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Climate change: Causes and Consequences

Outline

1 Introduction

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1.3 Thesis Statement:

Climate change, caused by factors like greenhouse gas emissions and land use changes, leads to significant global challenges, including extreme weather events, rising sea levels, and disruptions in ecosystems and human societies.

2 Causes of Climate Change

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2.2 Human-driven causes of climate change at social level

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- case study - Saudi Arabia

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3 Consequences of Climate change

3.1 Consequences/effects of Climate Change on weather

3.1.1 Higher average temperatures

- Case study: Asia; on July 16 2023, the Persian Gulf International Airport in Iran reported a heat index of 152°F (66.7°C)

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- Saudi Arabia (During Hajj) 14 to 19 June 2024, at least 1,301 people died due to extreme heat waves — 51.8°C

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- The loss of about 267 gigatons of ice every year world wide.

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- Antarctica lost about 148 billion tons of ice per year

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8-9 inches rise in sea level

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- The world is losing species

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- Air pollution - respiratory diseases, strokes, and heart attacks
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5- Conclusion



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The President of the United States of America Barack Obama once said, "There's one issue that will define the contours of this century more dramatically than any other, and that is the urgent threat of a changing climate." Climate change, being a global phenomenon, has become a controversial issue.

Climate ^{change} is a long-term shift in average temperature and weather at the global level. Since the beginning of the industrial era, the change in climate has been observed, primarily driven by human activities, like the excessive burning of fossil fuels. According to Intergovernmental Panel on Climate Change (IPCC) report, the average temperature of the Earth has already risen by more than one degree Celsius. This alarming rise in temperature has become a very serious threat in the twenty-first century. It has undoubtedly caused devastating problems for the world. No region is safe from its

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effects. Some of the most important consequences of climate change are rising Earth's surface temperature, rising sea levels, heavy floods, and shrinking ice sheets. Moreover, changing weather patterns, longer wildfires, and frequent droughts. Climate, caused by factors like greenhouse gas emissions and land use changes, leads to significant global challenges, including extreme weather events, rising sea levels, and disruptions to ecosystems and human societies.

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The causes of climate change stem from both natural factors and human activities. Firstly, volcanic eruptions are an important natural cause of climate change. The dispersal of gases, aerosols and ash particles by volcanic eruptions plays a major role in the climate system. One of the key gases released during an eruption is sulfur dioxide, which can form sulfate aerosols. These aerosols reflect sunlight away from the Earth, leading to a temporary cooling effect on the planet's surface. For instance, the eruption of Mount Pinatubo in 1991 caused global temperatures to drop by about 0.5°C for a couple of years. Secondly, the fluctuations in solar radiations play a very small role in Earth's climate. Solar radiation warms the atmosphere and produces global wind patterns due to the uneven distribution of solar energy across the planet's surface (because of Earth's spherical shape and the tilt of its axis). Cloud formation, precipitation, and temperatures at different locations on Earth are

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all directly influenced by the Sun. ~~But~~
Thus, the Sun is largely responsible for Earth's climate. Climate changes caused by the Sun take place over much longer spans of time, hundreds of thousands of years, versus the rapid warming we have been experiencing in recent decades. Lastly, tectonic plate movements are a natural cause of climate change that can affect the Earth's climate over long geological timescales. As tectonic plates shift, they alter the positions of continents and ocean currents, which in turn influences global climate patterns. For example, the formation of mountain ranges due to tectonic collisions can affect wind patterns and precipitation, while the drifting of continents toward or away from the poles can change how much sunlight they receive, impacting temperature and climate.

~~Moreover~~ ~~the~~

Climate Change is driven by a combination of natural processes and human activities, both of which have a profound impact on the Earth's climate system. Firstly, a human-driven cause of climate change is the cutting down forests.

Deforestation is a significant human induced cause of climate change. Trees and forests act as carbon sinks, absorbing carbon dioxide (CO_2) from the atmosphere during photosynthesis. When forests are cleared or burned, the stored carbon is released back into the atmosphere, increasing the concentration of greenhouse gases, which contributes to global warming.

