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Climate Change

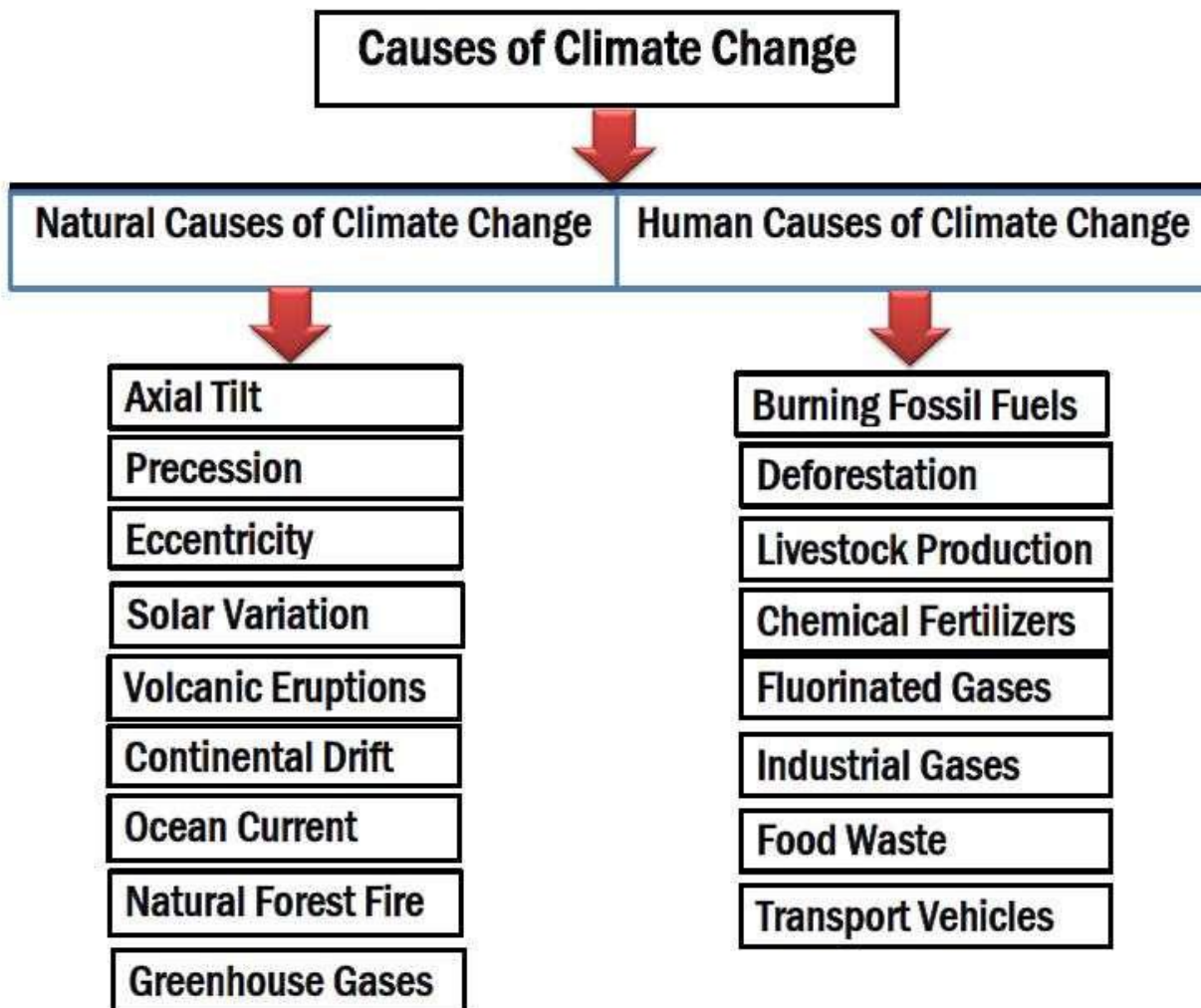
Climate change means a change in the atmosphere of certain areas for a long time. It also refers to the new condition of the weather including drought, temperature, rain, earthquake, snowfall and so more (Dagbegnon, Djebou, & Singh, (2016). Climate change brings new weather on the planet different than in previous years. The climate of the earth has been changed in the current decades. It is related to global warming that is a much-talked topic globally. Global warming denotes increasing the temperature of the earth. However, climate change does not only mention the temperature rising but also reduces the earth's temperature.

Way and Del Genio (2020) stated that the temperature on the planet has risen dramatically in the last 100 years. For instance, the planet is 2 degrees Celsius warmer than last century. However, the earth's temperature was never being constant rather it evolves from time to time. The last five years were the warmest year in the current age. The top country leaders including the prime ministers in America, Canada, and Australia aware of the climate change topic. World leaders and scientists have come up with a vision to control the planet's temperature.

