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Green House Effect

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ABSTRACT: The greenhouse effect is the process through which heat is trapped near Earth's surface by substances known as 'greenhouse gases.' Imagine these gases as a cozy blanket enveloping our planet, helping to maintain a warmer temperature than it would have otherwise. Greenhouse gases consist of carbon dioxide, methane, ozone, nitrous oxide, chlorofluorocarbons, and water vapor. Water vapor, which reacts to temperature changes, is referred to as a 'feedback', because it amplifies the effect of forces that initially caused the warming.

KEYWORDS: greenhouse effect, earth, temperature, global warming, gases

I. INTRODUCTION

Scientists have determined that carbon dioxide plays a crucial role in maintaining the stability of Earth's atmosphere. If carbon dioxide were removed, the terrestrial greenhouse effect would collapse, and Earth's surface temperature would drop significantly, by approximately 33°C (59°F).

Greenhouse gases are part of Earth's atmosphere. This is why Earth is often called the 'Goldilocks' planet – its conditions are just right, not too hot or too cold, allowing life to thrive. Part of what makes Earth so amenable is its natural greenhouse effect, which maintains an average temperature of 15 °C (59 °F) . However, in the last century, human activities, primarily from burning fossil fuels that have led to the release of carbon dioxide and other greenhouse gases into the atmosphere, have disrupted Earth's energy balance. This has led to an increase in carbon dioxide in the atmosphere and ocean. The level of carbon dioxide in Earth's atmosphere has been rising consistently for decades and traps extra heat near Earth's surface, causing temperatures to rise.[1,2,3]

II. DISCUSSION

The greenhouse effect is a process that occurs when gases in Earth's atmosphere trap the Sun's heat. This process makes Earth much warmer than it would be without an atmosphere. The greenhouse effect is one of the things that makes Earth a comfortable place to live. As you might expect from the name, the greenhouse effect works … like a greenhouse! A greenhouse is a building with glass walls and a glass roof. Greenhouses are used to grow plants, such as tomatoes and tropical flowers.

A greenhouse stays warm inside, even during the winter. In the daytime, sunlight shines into the greenhouse and warms the plants and air inside. At nighttime, it's colder outside, but the greenhouse stays pretty warm inside. That's because the glass walls of the greenhouse trap the Sun's heat.

The greenhouse effect works much the same way on Earth. Gases in the atmosphere, such as carbon dioxide, trap heat similar to the glass roof of a greenhouse. These heat-trapping gases are called greenhouse gases.

During the day, the Sun shines through the atmosphere. Earth's surface warms up in the sunlight. At night, Earth's surface cools, releasing heat back into the air. But some of the heat is trapped by the greenhouse gases in the atmosphere. That's what keeps our Earth a warm and cozy 58 degrees Fahrenheit (14 degrees Celsius), on average. Human activities are changing Earth's natural greenhouse effect. Burning fossil fuels like coal and oil puts more carbon dioxide into our atmosphere.

NASA has observed increases in the amount of carbon dioxide and some other greenhouse gases in our atmosphere. Too much of these greenhouse gases can cause Earth's atmosphere to trap more and more heat. This causes Earth to warm up. Just like a glass greenhouse, Earth's greenhouse is also full of plants! Plants can help to balance the greenhouse effect on Earth. All plants — from giant trees to tiny phytoplankton in the ocean — take in carbon dioxide and give off oxygen.

The ocean also absorbs a lot of excess carbon dioxide in the air. Unfortunately, the increased carbon dioxide in the ocean changes the water, making it more acidic. This is called ocean acidification.

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More acidic water can be harmful to many ocean creatures, such as certain shellfish and coral. Warming oceans — from too many greenhouse gases in the atmosphere — can also be harmful to these organisms. Warmer waters are a main cause of coral bleaching.
A greenhouse gas is called that because it absorbs infrared radiation from the Sun in the form of heat, which is circulated in the atmosphere and eventually lost to space. Greenhouse gases also increase the rate at which the atmosphere can absorb short-wave radiation from the Sun, but this has a much weaker effect on global temperatures.

