously selected trees are fell and transported with the least possible damage to the area. Also, eco-forestry not only calls for the preservation of the forest regions ecosystem but also allows for controlled and green timber extraction.

**Law and Regulations:**

Due to the nature and extent of forest destruction, efforts to stop the human activities can be complemented by laws and regulation at governmental and organizational levels. As much as people increasingly become aware of deforestation consequences, some people focus more on the immediate economic gains at the expense of the long-term environmental damage.

This attitude has encourages illegal logging for timber and other valuable resources like rubber and palm oil. Therefore, stopping deforestation and preserving the natural vegetations demands rules, laws, and regulations from organizations and governments to aid in enforcing forest preservation policies. Laws on timber, wood fuel, farming, and land use among other forest resources must be advanced and enforced to limit deforestation.

**Community Forestry:**

Community forestry is whereby local communities together with their local government and other local organizations such as schools, corporate, and universities join hands to start localized tree planting programs and management of their local forests. On various occasions such as public holidays, opening ceremonies, environment days, or other periodic localized activities, concerned local citizens can create awareness and plant trees.

This can be done within the surrounding areas as a method of boosting environmental sustainability and keeping the local forests viable. All local learning institutions, hospitals, local government headquarters, and the rest of the community can ensure trees are planted and the local forests are protected against damage as a way of finding solutions to the deforestation menace

**Replanting (Reforestation):**

Replanting or tree planting utilizes almost the same aspect as community forestry. However, it entirely focuses of replanting, a feature commonly known as reforestation. Reforestation is the restoration or replanting of forests that have been reduced by fire or felling. It requires an ongoing process and should not be viewed as a onetime thing.

People, communities, governments, and organizations are all active actors. It involves selecting and dedicating large tracts of land mainly for the purpose of cultivating forests. For instance, in local communities and urban centers, it can be done around market areas, in game/wildlife reserves, or within city parks. Replanting, therefore, qualifies restorative measure of deforestation

**Sensitization and Educative Campaigns:**

Deforestation can also be counteracted through awareness and sensitization. Sensitization and educative campaigns can be a simple but a more workable solution. Initiating awareness creation champagnes makes it easy for people to detect the causes, effects, and ways of counteracting deforestation. Personal experiences from adversely affected communities such as farmers can be used to emphasize the negative effects of deforestation.

Thus, making conscious efforts to share information with people including family, friends, colleagues, and the entire community on deforestation and its effects is an appropriate measure of standing up in unison to combat the clearing of forests.