Similarly, the construction of societies and buildings for living is a significant contributor to climate change. Today with rapidly increasing population and their housing demands, the whole world has been victimized by critical consequences of global warming and climate change. From simple to complex

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Construction, materials being used only consume massive energy and resources during their life cycle but also deteriorate the environment releasing an enormous amount of dust, solid waste and greenhouse gases. According to IPCC in 2010, buildings accounted for 32% of total global climate change to occur. Additionally, burning fossil fuels is one of the primary causes of climate change. The burning of fossil fuels for transportation is a major cause of climate change, as cars, trucks, airplanes, and ships release significant amounts of carbon dioxide and other greenhouse gases, leading to an increase in global temperatures. Lastly, generating electricity plays a large part in releasing harmful greenhouse gases; approximately three-quarters of electricity generated in the UK comes from fossil fuels. Hence, burning fossil fuels - coal, oil, or gas - causes a large chunk of greenhouse gases that blanket the Earth and trap the sun's heat.

Agriculture also plays an important role in climate change. Agriculture accounts for an estimated ~~forty five~~

45 percent of total methane emissions which is a greenhouse gas. Firstly, livestock such as cows, sheep and goats produce methane during digestion (enteric fermentation).

This potent greenhouse gas is about 25 times more effective at trapping heat in the atmosphere than carbon dioxide over a 100-year period.

Secondly, agriculture methane doesn't only come from animals, though. Paddy rice cultivation is the second largest contributor of agricultural methane emissions.

In which flooded fields prevent oxygen from penetrating the soil, creating ideal conditions for methane-emitting bacteria - accounts for another 8 percent of human

linked emissions. Global rice production is releasing ~~damaging~~ greenhouse gases into the atmosphere, doing as much harm as 1,200 average-sized coal

power stations, according to the Environmental Defense Fund (EDF).

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Lastly, microbial decomposition of fertilizers is a cause of climate change. It releases greenhouse gases into the atmosphere. In the last century, human-made fertilizers have greatly boosted crop production, letting farmers grow more food on less land. But this uptick in fertilizers use has led to increased greenhouse gas emissions, making agriculture the second-largest source of climate change pollution. Moreover, making ammonia - a fertilizer, requires high pressure and temperature, which consumes a lot of energy. Most of this energy comes from burning fossil fuels, releasing carbon dioxide, the main driver of climate change. Hence, both the manufacturing and application of fertilizer has a heavy emissions toll, which greatly cause climate change.

Along with agriculture, excessive carbon emissions by developing countries are increasingly contributing to climate change. As these countries undergo rapid industrialization and urbanization, they often heavily rely on fossil fuels for energy.

This results in a significant increase in carbon dioxide and other greenhouse gases in the atmosphere.

According to Climate Action Tracker, in 2022, China was the largest climate polluter, making up nearly 30% of global emissions.

Additionally, deforestation and land-use changes in these regions further exacerbate the problem, as fewer trees are available to absorb CO₂. Secondly, ineffective natural disasters management can exacerbate

the impacts of climate change, making it a significant contributing factor. When countries are unprepared for natural disasters like floods, hurricanes, droughts, and wildfires, the damage can be more severe, leading to ~~more~~ increased deforestation, soil erosion, and loss of vegetation.

This, in turn, reduces the planet's ability to absorb carbon dioxide, contributing further to greenhouse gas accumulation. For instance, in Pakistan, National Disaster Management Authority (NDMA). Despite the ^{presence of the} NDMA, the country frequently faces floods, droughts, heatwaves, and other climate-induced disasters. Lastly, the industrial revolution, which began in the late 18th century, making a significant turning point in the history of CO₂ emissions and the onset of human-induced climate change. During this period, there was a massive shift from manual labor to machine-based manufacturing, powered primarily by coal and later oil and natural gas. This led to the rapid expansion of factories, transportation, and energy production, releasing unprecedented amounts of carbon dioxide into the atmosphere. This can lead to the warming of the planet and contribute significantly to the current climate crisis.

Besides, industrialization, the BRICS (Brazil, Russia, India, China, and South Africa) economies play a crucial role in global climate change due to their reliance on fossil fuels. Firstly, China and India, for instance, are among the largest consumers of coal, which has led to severe air pollution and high carbon emissions. Similarly, Russia's economy depends heavily on oil and gas production, contributing significantly to greenhouse gases.

Brazil's deforestation of the Amazon rainforest to clear land for agriculture and mining releases stored carbon into the atmosphere. According to Global Forest Watch (GFW), between 2000 and 2019, Brazil lost approximately 500,000 square kilometers of forest cover, contributing to global carbon emissions. Secondly, Saudi Arabia's reliance on non-renewable energy sources like oil has been a significant contributor to climate change. Over the last few years, the electricity energy demand in the Kingdom of Saudi Arabia (KSA) has increased many folds due to several factors.