The CO_2 released from the burning of fossil fuels is accumulating as an insulating blanket around the Earth, trapping more of the Sun's heat in our atmosphere. Actions carried out by humans are called anthropogenic actions; the anthropogenic release of CO_2 contributes to the current enhanced greenhouse effect

The contribution that a greenhouse gas makes to the greenhouse effect depends on how much heat it absorbs, how much it re-radiates and how much of it is in the atmosphere.

In descending order, the gases that contribute most to the Earth's greenhouse effect are:
- water vapour (H_2O)
- carbon dioxide (CO_2)
- nitrous oxide(N_2O)
- methane (CH_4)
- ozone (O_3)

In terms of the amount of heat these gases can absorb and re-radiate (known as their global warming potential or GWP), CH_4 is 23 times more effective and N_2O is 296 times more effective than CO_2. However, there is much more CO_2 in the Earth's atmosphere than there is CH_4 or N_2O.[4,5,6]

Not all the greenhouse gas that we emit to the atmosphere remains there indefinitely. For example, the amount of CO_2 in the atmosphere and the amount of CO_2 dissolved in surface waters of the oceans stay in equilibrium, because the air and water mix well at the sea surface. When we add more CO_2 to the atmosphere, a proportion of it dissolves into the oceans.

Anthropogenic greenhouse gases
Since the start of the Industrial Revolution in the mid-18th century, human activities have greatly increased the concentrations of greenhouse gases in the atmosphere. Consequently, measured atmospheric concentrations of CO_2 are many times higher than pre-industrial levels.

III. RESULTS

Main sources of anthropogenic greenhouse gases
Burning fossil fuels
Carbon dioxide levels are substantially higher now than at any time in the last 750 000 years. The burning of fossil fuels has elevated CO2 levels from an atmospheric concentration of approximately 280 parts per million (ppm) in pre-industrial times to over 400 ppm in 2018. This is a 40 per cent increase since the start of the Industrial Revolution.

CO2 concentrations are increasing at a rate of about 2–3 ppm/year and are expected to exceed 900 ppm by the end of the 21st century.

If this continues, together with rising emissions of CH4 and other greenhouse gases, by 2100 the global average surface temperature could have increased by up to 4.8°C compared to pre-industrial levels. Consequently, some scientists suggest goals to limit concentrations to keep temperature change below +2°C. This would include substantial cuts in anthropogenic greenhouse gas emissions by the middle of the 21st century through large-scale changes in energy systems and land use.

In 2010, the burning of coal, natural gas and oil for electricity and heat was the largest single source of global greenhouse gas emissions (25 per cent). By comparison, in 2010, 14 per cent of global greenhouse gas emissions came from fossil fuels burned for road, rail, air and marine transportation.

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Agriculture, deforestation and other changes in land use account for one quarter of net anthropogenic greenhouse gas emissions. According to a United Nations report, livestock is responsible for about 14.5 per cent of this. The main sources of emissions are:

- feed production and processing (45 per cent)
- outputs of greenhouse gases during digestion by cows (39 per cent)
- manure decomposition (10 per cent

The rest is attributable to the processing and transportation of animal products.
Higher concentrations of atmospheric CH_4 are also caused by changes in land and wetland use, pipeline losses and landfill emissions. The use of fertilisers can also lead to higher N_2O concentrations.
Cement manufacture contributes CO_2 to the atmosphere when calcium carbonate is heated, producing lime and CO_2.

