NANGARHAR UNIVERSITY
INTERNATIONAL JOURNAL OF BIOSCIENCES
REVIEW ARTICLE
NUIJB
e-ISSN: 2957-9988
Special Issue, 2024

Received: 15 Dec 2023 Accepted After Revision: 22 Jan 2024 Published Online: 10 Feb 2024

Effects of Human Activities on Climate Change: A Narrative Review

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ABSTRACT
The sun supplies the energy which runs the earth's climate system. Changes and modifications in the configuration and intensity of incident solar radiation which hits the Earth may produce changes in global and regional Climate. Since 1950, most of the warming has been caused by human activities, human activities which create the emissions of greenhouse gases. The energy balance of the climate system has been significantly disturbed by Human activities not only by burning fuels but also by the usage of various components of carbon. Greenhouse gas concentrations increase and global temperatures rise, the total amount of water vapor in the atmosphere also increases, further amplifying the warming effect. Therefore, this paper aims to explore the effects of human activities on climate change.

Keywords: Climate Change, Greenhouse Gases, Human Activities, Industrial Revolution, Radiation

INTRODUCTION
Climate change refers to consequential, long-term changes in the global climate. The global climate is the joined system of sun, earth and seas, wind, rain fall and snow, timberlands, uncultivated lands and grasslands, and whatever people do, too (Shafer, 2017). The sun supplies the energy which runs the earth's climate system. Changes and modifications in the configuration and intensity of incident solar radiation which hits the Earth may produce changes in global and regional climate(Haigh, 2011). Though solar radiation is necessary to life on Earth, its Ultraviolet part of the spectrum may also damage both living organisms and non-living matter. Ultraviolet radiation is usually split and divided into three wavelength bands namely UV-A, UV-B and UV-C and there wavelengths are (315-400 nm), (280-315 nm) and (100-280 nm) respectively. UV-C radiation is potentially the most damaging but is entirely filtered out by the Earth's atmosphere and does not hit the surface of the Earth. Due to absorption by stratospheric ozone, the Earth's surface is also heavily protected from the most damaging short wavelength UV-B radiation. UV-A radiation passes through the atmosphere with little attenuation and thus is the largest component of ground-level solar UV radiation. Although generally less harmful than UV-B radiation, UV-A radiation has important effects on tropospheric chemistry, air quality, aquatic and soil processes, as well as being mutagenic and causing immune suppression in humans (Damian et al., 2011).

Climate feedback is a natural process that responds to global warming by decreasing or additional increasing change in the climate system. Feedback that decreases the change in climate is called negative feedback. Feedback that increases change is called positive feedback. Climate change leads to change in the coverage, altitude, and reflectivity of clouds. These changes can then either increase or amplify (positive feedback) or decrease or dampen (negative feedback) the original change. The net effect of these changes is an amplifying, or positive, feedback due to increasing altitude of high clouds in the tropics, that makes them able to trap heat in a better way, and decrement in coverage of lower-level clouds in the mid-latitudes, which decreases the amount of sunlight they reflect. The amount of this feedback is not constant or uncertain due to the complex nature of cloud/climate interactions(Stocker, 2014). Human activities have significantly disturbed the energy balance of the climate system not only by burning fuels but also by the usage of various components of carbon(Cowtan et al., 2015). Experts and scientists generally regard the later part of the 19th century as the point at which human activity started influencing the climate. But the new study brings that date forward to the 1830s (Hansen et al., 2019).

Since 1950, most of the warming has been caused by human activities, human activities which create the emissions of greenhouse gases(National Academies of Sciences & Medicine, 2020).
Emissions are from natural sources and are as a result of human activities. Emissions of greenhouse gases which originate from human activities, known as anthropogenic emissions. Atmospheric greenhouse gases are the significant climate tools because they can be used to show the effects of human activities (anthropogenic emissions) on the climate system. Greenhouse gases taking significant part in climate change are Carbon dioxide, methane, nitrous oxide, synthetic ozone depleting gases and other long- lived halogenated gases and their changes over time (Uspensky et al., 2022). Greenhouse gas concentrations increase and global temperatures rise, the total amount of water vapor in the atmosphere also increases, further amplifying the warming effect(Wuebbles et al., 2016).

A gas has three characteristics determining its contribution to global warming: (1) its radiative forcing (the absorptivity of the gas for IR radiation) (2) its atmospheric lifetime. This characteristic defines how long a gas will persist once it enters the atmosphere. (3) Its global warming potential (GWP). It is the reflection of the first two properties(Khalil & Rasmussen, 1994).