Climate change refers to the change in global climate patterns of the last century. Most scientists accept that it is a reality tied to carbon dioxide and other greenhouse gases emitted through human activities including the use of fossil fuels, that emits greenhouse gases and trap heat in the Earth's atmosphere causing temperatures to rise. In fact, the ten warmest years on record have all occurred since 1998. so how did we get here in 1769 James Watts's version of the steam engine was patented. This innovation led to the widespread use of coal a major fossil fuel.

Types of Climate Change Causes

Based on the previous studies, the most common two types of climate change causes are the natural causes and human causes of climate change. Natural causes refer to the physical factors that contribute to the change of the atmosphere on the Earth. On the other hand, human causes mean man-made factors and people's activities that change to climate on the Earth (Defar, 2017). Based on the studies, I have outlined a few major natural and human causes of climate change on the planet.



Conceptual Framework for the study

Natural Causes of Climate Change

Natural causes refer to the actual elements and actions that contribute to change the atmosphere of the earth. Natural factors occur naturally from the natural cycle of the planet. People can't control these factors therefore these are known as natural causes. The most common physical causes are the Milankovitch cycle, ocean, gravity, forest fire, solar activities, volcano, and greenhouse gases (GHG). Some factors contribute to increasing temperature on the planet; on the other hand, other factors trigger to reduce them. These natural causes stimulate change to the condition of the planet instantly and slowly.

Axial Tilt

According to Boulila, et al., (2010), the Milankovitch Cycle describes the entire process of how the planet orbits the sun. The planet needs 365 days to move around the sun. At the same time, the sun needs only 24 hours to rotate on its axis.

Axial tilt is the angle of the planet that occurs during rotation. It relates to the angle within the orbital and perpendicular plane. Axial tilt is also called obliquity. The axial tilt or obliquity is responsible for the various seasons on the planet. Boulila, et al., (2010) stated that the planet is 23.5 degrees tilted from its orbital plane. Usually, the obliquity differs from a minimum of 22.1 degrees and 24.5 degrees while rotation. The season gets extended when the axial tilt is maximum, and the season gets shorter when the axial tilt is minimum. The planet consumes more solar radiation when it rotates with maximum tilted towards the sun. In contrast, the planet receives less heat from the sun when it tilted the opposite side of the sun.

The cycle takes 41,000 years to get back to the ice age; so, people will see the ice age again after 41,000 years. Now the planet is 23.5 degrees tilted towards the sun therefore, it receives more heat from the sun. It is the reason for extended summer and winter on the planet.

Precession

Precession is the transition of rotational axis' adjustment for the gravity power. It relates to the action of the gyroscope power. It takes around 26,000 years to complete the entire cycle. The planet wobbles towards the sun or opposite the sun after this time period that contributes to the change in the climate. The planet gets more solar radiation when it leans toward the sun for precession. On the other hand, it gets less heat when leaned opposite the sun. So, precession is the natural cause to change the atmosphere on the planet.

Eccentricity

Eccentricity refers to the planet's position while moving around the sun; therefore, it is also called orbital eccentricity. The planet takes 365 days to orbit the sun completely. Salas-Brito (2021) mentioned that the planet does not follow the same path to move the sun. We know that

the planet moves around the sun on a round circle that is not true. The planet does not move the sun in the same way. Sometimes, it moves the sun elliptical way. So, it measures the deviation of the circular path of the planet. Orbital eccentricity is included the deviation of the circular and elliptical way of the planet's movement around the sun. The variation of the earth's movement around the sun controls the solar radiation received from the sun. The deviation path sets the distance between the planet and the sun.

Salas-Brito (2021) mentioned that the summer season is longer than the winter season due to the orbital path variation. The summer season is around 5 days longer than the winter season. The planet is located approximately 94.5 million miles away from the sun in the summer season. So, the planet receives more solar radiation from the sun when it locates the farthest distance. It receives more heat, not for distance but for the position of the planet. In contrast, the planet locates around 91.4 million miles far from the sun in the winter season. The planet moves around the sun in a short distance during the winter season. The cycle takes around 100,000 years to complete the round. Now the position of the planet and sun is not circular rather it is elliptical in shape with the eccentricity $e \approx 0.0167$ (Salas-Brito, 2021).