Estimates vary, but it is widely accepted that the cement industry produces between five and eight per cent of global anthropogenic CO_2 emissions, of which 50 per cent is produced from the chemical process itself and 40 per cent from burning fuel to power that process. The amount of CO_2 emitted by the cement industry is more than 900 kg of CO_2 for every 1000 kg of cement produced Aerosols are small particles suspended in the atmosphere that can be produced when we burn fossil fuels. Other anthropogenic sources of aerosols include pollution from cars and factories, chlorofluorocarbons (CFCs) used in refrigeration systems and CFCs and halons used in fire suppression systems and manufacturing processes. Aerosols can also be produced naturally from a number of natural processes e.g. forest fires, volcanoes and isoprene emitted from plants.

We know that greenhouse gases provide a warming effect to Earth's surface, but aerosol pollution in the atmosphere can counteract this warming effect. For example, sulphate aerosols from fossil fuel combustion exert a cooling influence by reducing the amount of sunlight that reaches the Earth.

Aerosols also have a detrimental impact on human health and affect other parts of the climate system, such as rainfall.[7,8,9]

Volcanic ash dunes of Tarvurvur, Papua New Guinea. Sea salt, dust and volcanic ash are three common types of aerosols. Aerosols directly scatter and absorb radiation. The scattering of radiation causes atmospheric cooling, whereas absorption can cause atmospheric warming.

IV. CONCLUSION

Human action is causing an increase in global temperature. For that reason, the greenhouse effect, far from being our great ally as was the case in the past, is now a risk to our survival. The flooding of coastal cities, the desertification of fertile areas, the melting of glacial masses and the proliferation of devastating hurricanes are just some of the main consequences.
The increase in the average temperature on Earth is changing living conditions on the planet. Let's find out about the main consequences of this phenomenon:

- Thawing of glacial masses

Glaciers retreat also has its own consequences: reduced albedo — the percentage of solar radiation that the earth's surface reflects or returns to the atmosphere —, a global rise in sea level and the release of large methane columns are only some of them, however, they are all dramatic for the planet.

- Flooding of islands and coastal cities

According to Intergovernmental Panel on Climate Change (IPCC, 2014), during the period 1901-2010 the global average sea level rose 19 centimetres. It is estimated that by 2100 the sea level will be between 15 and 90 centimetres higher than it is now and will threaten 92 million people. This is reflected in NASA reports indicating that in the last year, the average global sea level rose by 0.27 centimetres.

- Hurricanes will be more devastating

The intensification of the greenhouse effect does not cause these extreme climatic events, but it does increase there intensity. Hurricanes formation are connected with sea temperature — they only form over waters that have a temperature of at least 26.51 ºC —. In 2021, the Mediterranean in Spain reached 31 degrees Celsius, with 95 % of the days being warmer than usual.[10,11,12]
Migration of species
Many animal species will be forced to migrate in order to survive the changes in the main climatic patterns altered by the progressive increase in temperatures. The lastest studies in Canada have confirmed that 66% of the migratory birds have arrived before the first one started and flew later than usual; this is due to the increasingly shorter winters. Human

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beings will also have to move: according to the World Bank, by 2050 the number of people forced to flee their homes due to extreme droughts or violent floods could reach 140 million.

Desertification of fertile areas

Global warming is having a profound impact on the processes of soil degradation and is contributing to the desertification of areas on the planet, a phenomenon that destroys all the biological potential of affected regions, turning them into barren and unproductive land. As recognised by the UN on the occasion of the World Day to Combat Desertification in 2018, 30% of land has been degraded and lost its real value.

In recent years, almost 12 million hectares have been lost annually, 40% of degraded lands are also in vulnerable areas, which is leading to serious problems for the food security of almost 3 billion people, according to the UN.

Impact on agriculture and livestock

Global warming has already altered the length of the growing season in large parts of the planet. Similarly, changes in temperatures and seasons are influencing the proliferation of insects, invasive weeds and diseases that can affect crops. The same is happening with livestock: climatic changes are directly affecting important species in multiple ways: reproduction, metabolism, diseases, etc

Greenhouse effect

The consequences of the greenhouse effect: from desertification to floods

Nature

Human action is causing an increase in global temperature. For that reason, the greenhouse effect, far from being our great ally as was the case in the past, is now a risk to our survival. The flooding of coastal cities, the desertification of fertile areas, the melting of glacial masses and the proliferation of devastating hurricanes are just some of the main consequences.

