

How to Cite:

Jyani, S., Dhinwa, M., Jha, N., Lachyan, A., & Kumar, S. (2022). COVID-19 pandemic's environmental and climatic effects in India: A review. *International Journal of Health Sciences*, 6(S2), 10411–10420. <https://doi.org/10.53730/ijhs.v6nS2.7713>

COVID-19 pandemic's environmental and climatic effects in India: A review

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Abstract--The COVID-19 epidemic has had a major impact on human lives as well as the global financial system. The global spread of a novel coronavirus turned into a pandemic, and its impact on humanity is currently the talk of the town. This virus has afflicted every country on the planet, and the nationwide lockdown has had a short-term worldwide environmental impact. The exponential rise in COVID-19 transmission and mortality rates has brought the entire planet to a stop as a result of its devastating implications. The country's social and economic development were severely harmed as a result of the nationwide lockdown. However, it has some good environmental effects, particularly in terms of air quality, since particulate matter (PM), NO₂, and CO concentrations in major cities throughout the world are reduced. In India, PM₁₀, PM_{2.5}, NO₂, SO₂, CO, O₃, and NH₃ concentrations were reduced by 51.84 percent, 53.11 percent, 52.68 percent, 17.97 percent, 30.35 percent, 0.78 percent, and 12.33 percent, respectively. This research examines the

national lockdown's environmental and climatic effects, as well as India's air pollution levels before and after the lockdown. Several components of the environment, including air, impact on weather conditions, water, noise pollution, and waste management, were investigated and reviewed in depth during, before, and after the lockdown scenarios. As a result, this review will serve as reference for administrators, environmentalists, and ground defenders in the fight against this deadly disease and its long-term health and environmental consequences.

Keywords---climate change, COVID-19, environmental impacts, air quality index, outbreak, waste-management.

Introduction

The novel COVID, called Coronavirus by the World Health Organization (WHO), first appeared in Wuhan, China, in late December 2019.¹ The episode of Coronavirus pandemic with a disturbing dramatic spread has made wellbeing emergencies all through the world. For the past two decades, a coronavirus outbreak has been reported by a number of people. Coronavirus first appeared in the form of severe acute respiratory syndrome (SARS) in 2003, and subsequently Middle East Respiratory Syndrome (MERS) in 2012, both of which originated in China.² The third, a zoonotic new coronavirus COVID-19, also known as SARS-CoV2, it has now become an international health emergency, has only been reported from China.³ Toward the beginning of March 2020, because of its fast spread, the WHO announced Coronavirus as a pandemic. Before its discovery, the disease that was eventually termed COVID-19 had already impacted over hundred countries.⁴ The disease became a global menace just after the deadly impacts.⁵

To contain the infection and adapt to the disease's negative consequences, many nations have implemented measures to reduce anthropogenic interactions, such as imposing strict quarantines, prohibiting public gatherings, limiting various modes of transportation, allowing social removing, and upholding curfews and lockdowns. Upon the confirmation of the first coronavirus case in India on January 30, 2020, an alert was given on March 11, 2020, imposing prohibitions on international travel to China, Iran, Italy, and Japan. The first COVID-19 positive case occurred on January 30 in Kerala, when a student returned from Wuhan, China.⁶ Kerala was the state in India with the most Coronavirus cases at first. As a result of the situation, necessary precautions were developed to mitigate the severity of this rare disease. Large social gathering places, such as institutions, shopping centers, and cinemas, were closed nationwide India on March 16, 2020. The lockdown was implemented in stages, with growing relaxations in socio-economic activities in less contaminated areas. The time of the multiple COVID-19 lockdowns was divided into phases in India.⁷ On March 22, 2020, Phase-I was executed for 14 hours, followed by a twenty-one-day total lockdown from March 25 to April 14, 2020, to identify red-zone cities (those having highest COVID-19 instances) and regulate third-stage communal transmission. To limit the spread and save as many lives as possible, the state-wide complete lockdown was expanded from 15.04.2020 to 03.05.2020 (phase-II)

and from 04.05.2020 to 14.05.2020 (phase-III).⁸ A substantial alteration in Earth's atmosphere and ecosystem was documented during the whole lockdown and quarantine period of Janta curfew, lockdown phase-I and lockdown phase-II, and pollution levels were lowered by nearly 50%.⁹