Solar Activities

Solar activities mean releasing various types of radiation from the sun from time to time. It includes sunspots, solar flares, and solar radiation. For example, sunspots release more solar radiation compare to the regular portion of the sun that makes the planet warmer. So, the sun's heat depends on the solar activities driven by the sunspots. Recently scientists have identified many sunspots on the sun's outer layer that emit a larger number of solar radiation. However, the temperature in the sunspot is lower than the natural part of the sun. It seems like a black hole that gets visible for the magnetic cycle. According to Al-Ghussain (2019), sunspots occur from the storm on the surface. It is the most crucial factor in the sun that emits solar flares.

Biktash (2019) asserted that the sunspot's temperature is around 3,800 degrees Kelvin and the average temperature of the sun is 5,800 degrees, Kelvin. So, it is perceived that the sunspot's temperature is lower than another part of the sun. Sunspots emit a large number of ultraviolet rays that hit on the planet's surface and increase the temperature. It takes around 11 years to

reach the sunspots on a peak that is also known as the solar maximum (Al-Ghussain, 2019). The solar minimum of the solar cycle occurs when there is a small number of sunspots visible. In recent decades, the planet's temperature has risen 0.1 degrees Celsius due to solar maximum (Biktash, 2019). It makes the sun brighter and the planet warmer.

Volcanic Eruptions

Volcanic eruption is a natural hazard that occurs naturally (Taran, Zelenski, Chaplygin, Malik, Campion, Inguaggiato, & Fischer, 2018). It releases a huge number of dust, magma, and gases that affect the environment. The most adverse impact of the volcanic eruption is destroying the ecosystems. Many people can die from the eruption who stay near to the place. Additionally, it raises around 1100 degrees' Celsius temperature of the surrounding place (Taran et al., 2018). The lava can set fire on the forest that causes forest fires. Volcanic eruption destroys animal diversity and the ecosystem when it occurs in the ocean. The dust and gases emitted from the volcanic eruption make a dark ash cloud on the atmosphere. This ash cloud works like a sheet that reflects the sun's radiation. Solar radiation cannot enter the planet due to the ash cloud in the sky. Therefore, the ground place gets colder than the average temperature.

Many people believe that volcano eruptions raise the planet's temperature that is not true. The extremely hot lava emitted from the volcano increases the surrounding temperature for short time. However, the ash cloud reflects the solar radiation that makes the surrounding area colder for long time.

Continental Drift by Plate Tectonics

Continental drift means movement of the planet's plate tectonic called a change in the planet's crust (Yoshida & Yoshizawa, 2021). The planet has seven continents and the position of these continents is not constant. The research has shown that few continental drifts are moving slowly. The process of movement is very slow. The movement motion is approximately 0.5 to 10 cm annually (Yoshida & Yoshizawa, 2021).

Hence, the movement of continental drift causes to change the atmosphere on the planet. It has both positive and negative consequences on the planet. The continent is set on the planet's crust

and each continent is separated from another. The tectonic crust is differing into two types of crust such as less dense and denser crust. These tectonic crusts move slowly and independently. The movement of these crusts is responsible for earthquakes, volcanoes, and tsunamis. There are few factors that provide evidence of the planet's crust movement such as crust collision, subduction, spreading, and movement fault. The plate tectonic collision is the main reason for the earthquakes. Recently, a study showed that the Himalayan mountain height has extended due to the collision between Indian and Eurasian plates.

The collision between plates is also responsible for volcanic eruptions. It emits lava that is made from molten rock. So, continental drift is responsible to change the atmosphere on the planet.

Ocean Current

The ocean current refers to the continuous movement of the ocean waters (Ussiri & Lal, 2017); and it is a crucial physical cause to change the environment. The ocean current is formed from the gravitation power between the sun and moon, winds, and axial rotation of the planet. The ocean occupies around 75% area on the planet therefore it absorbs the majority of solar radiation emitted from the sun. The solar radiation evaporates the ocean water and generates vapor gases (H_2O). Although the land receives some solar radiation, it returns some heat to space. The ocean returns very little heat compared to the land areas. The solar radiation evaporates the water and creates the ocean current. The evaporation process raises the temperature in the surrounding areas on the planet. However, it makes rains by the evaporation cycle that reduce the temperature and humidity.

The ocean current melts the ice of the northern part that increases the sea level. It is responsible to melt the ice in raising the sea level continuously. The planet's weather gets changes rapidly if there are no ocean currents. It warms the planet.

Natural Forest Fire

Forest fires mean burning a forest for natural and human activities. Natural forest fire is the burning of a forest extremely due to natural causes such as drought and lightning. It is a physical

or natural cause of environmental change. Fires always create smoke, dust, greenhouse gases, and heat. These elements undoubtedly raise the temperature of the surrounding areas.