Global warming is having a profound impact on the processes of soil degradation and is contributing to the desertification of the most arid areas on the planet.

The increase in the global temperature of the planet produces a rise in the level of the sea, which will cause the disappearance of islands and coastal cities.

Fighting the consequences of the greenhouse effect

What is the greenhouse effect

The greenhouse effect is a natural phenomenon and is beneficial for us. Certain gases in the atmosphere retain part of the thermal radiation emitted by the Earth's surface after being heated by the sun, this maintains the planet's temperature at a level suitable for the development of life. Human action — through activities such as industry, intensive agriculture and livestock farming, or transport —, however, has increased the presence of these gases in the atmosphere — mainly, carbon dioxide and methane as a result of the burning of fossil fuels such as coal, oil or gas —, causing them to retain more heat and to increase the temperature on the planet. This is what we know as global warming.

Consequences of the greenhouse effect

The increase in the average temperature on Earth is changing living conditions on the planet. Let's find out about the main consequences of this phenomenon:

Thawing of glacial masses

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Impact on agriculture and livestock

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Thawing will produce a global rise in sea level and the release of more methane, among other consequences.

The intensity of hurricanes will be greater due to the greenhouse effect.

Many animal species will migrate as consequence of the high temperatures.

With global warming, insects, invasive weeds and diseases will affect crops.

Consequences of the greenhouse effect on human health

The greenhouse effect is also directly affecting human health through:

Food shortages

The United Nation's Food and Agriculture Organization (FAO) states that climate change is raising serious doubts about food availability: in its last biennial report on the state of world food and agriculture, it warns that a decline in agricultural production would result in food shortages, most severely affecting sub-Saharan Africa and South Asia.

The spread of diseases and pandemics

In addition to the problems derived directly from pollution, the World Health Organization (WHO) states that global warming will cause infectious diseases such as malaria, cholera or dengue to spread to many more areas of the planet, which is closely related to the need for people to emigrate due to economic problems.On the other hand, extreme heat will increase and aggravate cardiovascular and respiratory problems. In Spain, studies indicate that there have already been cases of Dengue and Zika by native species, although always of a mild nature. If temperatures continue to rise, there is a possibility that one of the most dreaded diseases of the African continent, the same one that has been eradicated in Spain since 1964, may return.

Reducing emissions of the so-called greenhouse gases, such as CO_2 or CH_4 is not the only solution to curb the greenhouse effect. International organisations also agree on the following recommendations:

- Use renewable energy. They are driving our progress in preserving the environment and alleviating the crisis of exhaustible energy sources, such as gas and oil.
- Use public transport and other non-polluting means, such as electric vehicles or bicycles.[16,17,18,19]
- Promote ecological awareness among citizens and different administrations.
- Commit to recycling and the circular economy.

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- Reduce the consumption of meat and the food waste.
- Consume organic products.

Climate action is synonymous with any policy, measure or programme that works to reduce greenhouse gases, builds resilience to climate change or supports and finances those objectives. The Paris Agreement (2015) was the first major international agreement towards those ends. At COP21, when it was signed, 174 countries and the European Union agreed to work with the goal of keeping global warming below 2°C.

Within its climate action, the Iberdrola group is committed to becoming carbon neutral by 2030 in Europe, it has also committed to reducing its global CO2 emissions intensity to 50g/kWh — which would be 70g/kWh by the end of 2025 — until it becomes carbon neutral globally by 2050. The company has also set a target to reduce absolute Scope 1, 2 and 3 greenhouse gas (GHG) emissions, which has been approved by the Science Based Target initiative.[20]

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