Comprehensive data on air quality from numerous Indian cities indicated that COVID-19 countermeasures resulted in a considerable and noticeable improvement in air quality. According to WHO¹⁰, roughly 4.2 million people died as a result of poor air quality in 2016. Having a beneficial impact on the air quality index (AQI) during India's nationwide lockout may therefore quite certainly save lives. According to the WHO, New Delhi is the 2nd most polluted city in the world, with PM_{2.5} levels of 32.8 g/m³.¹¹ According to data from the Environmental Performance Index, Delhi is one of the world's 100 most polluted cities.¹² According to the National Ambient Air Quality Standards (NAAQS), PM_{2.5} levels in Delhi are extremely high and well beyond acceptable levels.¹³⁻¹⁵ Increased air pollution has been linked to a variety of health problems, including respiratory problems.¹⁶

People's health is significantly harmed by air pollution. In a nation whose economy is built on energy, manufacturing, transportation, farming, and regional growth, it is vital to study the current situation of air pollution. Air quality is improving as a result of the nationwide lockdown, which is felt by everyone.¹¹ Smog has dissipated in areas like Delhi, and marine life is flourishing. In practically all of India's metro cities, pollution levels have decreased, and wildlife, including birds, are wandering around of their own accord.¹¹ The National Lockdown has also been found to enhance air quality on a larger scale in metro areas such as Delhi, where its energy consumption is considerable.¹¹

"These environmental changes are transient, not permanent," according to UN Environment Program Director Inger Andersen¹⁷, because the world environment experienced a brief pause before industrial activity resumed. According to certain recent investigations, the quality of air has improved drastically as a result of the limits placed on industrial activity during the lockdown. Greenhouse gas (GHG) concentrations have decreased to levels not seen since World War II, according to climate scientists. There has been a greater reduction in air pollution in industrialised cities near cold temperature zones.¹⁸ The article's main goal is to assess the considerable impact of COVID-19-related nationwide lockdown on air quality of India. This study attempted to look at not just the state of air quality, but also lockdown on noise and water pollution, as well as the critical issues of waste generation and recycling. The COVID-19 appears to be a boon, according to this review.

Various changes in India's environment during the lockdown

The Covid-19 epidemic has had a number of consequences for our environment. It has significantly improved the quality of our air and water, as well as drastically reduced our material use, water consumption, and waste output. As a result, human coronaviruses, which cause deadly respiratory tract infection, are linked to air pollution levels. More research on COVID-19 aggregation in a given set of environmental settings, based on actual experimental data, is needed.¹⁹

According to research conducted by the Central Pollution Control Board (CPCB) across 115 Indian cities, particulate matter (PM), nitrogen dioxide (NO₂), and sulphur dioxide (SO₂) emissions all fell significantly throughout the lockdown period. From 16 March and 15 April 2020, the CPCB inspected the cities. During lockdown, the air quality index (AQI) for cities was 78 percent, with 'good' and 'satisfactory' ratings, compared to 44 percent during the pre-lockdown period. So according to Central Pollution Control Board (CPCB), this drop may be because of restricted vehicle movement, stoppage of construction activities and control on industrial activities.”²⁰

According to Susanta Mahato et al²¹ research, just three weeks after the lockdown began on March 24, 2020, Delhi saw a significant improvement in air pollution levels. PM₁₀, PM_{2.5}, CO, and NO₂ concentrations had all decreased during the course of the research. The mean PM₁₀ and PM_{2.5} concentrations were reduced by 51.84 percent and 53.11 percent, respectively. The magnitude of PM_{2.5} dropped by 62.61 percent and 59.74 percent, respectively, as reported by vehicle and factory backdrop sites. Between before and after the Nationwide lockdown, there was a considerable difference in the percent of air pollutants (-30.35 percent CO and 52.68 percent NO₂). However, no such substantial reductions were recorded for SO₂ (17.97%) and NH₃ (12.33%), whereas the growing trend in ozone concentration was also reported in this study.

Another investigation conducted by Bera et al. (2020)²² found a significant reduction in PM_{2.5} and PM₁₀ concentrations in Kolkata city, from March 25 to May 15, 2020 compared to the last three years. In comparison to 2019, the PM₁₀ level fell to 8.94 percent during this time. Furthermore, during the lockdown in Kolkata, the level of NO₂ was reduced by 19.46 percent. Aside from that, pollutant SO₂ levels were reduced to 5.36 g/m³ in 2020. This study found a similar upward trend in the concentration of ozone, with the concentration of O₃ growing to 9.73 percent in April 2020 in Kolkata. Although, due to lower nitrogen oxide (NO) levels and low O₃ consumption, this spike in ozone concentration occurred in areas occupied by industries and traffic.

