From the Desk of the Patron

We have addressed the critical challenges faced by the global community due to Earth processes, global warming, and climate change, and emphasized remedial measures. "From the Desk of the Patron" provides a synoptic and comprehensive explanation of the “Earth System Science Panorama - Section 2” in this issue. This section is a compilation and revitalization of findings, news, and events in Earth, climate, and environmental science, aimed at developing awareness and understanding within the student-teacher community and the wider public on these crucial and challenging issues. The key findings, such as rising global temperatures, severe weather events, resource depletion, melting polar ice caps, rising sea levels, and disruptions in ecosystems, are indeed alarming. It is important to highlight the interconnectedness between these environmental changes and their impacts on biodiversity, as well as the direct effects on human livelihoods and well-being. Human activities, such as greenhouse gas emissions, deforestation, and unsustainable practices, are significant contributors to climate change and environmental degradation. Presenting this information in simple language is essential for broadening the understanding of the general public, including students and teachers. Our proposed strategies, including transitioning to renewable energy sources, adopting sustainable land-use practices, conserving biodiversity, and developing climate-resilient infrastructure, align with our primary goals. Additionally, understanding Earth's geological processes is crucial for scientific advancements and addressing challenges posed by natural disasters and resource management. This section aims to foster a community-driven approach to understanding and addressing issues related to Earth, climate, planetary, and environmental sciences. By presenting complex scientific information in an accessible manner and encouraging critical analysis, we strive to engage and educate a broad audience. Together, through informed analysis and collective action, we can mitigate the impacts of global warming and climate change, ensuring a sustainable future for all.

Air Pollution and severe heat wave vrs Human Survivality in India

India, one of the fastest-growing economies in the world, grapples with severe air pollution issues, particularly in its urban centers. The combination of rapid industrialization, urbanization, vehicular emissions, agricultural practices, and inadequate regulatory measures has contributed to the alarming levels of air pollution in the country. Four of the world’s most polluted cities are in India. New Delhi has the worst air pollution of any capital city. Air pollution kills 1.25 million people in India every year. There is often haze of smog blanketing the city. New Delhi’s problems are caused by fumes from its sclerotic traffic and accentuated by diesel generators and the burning of fossil fuels in cooking by less-well-off families. Industry plays its part, as does the burning of waste and farmers setting fields alight after crops are harvested. Air pollution has been a significant issue in India for several years, and 2022 was no exception. The country faces challenges related to industrial emissions, vehicular pollution, agricultural burning, and other factors contributing to poor air quality. Here are some key points regarding air pollution in India during 2022.The most polluted cities of India in the year 2022 were Bhiwadi ,NewDelhi ,Darbhanga, Asopur, Patna, Ghaziabad, Darbhanga, Chapra, Muzaffarnagar, Greater Noida. Bhiwadi was the most polluted city in India in 2022, with an average PM2.5 concentration of 92.7 micrograms per cubic meter of air ($\mu g/m^3$). Nearby Delhi had the second highest PM2.5 concentration in India during the year, also above 92 $\mu g/m^3$. Bhiwadi and Delhi, which are less than 100 kilometers apart, were also among the top five most polluted cities worldwide in 2022.India's industrial sector, comprising manufacturing plants, power generation units, and refineries, emits significant amounts of pollutants such as particulate matter (PM), sulfur dioxide (SO2), nitrogen oxides (NOx), and volatile organic compounds (VOCs).The surge in the number of vehicles, coupled with outdated emission standards and poor maintenance practices, results in high levels of pollutants being released into the atmosphere. Agricultural practices such as crop residue burning, especially prevalent in northern India, contribute significantly to air pollution, especially during the winter months. Rapid urbanization leads to extensive construction activities, which generate dust and particulate matter, further exacerbating air quality. **Air pollution is linked to respiratory diseases, cardiovascular problems, and premature mortality. Vulnerable populations, including children, the elderly, and individuals with pre-existing health conditions, are particularly at risk. Pollution not only affects**

human health but also harms ecosystems, biodiversity, and agricultural productivity. Acid rain, caused by pollutants such as sulphur dioxide and nitrogen oxides, damages soil fertility and aquatic habitats.

Heat waves in India and Pakistan

The 2022 heatwave is estimated to have led to at least 90 deaths across India and Pakistan, and to have triggered an extreme Glacial Lake Outburst Flood in northern Pakistan and forest fires in India. The heat reduced India's wheat crop yields, causing the government to reverse an earlier plan to supplement the global wheat supply that has been impacted by the war in Ukraine. In India, a shortage of coal led to power outages that limited access to cooling, compounding health impacts and forcing millions of people to use coping mechanisms such as limiting activity to the early morning and evening. It is concluded that human-caused climate change made this heatwave hotter and more likely. Because of climate change, the probability of an event such as that in 2022 has increased by a factor of about 30. The same event would have been about 1C cooler in a preindustrial climate. With future global warming, heatwaves like this will become even more common and hotter. At the global mean temperature scenario of +2C such a heatwave would become an additional factor of 2-20 more likely and 0.5-1.5C hotter compared to 2022. It is important to note that this early heatwave was accompanied by much below average rainfall and humidity and thus constituted a dry heatwave, rendering humidity much less important for health impacts than heatwaves occurring late in the season and in coastal areas. In India, extreme heat hits hardest for people who must go outside to earn a daily wage (e.g. street vendors, construction and farm workers, traffic police), and consequently lack access to consistent electricity and cooling at home, limiting their options to cope with prolonged heat stress. Rising temperatures from more intense and frequent heat waves will render coping mechanisms inadequate as conditions in some regions meet and exceed limits to human survivability. Mitigating further warming is essential to avoid loss of life and livelihood. While some losses will inevitably occur due to the extreme heat, it is misleading to assume that the impacts are inevitable. Adaptation to extreme heat can be effective at reducing mortality.

In conclusion, **addressing air pollution and mitigating climate change are paramount for India and the global community to safeguard public health, protect the environment, and ensure sustainable development for future generations. Effective policies, technological innovations, and collective action are essential in tackling these interconnected challenges**. Attributed to human-caused climate change, the heatwave served as a warning of the increasing frequency and intensity of extreme weather events. As temperatures rise and heatwaves become more common, effective adaptation strategies will be crucial to reduce mortality and alleviate the strain on livelihoods and infrastructure. While losses due to extreme heat are inevitable to some extent, the implementation of **Heat Action Plans and other adaptive measures can significantly mitigate their impact. India's rollout of such plans across numerous cities and towns demonstrates progress in this regard, emphasizing the importance of early warning systems, public awareness campaigns, and supportive public services.** The 2022 heatwave in India serves as a stark reminder of the urgent need to address climate change and implement effective adaptation measures to protect vulnerable communities and build resilience against future extreme weather events.

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