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including increased population, industrialized economic activities, and urbanization.

Almost one third of greenhouse gas emissions are contributed from the electric power generation sector, mainly, by burning diesel and natural gas,

which significantly contributes to climate change. Lastly, the lack of

strong accountability and enforcement of the Paris Accord has contributed

to a slower global response to climate change. As a result, many

countries are not on track to meet their emission reduction

targets, and global temperatures are rising faster than anticipated.

The gap between pledged actions and actual implementation is widening,

increasing the risk of severe climate impacts.

Currently, the menace of climate change has become a great concern for living things, taking them to the brink of destruction. Moreover, it has, nowadays, started to express itself in multiple forms, such as the rise in the number of diseases and natural disasters. According to the World Research Institute (WRI), the temperature of the earth has currently risen by 1.1 Degree Celsius since the industrial revolution; apart from it, to the International Panel on Climate Change (IPCC), the rise in temperature will reach 1-5-degree Celsius by 2050.

Climate change has multiple of consequences, the first and foremost impact is the constant rise in temperature of the globe. On July 16, 2023, the Persian Gulf International Airport in Iran reported a heat index of 152°F (66.7°C). Such extreme temperatures are not only hazardous to human health, leading to heat stroke and dehydration, but they also strain infrastructure, disrupt air travel, and pose severe

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Challenges to daily life. Moreover, intense heat waves are one of the most severe consequences of climate change. UN Secretary General Antonio Guterres stating, "The era of global warming has ended. The era of global boiling has arrived." July 2023 had become the hottest month in the past 120,000 years. Furthermore, this year's Hajj turned tragic as over 1,300 pilgrims succumbed to scorching temperatures, which reached a blistering 51.8 Degree Celsius. The deadly heatwave in Saudi Arabia is part of a broader trend of unprecedented heat affecting regions worldwide. Additionally, irregular rain patterns are a crucial impact of climate change, leading to a range of environmental and socio-economic challenges. Some regions experience prolonged droughts, while other areas face heavy rainfall, resulting in flooding, soil erosion, and damage to infrastructure. For instance, the floods wreaked havoc, resulting in deaths in the UAE and Oman in 2024 April. Over 1000 flights at Dubai's airport were cancelled, causing significant travel disruptions.

Similarly, Southern China faced severe flooding in Guangdong province ^{in 2024} displacing over 100,000 people. Meanwhile, northern China battled prolonged droughts and heatwaves, highlighting the varied and devastating impacts of climate change across the country.

In the same fashion, the consistent rise in the melting of glaciers world wide is the great impact of climate change. The glaciers are the main source of clean water used to water plants, grow vegetables, drink, and, above all, have agricultural activities. The main source of income for agrarian countries like Palustan and to some estimates, glaciers lose about 267 gigatons of ice each year due to global warming. Thus, if the glaciers continue to melt at the same pace, the world, after some time, will surely face a shortage of clean water. Moreover, the polar regions are particularly vulnerable to a warming atmosphere. Average

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temperatures in the Arctic are rising twice as fast as they are elsewhere on earth, and the world's ice sheets are melting fast. The most severe impact of this is on rising sea levels. Sea level has risen globally by about 20 centimeters (approximately 8 inches) since 1900. By 2100, it's estimated our oceans will be 1.6 to 6.6 feet higher, threatening coastal systems and low-lying areas, encompassing entire island nations and the world's largest cities, including Los Angeles, Miami, and New York City, as well as Mumbai, India, and Sydney, Australia.

Additionally, severe dry spells and droughts are also caused due to the constant rise in temperature of the earth and its atmosphere. The droughts not only make the soil infertile but also cause difficulties for the farmers to sow and reap their agricultural products. Moreover, Pakistan has been included by the United Nations Convention to Combat

Desertification (UNCCD) in the list containing the top twenty-three drought-hit countries between 2020 and 2022, and that region is one of the major areas in Pakistan hit by the droughts and dry spells. This overall causes the migration of people to somewhat stable areas and the reduction of agricultural production, causing food shortages. Thus, the higher the temperature of the world, the lesser the agricultural products. Similarly, the earth's marine ecosystems are under pressure as a result of climate change. Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent. This increase is due to humans emitting more carbon dioxide into the atmosphere and hence more being absorbed into the ocean. As this acidification accelerates, it poses a serious threat to underwater life, particularly creatures with calcium carbonate shells or skeletons, including mollusks, corals, and corals. This can have

a huge impact on shellfisheries. The US Shellfish industry could lose more than \$400 million annually by 2100 due to impacts of ocean acidification. Furthermore, Karachi's fisheries, which contribute around 1 percent to Pakistan's GDP and support the livelihood of around 500,000 people, have experienced a drop in fish catch rates. Fish species like sardines, mackerel, and shrimp, essential to local diets and the economy, are seeing a 10-20 percent decline due to changing ocean chemistry.