The most common types of forest fires are natural and human forest fires. Natural forest fires occur naturally without humans' activities. On the other hand, human forest fires mean setting the fire by the people intentionally or unintentionally. Forest fires can burn millions of plants, animals, insects, and birds. Its impacts the ecosystem and diversity extremely. The studies have shown that the number of natural forest fires is only 18 percent and man-made forest fires occupy 82 percent.

The warm temperature during the summer season triggers to set fire in the forest. Although lightning and drought are responsible to set fire in the forest, the wind spread the fires shortly. It engulfs the entire forest within a short time.

The forest fires can make a green forest into a dark desert. Forest fires release a large number of greenhouse gases, for example, carbon dioxide (CO₂), methane (CH₄), and ashes. (Köster, Köster, Berninger, Prokushkin, Aaltonen, Zhou, & Pumpanen, 2018). The greenhouse gas especially carbon dioxide traps the heat in space that increases the temperature on the planet. Additionally, it spoils the soil nutrient and creates methane gases that also contribute to raising the temperature on the planet.

Natural Greenhouse Gases

Natural greenhouse gases include carbon dioxide (CO₂), water vapor (H₂O), methane (CH₄), nitrous oxide (N₂O), and ozone (O₃) (Kweku, Bismark, Maxwell, Desmond, Danso, Oti-Mensah, & Adormaa, 2017). These gases contribute to increase the planet's temperature by trapping heat on the temperature. There are two types of greenhouse gases such as natural greenhouse gas created naturally and greenhouse gases created by human activities. The volcanic eruption, forest fire, and ocean current generate carbon dioxide and water vapor which are greenhouse gases. These gases can be created without human involvement therefore they are natural greenhouse gases.

These greenhouse gases let the solar radiation enter the planet easily however, they trap the heat in space without letting them go back. So, the greenhouse gases stimulate to raise the temperature on the planet.

Human Causes of Climate Change

Human causes refer to the people's activities that change the atmosphere on the planet. People's activities affect climate change directly. Therefore, it is also known as the anthropogenic cause of climate change. Anthropogenic denotes human activities that pollute the environment. People pollute the environment directly, which changes the climate; therefore, it is known as the human cause.

The most common human activities that cause climate change are Burning Fossil Fuels, Deforestation, Livestock Production, Fluorinated Gases, Chemical Fertilizers, Fluorinated Gases, Industrial Gases, Food Waste, and Transport Vehicles.

Burning Fossil Fuels

Fossil fuel burning is the most crucial human because that enhances the temperature on the planet (Ağbulut & Sarıdemir, 2019). Fossil fuels contain a large amount of carbon and hydrogen gases beneath the Earth's crust. They are made from decomposing animals and plants. The most common examples of fossil fuels are natural gas, bitumen, oil, coal, tar sands, and petroleum. People burn fossil fuels to generate energy for electricity and transportation. Fossil fuels release greenhouse gases, including carbon dioxide (CO₂), that trap heat in the atmosphere. So, burning fossil fuels is a catastrophic cause of global warming. They are the source of 80% of Earth's energy that is not renewable. The average temperature of the Earth has risen around 1-degree Celsius and sea level. As a result, people experience scorching weather in summer. It is also caused to biodiversity destruction, plant and animal extinction, worsening health conditions of people globally.

Deforestation

Deforestation is another human cause of environmental change in the Planet that occurs by the people's activities. People are directly associated with deforestation that affects biodiversity and the ecosystem on the Earth. Deforestation means cutting the forest areas by humans. People cut trees in the forest for urbanization, crop cultivation, and mining factors. Since 1960, the deforestation process reduces the forest areas on the Earth extremely, which contributes to change the atmosphere. According to the oxygen cycle, people inhale oxygen and exhale the carbon dioxide that trees consume. On the other hand, trees receive carbon dioxide and release oxygen for the respiration process.

The amount of carbon dioxide is increasing in the atmosphere due to deforestation. The more trees on the planet consume, the larger amount of carbon dioxide (CO₂). Deforestation destroys the carbon stores and releases the carbon dioxide on the planet. It is a primary human cause of rising greenhouse gases and climate change. According to the study in 2019, deforestation is responsible for an increase of 11 percent of carbon dioxide (CO₂) (Bennett, 2017).

Livestock Production

Livestock production is another primary human cause of climate change. It contributes to producing greenhouse gases that trap heat in the atmosphere. Livestock production is the agricultural process of farming domestic animals, including breeding, caring, and raising them. Nowadays, people farm domestic animals for commercial purposes to produce meat, milk, leather, etc. The most common animals in livestock farms are cows and sheep. These animals generate methane(CH₄) when they consume and digest foods. A report shows that cows generate around 150 billion gallons of methane gas every day (Das, 2017).