The large reduction in vehicle exhaust and industrial output emissions during the Nationwide lockdown period was primarily responsible for the decrease in PM₁₀, PM_{2.5}, NO₂, and CO concentrations.¹¹ In such a short period of time, India has seen an exponential decrease in greenhouse gas emissions, air pollution (50 percent reduction in the air quality index), water pollution, noise pollution, and solid waste pollution, all of which have had a good influence on the environment.¹⁹

Pre-lockdown and lockdown air quality indexes

In 2016, the Government of India and IIT Kanpur launched the 'National Air Quality Index' as part of the 'Swacch Bharat Mission' (NAQI).²³ CPCB issues a daily NAQI bulletin, in the year 2019, India announced 'The National Clean Air Programme,' with a projected national aim of a 20% -30% reduction in PM_{2.5} and PM₁₀ concentrations by 2024, using 2017 as a baseline. The National Air Monitoring Program (NAMP), which covers 240 cities across India, is run by the Central Pollution Control Board (CPCB) in collaboration with State Pollution

Control Boards to assess the level of air pollution hourly.⁹ The Air Quality Index (AQI) is a method for effectively disseminating air quality information to the general public so that they are aware of the country's air pollution levels.

Mahato et al.²¹ investigated the impact of lockdown on air quality between March 3rd and April 14th, 2020. Compared to the pre-lockdown, there was a considerable improvement in air quality one day following the commencement of lockdown (March 25, 2020). According to research conducted by Suresh et al. in Jaipur, due to a complete nationwide lockdown, the AQI fell from good to severe too good to satisfactory for more than 90% of cities in India. It is undeniable that the nationwide lockout improved air quality and reduced pollution.¹⁹

Predicting the impact of weather on concentrations

Furthermore, because to unfavourable weather circumstances, this shift in total air quality could be related to higher dispersion of pre-monsoon when the lockdown occurred.¹¹

Water quality during Covid-19

According to data from the CPCB and the UPPCB (Uttar Pradesh Pollution Control Board), the Ganga's water carries more dissolved oxygen and fewer nitrates on its most polluted stretch in Uttar Pradesh. These conditions are favourable for aquatic life to survive. Its biochemical oxygen demand (BOD) has decreased significantly, as has the overall coliform bacteria concentration, indicating improved water quality.²⁰ Similarly remarkable changes have been reported for the Yamuna River.²⁰ The Dhauladhar range in Himachal Pradesh was reportedly visible from Jalandhar, which is 200 kilometres away. During the lockout, citizens could view Mt. Kanchenjunga from Siliguri and Mt. Everest from various regions of Bihar. This occurred after 30 years, reflecting how long we had struggled with severe air pollution.²⁰

Waste generation and recycling in the context of Covid-19

The many environmental threats caused by organic and inorganic waste creation include soil deterioration, deforestation, and air and water pollution.^{24, 25} The WHO has declared COVID-19 to be an emergency, leading people all across the world to stay at home. Managing medical waste could be a serious issue because COVID-19 is spreading quickly to different countries throughout the world and there was no time. Organizations and enterprises involved in waste management have implemented coronavirus decontamination procedures to ensure proper disposal of medical waste. As a result, it is becoming increasingly important for concerned governments to develop answers to the problem.

When dumping face masks and other medical waste, it is the obligation of each individual to follow the rules and regulations.²⁶ Personal protective equipment (PPEs) such as gloves and masks have contributed to an increase in trash production in many developed countries.²⁷ Certain members of the community are more likely to suffer terrible repercussions as a result of their interactions with medical waste, household personnel, waste pickers, and other persons who

spend more time in public locations. The masks are made of plastic and are resistant to liquids. They are non-biodegradable and wind up in the water after being discarded.

Respirators, empty sanitizer bottles, and solid tissue sheets, and polycarbonate masks, account for a significant amount of medical waste when discarded. The massive amount of waste generated by millions of individuals using masks, gloves, and hand sanitizers on a daily basis will be a major problem. When various therapeutic wastes are thrown in a wildlife' natural environment on land and in the waters, animals may swallow these wastes, which could be fatal to them.²⁸

The COVID-19 pandemic is a global disaster, and regardless of its human impact, it will produce massive amounts of garbage that must be managed economically. Recycling garbage is an important ecological issue that should be a top priority for all countries.¹ It is the primary approach of pollution control, natural resource preservation, and energy conservation.²⁹ Noise levels in the environment around COVID-19.

