

Human activities have been the primary drivers of recent climate change, resulting in global warming and a wide range of environmental and societal impacts. Mitigating climate change requires reducing greenhouse gas emissions, transitioning to cleaner energy sources, and adopting sustainable land and resource management practices. International efforts, such as the Paris Agreement, aim to address climate change through global cooperation and commitments to limit temperature rise.

Climate change refers to long-term shifts in the average weather patterns on Earth, including changes in temperature, precipitation, and extreme weather events. It is primarily driven by natural and human-induced factors. Here are the key causes of climate change:

- **Greenhouse Gas Emissions:** The primary driver of contemporary climate change is the increase in greenhouse gas concentrations in the atmosphere. These gases, such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), trap heat from the sun, leading to the greenhouse effect. Human activities, such as the burning of fossil fuels (coal, oil, and natural gas), deforestation, and industrial processes, have significantly increased the levels of these gases.
- **Deforestation and Land Use Changes:** The removal of forests and changes in land use, such as urbanization and agriculture, can reduce the planet's ability to absorb and store carbon. Forests act as carbon sinks by absorbing CO₂ through photosynthesis, and when they are cut down or burned, the stored carbon is released into the atmosphere.
- **Agriculture and Livestock:** Agriculture, particularly the production of rice and livestock, contributes to climate change through the release of methane, a potent greenhouse gas. The use of synthetic fertilizers in agriculture also releases nitrous oxide, another potent greenhouse gas.
- **Industrial Processes:** Industrial activities release greenhouse gases, including CO₂, CH₄, and N₂O, through various processes like cement production, chemical manufacturing, and refrigeration.
- **Transportation:** The combustion of fossil fuels in vehicles, including cars, trucks, ships, and airplanes, is a major source of CO₂ emissions. Transportation emissions have been steadily increasing with the growth in the number of vehicles and global trade.
- **Energy Production:** The generation of electricity and heat through the burning of fossil fuels is a significant source of CO₂ emissions. The transition to cleaner energy sources, such as renewable energy (solar, wind, and hydroelectric power), is a critical step in mitigating climate change.

- **Waste and Landfills:** Landfills release methane as organic waste decomposes anaerobically (without oxygen). Improved waste management practices can help reduce methane emissions.
- **Natural Factors:** Climate change can also be influenced by natural factors, including volcanic eruptions that release aerosols into the atmosphere, leading to short-term cooling, and variations in solar radiation.
- **Land Use Changes and Urbanization:** The conversion of natural landscapes into urban areas can alter local climate conditions, leading to increased temperatures in urban heat islands.
- **Changes in Land and Sea Ice:** The melting of land and sea ice in polar regions contributes to sea level rise and alters the planet's reflectivity (albedo), which can amplify warming.
- **Oceans and Carbon Sequestration:** Oceans act as carbon sinks, absorbing CO₂ from the atmosphere. However, as they absorb more CO₂, they become more acidic and can disrupt marine ecosystems.
- **Positive Feedback Loops:** Certain processes can amplify the effects of climate change. For example, the melting of Arctic ice exposes darker ocean water, which absorbs more heat, accelerating ice melt. This is known as a positive feedback loop.