LITERATURE REVIEW

Carbon Dioxide

Carbon dioxide is the vitally important greenhouse gas of the Earth. Without carbon dioxide, Earth's natural greenhouse effect would be too weak to keep the average global surface temperature above freezing. By adding more carbon dioxide to the atmosphere, the natural greenhouse effect is supercharged, causing global temperature to rise. Global atmospheric carbon dioxide has increased from 280 ppm in the pre-industrial atmosphere to over 413 ppm as of July 2020 (Berry, 2021). This increment is because of the anthropogenic emissions of carbon dioxide(Tans, 2009). As of 2019, among the total anthropogenic emissions from long- lived gases 2/3 (2.076 $W^{m^{-2}}$ out of 3.140 $W^{m^{-2}}$) is carbon dioxide, not including ozone, aerosols and clouds (Hofmann et al., 2009). In atmosphere, carbon dioxide is rising mostly because of the fossil fuels that are burnt for energy. Fossil fuels like coal and oil have carbon that plants pulled out of the atmosphere by photosynthesis over millions of years; that carbon is returned to the atmosphere as anthropogenic in just a few hundred years. Since the middle of the 20th century, annual emissions from burning fossil fuels have increased every decade, from about to 11 billion tons of carbon dioxide per year in the 1960s to an estimated 36.6 billion tons in 2022 according to the global carbon budget 2022. The present increase in carbon dioxide is caused by the anthropogenic emissions of carbon dioxide(Prentice et al., 2001).

Methane

Methane is the second most important greenhouse gas forcing with an estimated value of 0.5 Wm^{-2}since the pre-industrial period(Shindell et al., 2005). Methane is responsible for about 30% of the rise in global temperatures. Annual global methane emissions are about 580 Mt, which include 40% of emissions from natural sources and the remaining 60% originates from human activities, known as anthropogenic emissions. The largest anthropogenic source is agriculture, accounts for about 1/4 of emissions, followed by the energy sector, which includes emissions from coal, oil, natural gas and biofuels (IEA, 2022). In 2019, methane gave 0.52 Wm^{-2} to global total anthropogenic radiative forcing, around ¼ of that is because of carbon dioxide(Hofmann et al., 2006).The global warming potential of methane is 34 times more effective at trapping heat in the climate system compared to an equivalent emissions of carbon dioxide(Change, 2013). The atmospheric concentration of methane has increased by the factor of 2.5 since the pre-industrial period(Etheridge et al., 1998).

Nitrous Oxide

Nitrous oxide is of specific significance to human being as it is tied to energy use and to modern agriculture(Marland & Rotty, 1984). The abundance of N_2O in the atmosphere is growing at the rate of $0.94\ ppb\ year^{-1}$ (Berry, 2021). Its atmospheric lifetime is $\sim 120\ years$ and it has a GWP100 of 298 (Davidson & Kanter, 2014). The industrial sources of N_2O include the productions of nylon and nitric acid, fossil fuel fired power plants and vehicular emission(Berges et al., 1993). Around 66% of its anthropogenic emissions are because of agriculture(Röckmann & Levin, 2005). In the atmosphere, the global concentration of nitrous oxide has risen since the start of the Industrial Revolution, before the Industrial Revolution the concentration of nitrous oxide was almost constant at about 280–290 ppbv. In 1990, it reached about 310 ppbv and is rising at a rate of 0·5–1·1 ppbv (i.e. 0·2–0·3%) per year(Badr & Probert, 1992).

CONCLUSION

Since 1950, most of the warming has been caused by human activities, human activities which create the emissions of greenhouse gases. Emissions can be from natural sources and can be as a result of human activities. Emissions of greenhouse gases which originate from human activities, known as anthropogenic emissions. An example of human activities causing global temperature to rise is adding carbon dioxide to the atmosphere and by adding more carbon dioxide to the atmosphere, the natural greenhouse effect is supercharged, causing global temperature to rise. Global atmospheric carbon dioxide has increased from 280 ppm in the pre-industrial atmosphere to over 413 ppm as of July 2020. Another example of human activities causing global temperature to rise is adding methane to the atmosphere and adding more methane causing global temperature to rise as its global warming potential is 34 times more effective at trapping heat in the climate system compared to an equivalent emissions of carbon dioxide and as a result of human activities its atmospheric concentration has increased by the factor of 2.5 since the pre-industrial period. The third example of human activities causing global temperature to rise is adding nitrous oxide to the atmosphere. Sources of Nitrous oxide are nylon and nitric acid, fossil fuel fired power plants and vehicular emission and agriculture. the global concentration of nitrous oxide has risen since the start of the Industrial Revolution, before the Industrial Revolution the concentration of nitrous oxide was almost constant at about 280–290 ppbv. In 1990, it reached about 310 ppbv and is rising at a rate of 0·5–1·1 ppbv (i.e. 0·2–0·3%) per year.

Acknowledgment: We are thankful to the members of Basic science and biochemistry departments for giving as their valuable advice about the manuscript preparing.

Conflict of Interest: All authors express no conflict of interest in any part of the research.

Funding: This research received no external funding.

Authors Contributions: Adil developed the concept, literature search, paper writing, Hemmat edited the manuscript and Sherzad cited the reference and finalized the manuscript.

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