Along with ocean acidification, climate change has also the consequences of health issues and malnutrition. Moreover, the spread of bacteria and other harmful fungi gets access to humans, especially women and children with vulnerable immune systems, in the presence of water. According to the World Health Organization (WHO), Pakistan has reported 4531 cases of measles and 15 cases of wild poliovirus in 2020.

and the main factor behind the rise of cases was uncontrolled floods. Additionally, the main cause of climate change is the burning of fossil fuels, which also causes air pollution. Air pollution in turn can lead to respiratory diseases, strokes, and heart attacks. According to Renewable Energy Policy Network for the 21st Century (REN21), more than 8.7 million people currently die every year due to outdoor air pollution. Similarly, climate change is impacting health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, heatwaves, storms, and floods. According to WHO, in 2020, 770 million people faced hunger - malnutrition, predominantly in Africa and Asia. Thus, climate change affects food availability, quality and diversity exacerbating food and nutrition crisis.

Page 202 Floods affected 53 million people
more than 1730 lost their lives
more than 8 million displaced people were
in health crisis

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Besides health issues and malnutrition, the rise in the temperature of the world due to climate change has compelled the movement of people from climate-affected countries to developed and climate-unaffected countries. People who live in drought-hit countries or states usually migrate to somewhat stable countries, like the migration of people from Somalia to Italy. According to the Internal Monitoring Displacement Center, weather related disasters caused the internal displacement of 23.9 million people in 2019 alone. Adding more to it, climate change has become a major threat to the migration of animals and birds. Moreover, every habitat has a particular type of species, are fulfilled by that in that particular region. However, it has been observed that a number of birds have left their habitats due to the rise in temperature and have migrated to the cooler regions of the world, causing

a disturbance in the equilibrium of nature. A better example is the migration of certain fish species from the Indian Ocean to the Antarctic regions, to the reports of 2010. Thus, if the rise in temperature and other natural disasters continued at the same rate, there might be no beautiful creatures after some time.

Along with migration of birds and animals, the economy of multiple nations has come under threat due to climate changes. The disasters not only take lives but also washes agricultural areas, which can easily be witnessed from Pakistan's Planning Minister's statement that more than ~~50~~^{14.8} billion dollars worth of damage has been done by the floods of 2022. Apart from it, the land that comes under the curse of floods becomes infertile, causing a decrease in agricultural products - a cause of food shortage, and it can easily be observed from the flour

crises in Balochistan. Thus, if floods and other natural disasters kept on increasing, multiple nations, especially the underdeveloped ones, would face food shortages.

Similarly, climate change has a profound impact on poverty.

~~Climate~~ Climate change is an emergency that has been affecting the planet and its inhabitants, human, plant, and animal, in big and small ways. However, it has had a greater impact on the poor and developing nations due to its disproportionate influence.

According to 2018 report by the Intergovernmental Panel on Climate Change of the United Nations estimates that "even a 1.5 degree increase in global temperature could push tens of millions of people into poverty."

It can be estimated that by 2030, climate change could push more than 120 million more people into poverty.

Furthermore, global climatic change affects agriculture and its impacts seem to increase daily. Pakistan is especially vulnerable to climate and has been ranked as the 12th most detrimentally impacted country due to climate change impacts on agriculture and livelihoods.

Climate change has increased temperature resulting in abrupt changes in rainfall patterns, which likely linked to agricultural production, water, and forest resources. In Pakistan, agriculture is the prime economic sector that supports approximately 45 percent of the country's workers, adds 21 percent to country's GDP (Gross domestic product), and contributes almost 60 percent to country exports.