Methane is one of the greenhouse gases that contribute to raising the temperature on the planet. Livestock production is responsible for producing 14.5 percent of greenhouse gases. Domestic animal farming produces a large amount of carbon footprint that causes climate change. As people are actively associated with livestock, it is optimal to say that livestock production is an important human cause of climate change.

Chemical Fertilizers

Chemical fertilizer is responsible for changing the climate on the Earth; therefore, it is another man-made cause of climate change. People produce chemical fertilizers to use in modern agriculture.

Chemical fertilizers are modern fertilizers formed with chemical syntheses such as nitrogen, phosphorus, potassium, sulfur, etc. These ingredients contain nutrients for the plants. Fertilizers containing nitrogen produce nitrous oxide emissions. The farmers use chemical fertilizers to get more benefits from the farm. Although these fertilizers help to grow plants quickly and produce more corn and fruits, chemical fertilizers have adverse consequences on the environment.

For example, nitrogen-based chemical fertilizers emit nitrous oxide (N_2O), known as greenhouse gas (GHG). It is said that nitrous oxide (N_2O) is a long-lived greenhouse gas produced by agricultural activities. Chemical fertilizers contain nitrate (NO_3^-) and ammonia (NH_4^+). As a result, chemical fertilizer in agriculture generates critical greenhouse gas nitrous oxide (N_2O). Nitrous oxide (N_2O) traps the heat in the atmosphere that allows shortwave infrared to enter the Earth and obstacle the longwave Infrared to return toward the sun. The percentage of nitrous oxide in greenhouse gasses is 10-14 percent. People are responsible for producing 80% nitrous oxide by modern agriculture. The scientists warned the modern farmer to reduce chemical fertilizers in agriculture to combat the climate change problem.

Fluorinated Gases

Fluorinated gases are also human causes of climate change as people produce these gases for commercial purposes. The most common fluorinated gases are fluorinated gases (hydrofluorocarbons (HFCs), nitrogen difluoride perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) (Jiang, Lei, & Yu, 2021). People produce these fluorinated gases as the elements of aerosol cans, air conditions, refrigerators, and so more. These gases are crucial materials to produce semiconductors in the factory.

Fluorinated Greenhouse Gases

1. Hydrofluorocarbons (HFCs)
2. Sulfur hexafluoride (SF₆)
3. Nitrogen trifluoride (NF₃)
4. Perfluorocarbons (PFCs)

The fluorinated gases are also powerful GHG that trap temperature in the atmosphere. Fluorinated greenhouse gases are also known as F-gases that are responsible for global warming. According to the report, fluorinated greenhouse gases affect global warming more than 23000 times than carbon dioxide (CO₂).

Industrial Gases

Industrial gasses include carbon dioxide, nitrogen, oxygen, hydrogen, helium, noble gases, and so on. Industrial gases can be produced from two types of human activities: people produce them intentionally and industrial gases are emitted from industrial factories. Firstly, people produce these industrial gases in factories for commercial purposes. They compress these gases into liquid in the cylinder to sell them in the market. Secondly, electrical factories generate carbon dioxide and nitrogen when producing goods and energy. In the United States, electricity production factories emit 40 percent carbon dioxide (CO₂) (www.eia.gov, n.d.).

Industrial gases such as carbon dioxide and nitrogen gaseous materials are greenhouse gases that affect ozone depletion. The quantity of industrial gas emissions is increasing due to rising factories globally.

Food Waste

Food waste is a silent human cause of climate cause that many people do not know. Food waste means lose food intentionally or unintentionally. For example, many people waste foods intentionally without knowing the negative consequences of food waste. Food waste occurs during processing and distribution from the seller to the buyer. It is estimated that American people waste around 40 percent of their food yearly (Schanes, Dobernig, & Gözet, 2018).

Additionally, Americans waste around 27,000 gallons of water annually by throwing vegetables, fruits, eggs, and beef. Food waste produces methane(CH₄) gas when it decomposes in landfills. Methane(CH₄) is a powerful greenhouse gas that causes global warming and climate change on the Earth. The study shows that around 6-8 percent methane gas is emitted from wasted food. Therefore, food waste is a significant factor of climate change that many people do not know.

Transport Vehicles

Transport vehicles consume fossil fuels and emit greenhouse gases such as carbon dioxide (CO₂). Carbon dioxide (CO₂) is the most devastating greenhouse gas that raises the temperature (Jiang, Xiao, Kuznetsov, & Edwards, 2010) It is estimated that vehicles generate around 30 percent of greenhouse gases. The greenhouse gas emission has been increased rapidly in the last 30 years.

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