Environmental noise is defined as an unpleasant sound produced by a high-volume anthropogenic operation such as a commercial or industrial operation, car engine movement, or some types of music. It is a major source of annoyance not just for the public but also for the ecosystem, producing health problems and altering natural environmental conditions.³⁰ Several countries-imposed quarantine measures, causing many people to stay at home. As a result, public transportation usage has dropped dramatically. The flights were cancelled all across the world. Commercial activity had nearly ceased. Cricket, football, volleyball, and hockey had all been suspended. Malls and markets were shuttered. All education institutions and schools were closed, and so were all private and public meetings. All of these modifications have resulted in a significant reduction in noise levels, particularly in large cities around the world. According to a study conducted by Suresh et al. in Jaipur, pollution levels were reduced by an average of 50% during Janta curfew, phase-I lockdown, and phase-II lockdown, and the same level of decrease was also accomplished for noise pollution.¹⁹

Covid-19 Pandemic: Risks, Rules, and Regulations

1. Controlling the present COVID-19 outbreak will need a variety of common activities to reduce the spread of coronavirus from person to person. Social isolation is a powerful tool for reducing illness spread. Working from home reduces social interaction.⁷
2. Several guidelines for medical workers, individuals, and researchers interested in the COVID-19 pandemic control have already been released.³¹ Decontaminating materials must be made available to public services.³²
3. Restrictions should be implemented to protect vulnerable populations such as the elderly, children, and, of course, health-care employees.³³ Coronavirus has been shown to raise the risk of people with cardiovascular

disease or even high blood pressure, diabetes, chronic respiratory illness, and cancer.³⁴

4. Follow proper travel guidelines, since travel screening could help to contain the virus and prevent it from spreading.³⁵
5. To avoid providing a breeding ground for flies, household garbage should not be tossed or collected outside. It should be dumped in pits instead. When spraying disinfectants, proper protective equipment must be used.³⁶
6. Every state should employ zonal colour codes to distinguish no infection, moderate infection and highly infectious zones.³⁷
7. To reduce crowding and movement, online ordering and delivery of medicines, groceries, veggies, and milk should be encouraged.³⁸

Conclusions

Pollution levels are strongly tied to public health, and lowering them in the country has become a necessity for everyone. The COVID-19 pandemic disaster's lockdown techniques send a powerful message to all governments throughout the world about the importance of maintaining environmental quality and natural ecosystem stability. Despite the fact that the COVID-19 pandemic and ongoing lockdowns have become a curse for millions of people and the global economy has collapsed. The COVID-19 pandemic, on the other hand, has resulted in better air, water, and noise pollution. As a result of the COVID-19 pandemic, governments around the world have taken a variety of measures that have resulted in significant reductions in air, water and environmental pollution and improvements in environmental quality, notably in countries with high COVID-19 transmission rates, such as India, the United States, Italy, and Spain. The concentrations of PM10, PM 2.5, O3, SO2, NO2, CO, and NH3 in India have all decreased significantly. Reducing concentrations of greenhouse gases in such a short time is not a long-term solution to environmental pollution.

The dramatic increase in air quality could have significant health implications. Planting trees and forest areas contribute significantly to carbon fixation and GHG reduction, which is closely connected to everyone's health. Planting requirements in dwellings and firm land, as well as strong enforcement by the relevant authority, will help achieve this goal. This can be accomplished through the development, implementation, and strict adherence to future strategy., The Covid-19 pandemic and its associated lockdown have provided us with a once-in-a-lifetime opportunity to take assessment of our environmental effect.

We are witnessing the clean air, pure water, and liveable cities/towns that we have long wanted. As a result, before we return to our normal lives, we should make a commitment to follow the sustainability principles in our social behaviour and lifestyle in order to keep our environment clean and permanent. Finally, the COVID-19 pandemic will have significant beneficial and harmful indirect effects on the ecosystem, with the latter having a greater impact. However, because the death tolls due to Covid-19 is rising at an alarming rate, it should not be viewed as a means of achieving beneficial environmental change.

This study was not supported by any other sources.
The authors have declared no conflicts of interest.

Consent to participate and ethics approval

This evaluation does not require ethical approval because no patient data will be collected. Plagiarism, confidentiality, malfeasance, data falsification and/or falsification, double publishing and/or submission, and duplication are all ethical issues that the author has thoroughly examined in this work.

Acknowledgements

We are thankful to the Government of India and our Administration for implementing a nationwide complete lockdown and its impact on the environment and climatic conditions are the basis for this paper. Our Central Pollution Control Board (CPCB) and Indian Meteorological Department (IMD) are widely credited for making free AQI data available online. The authors owe a debt of gratitude to every Indian citizen who was quarantined and remained at home during the recent COVID-19 outbreak. We are extremely grateful to the authors of published papers who provided us with an additional source of valuable pieces of information.

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