Similarly, the floods of 2010 and 2022 have played havoc. The floods of 2022 were the worst disaster in Pakistan's history as the country faced a loss of \$10 billion while its food insecurity increased by 10%. A study points out that in Pakistan climate

Change will decrease agriculture productivity by 8 to 10 percent till 2040 and wheat will be one of the major losses. Additionally, soils support the growth of most plant life. They are a crucial element of land-based ecosystems and agriculture. Many soils properties are affected by changes in temperature and rainfall. If the rain is heavy enough, the soil cannot absorb it and water flows across the surface taking a layer of topsoil with it. It is estimated that climate change will have an overwhelming impact on agriculture through direct and indirect effects on the evolution of agricultural production, soil quality, animal breeding and diseases.

After analysing the drastic impacts of climate change, it becomes pretty important to suggest some

measures in order to counter the menace. Firstly, the use of renewable energy resources, like water, air, and sun, that are free from the release of Green House Gases (GHGs) instead of non-renewable energy resources, such as coal, natural gas and oil, producing a large amount of GHGs.

Initiatives for the purpose have already been taken both nationally and internationally, like Dera Hydropower Projects in Pakistan, will become Pakistan's largest hydropower producer, delivering 21 billion units of electricity annually. Similarly, China produces 63 percent of the world's solar photovoltaics (PV). It is the world's largest solar panel manufacturer as of at least 2024. Moreover, using less energy overall - in buildings, industries, public and private spaces, energy generation and transmission, and transportation - helps reduce emissions. This can be achieved by using thermal comfort standards,

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better insulation and energy efficient appliances, and by improving building design, energy transmission systems and vehicles. Furthermore, certain farming methods release high amounts of methane and nitrous oxide, which are potent greenhouse gases. Regenerative agricultural practices - including enhancing soil health, reducing livestock-related emissions, direct seeding techniques and using cover crops. (support mitigation)

Along with renewable energy resources, measures to reduce deforestation and forest degradation are key for climate mitigation and generate multiple additional benefits such as biodiversity conservation and improved water cycles. Forests act as carbon sinks, absorbing carbon dioxide and reducing the overall concentration of greenhouse gases in the atmosphere. Moreover, the Amazon forests are usually termed the lungs of the earth due to the provision of twenty percent oxygen worldwide. But they are constantly used for different purposes,

like paper and fireworks, causing a fall in the number of trees and oxygen levels, which overall raises global warming. Thus, there should be a worldwide campaign for reforestation similar to the ten-billion tree program of Pakistan. Similarly, population growth, along with increasing consumption, tends to increase emissions of climate changing greenhouse gases. It is impossible to control the rise in population unless every state worldwide collaborates with one another. Thus, every state must adopt the measures compulsory for the control of population growth.

Climate change can also be countered through the implementation of different climate accords signed by a number of countries. The Paris climate accord is an example of such an accord that was signed by 190 countries. However, no developed nation has followed the terms and conditions of the accord, due to which there occurs a constant rise in greenhouse gases and, ultimately

global warming. Thus, if the accord is implemented in its true spirit, the developed nations would limit the removal of GHGs and, ultimately, climate change. Moreover, the threat of climate change can also be countered through the provision of economic, food, and technological help to the climate-hit countries. With the provision of technological help, the suffering states would become able to rebuild their infrastructure and adopt all these measures with the help of which they can counter severe floods and draughts in future.

And the provision of economic help will enable them to sustain their lives on the blue planet Earth after facing draughts and floods.

Thus, developed countries have to help the climate-hit countries so that they can fight the threats of climate change effectively.

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In conclusion, climate change is one of the most threatening challenges facing humanity today, with far reaching causes and consequences. Some amount of climate change can be attributed to natural phenomena. Over the course of Earth's existence, volcanic eruptions, fluctuations in solar radiation, and tectonic shifts have all had observable effects on planetary warming and cooling patterns. Similarly, human activities, particularly the burning of fossil fuels, deforestation, and industrial processes, have accelerated the release of greenhouse gases, leading to a warming planet. Moreover the consequences of climate change are not only environmental but also social and economic, widening inequalities and posing significant health risks. Urgent and collective action is needed to mitigate its impact through sustainable practices, renewable energy adoption, and policies that limit emissions. Addressing climate change is not just about protecting the environment

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but also ensuring a safer, more equitable future for all, emphasizing the need for global cooperation and individual responsibility. As Jane Goodall (a British ethologist) wisely said, "Together, we have the power to change our course and create a sustainable future where our planet thrives for generations to come."



The end