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# Impact of COVID-19 on Environment

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## Abstract

Worldwide spread of COVID-19 in a quite short time has brought a dramatic decrease in industrial activities, road traffic and tourism. Restricted human interaction with nature during this crisis time has appeared as a blessing for nature and environment. Reports from all over the world are indicating that after the outbreak of COVID-19, environmental conditions including air quality and water quality in rivers are improving and wildlife is blooming. India has always been a hub of pollution with huge population, heavy traffics and polluting industries leading to high air quality index (AQI) values in all major cities. But after declaration of lockdown due to COVID-19, quality of air has started to improve and all other environmental parameters such as water quality in rivers have started giving a positive sign towards restoring. This paper provides evidence-based insight into improvement of air quality and environment during pre and post lockdown of this pandemic situation. An attempt has been made to visualize the improvement in the air quality using tools like satellite images of Indian atmosphere, results of onsite real-time monitoring at specific locations (Ghaziabad-highest polluting city of India) and Air quality index (AQI) calculated by central pollution control board of India.

## Introduction:

Coronaviruses (CoVs) are a group of viruses which affects human beings through zoonotic transmission. This is the third time in past two decades that novel virus has created pandemic condition, after Severe Acute Respiratory Syndrome (SARS) in 2003 and Middle East Respiratory syndrome corona virus (MERSCoV) in 2012 (Ramdan and Shaib, 2019; Zhong et al., 2003). Pertaining to the Corona virus (2019), it was on December 31, 2019 wherein first case was reported to WHO Country Office in Wuhan, China with symptoms of unexplained low respiratory infections. This was classified as “pneumonia of unknown etiology” as the cause of infection was not known. On January 12, 2020, WHO found that Corona virus was the reason of this infection in Wuhan and later on 11th February, WHO Director-General announced this novel CoV as ‘COVID-19’ which is an acronym of ‘Corona virus disease 2019’ (Cascella et al., 2020). Covid-19 contain a single-stranded RNA as nuclei material and are 65 nm - 125 nm in diameter (Shereen et al., 2020). The major causes of concern for Covid-19 includes its global scale transmission, repeated emergence, significant number of deaths, infection and mortality to care providers and multiplicative effect in vulnerable or susceptible groups.

Covid-19 was declared pandemic disease by Director General-WHO on 11th March, he also briefed regarding the 13-fold increase in positive cases in China and 114 countries suffering form 1, 18,000 positive cases and 4291 deaths till date (World Health Organization, 2020). In India the first confirmed positive case was reported on 30th January in a student from Thrissur district of Kerala who had returned home for a vacation from Wuhan University in China (India Today, 2020a) followed by two other cases on February 2 and 3 again in Kerala having the same history. As on 14th April, Ministry of Health & Family Welfare (MOHFW) reported 10,815 positive cases and 358 deaths covering 32 states in India. Fig. 1 shows the spread of COVID-19 from January 30, 2020 to April 14, 2020. It is evident from the figure that spread of corona virus became rapid after 15 March and started taking a horrible shape in entire country.

Presently in comparison to the top six affected countries viz USA, Italy, Spain, China, Germany and Iran, we in India have lesser capacity to serve patients. With a population of 1.2 billion, India has only 118 Government approved testing

laboratories, 1.1363 beds per thousand patients (China has 4.2) and more than one million tests done. On the contrary, India has the highest recovery rate of 41.39% as compared to Italy (16.91%) and USA (3.17%) which is the direct effect of lockdown. Although, the researchers round the globe are rigorously working to find the cure of the infection caused by this deadly virus but unfortunately, till date no definite cure or vaccine has got developed. The only way to control the spread of this virus at this moment is suggested to be "social distancing", which is being practiced by many countries at this crisis time and has led to reduction GHG emissions in air (Zambrano-Monserrate et al., 2020) at global level.

# Objectives:

The overarching objectives of this research are to unravel the multifaceted impact of the COVID-19 pandemic on the environment. Each objective is designed to address specific aspects of this complex relationship, providing a comprehensive understanding of the environmental consequences spurred by the global health crisis.

**Assessing Changes in Air Quality:**

**Objective**: To evaluate the extent and sustainability of improvements in air quality during periods of lockdown and reduced industrial activities.

**Rationale:** The lockdown measures implemented in response to the pandemic resulted in a noticeable reduction in anthropogenic activities known to contribute to air pollution. This objective aims to quantify and analyze the temporal changes in air quality, exploring the potential for sustainable practices that emerged during the pandemic.

**Investigating the Impact on Wildlife:**

**Objective :** To examine the impact of reduced human presence on wildlife and natural habitats, assessing changes in behavior and patterns during lockdown periods.

**Rationale:** The unexpected decrease in human activity offered a unique opportunity to observe how wildlife responded to diminished human interference. This objective seeks to understand the resilience of ecosystems, document any changes in wildlife behavior, and identify conservation challenges arising from altered human-wildlife interactions.

**Analyzing Challenges in Waste Management:**

**Objective:** To analyze the surge in single-use plastics and challenges in waste management systems during the COVID-19 pandemic.

**Rationale:** The increased reliance on single-use plastics for personal protective equipment (PPE) and changes in consumer behavior during the pandemic have resulted in a significant impact on waste management. This objective aims to assess the scale of this impact, exploring potential strategies for mitigating the environmental repercussions.

**Evaluating Implications for Global Climate Goals:**

**Objective:** To evaluate the implications of the COVID-19 pandemic on global climate change mitigation goals, focusing on shifts in global energy demand and production.

**Rationale:** The pandemic induced a temporary shift in global energy consumption patterns, prompting questions about its potential impact on long-term climate goals. This objective seeks to understand the relationship between the pandemic-induced changes and the broader context of global efforts to mitigate climate change.

**Exploring Interconnections between Objectives:**

**Objective:** To explore the interconnected nature of the identified environmental impacts, considering how changes in air quality, wildlife patterns, and waste management collectively influence the overall ecological balance.

**Rationale:** Recognizing the interdependence of environmental factors is crucial for developing holistic and sustainable approaches to address the challenges posed by the pandemic. This objective aims to synthesize findings from the previous objectives, offering a more nuanced understanding of the intricate relationships within the ecosystem.

# Statements of Problems:

The profound and unexpected consequences of the COVID-19 pandemic on the environment have introduced a series of challenges and concerns that warrant thorough investigation. This section articulates the specific problems that this research seeks to address, highlighting the critical issues that have emerged as a result of the pandemic.

**Balancing Air Quality Improvements with Sustainability:**

**Problem Statement:** The immediate improvement in air quality during lockdowns raises questions about the sustainability

of these improvements once economic activities resume.

**Context:** While reduced industrial and vehicular emissions during lockdowns contributed to cleaner air, the potential resurgence of pollution post-lockdowns poses a challenge. Determining how to maintain or extend these air quality improvements sustainably is a critical concern for environmental policymakers.

### Wildlife Conservation Amidst Shifting Human-Wildlife Dynamics:

**Problem Statement:** The reduction in human presence in natural spaces has created both opportunities and challenges for wildlife conservation efforts.

**Context:** Observing changes in wildlife behavior during periods of reduced human activity provides valuable insights. However, the altered dynamics may also pose threats, such as increased poaching or disruptions to established conservation routines. This problem statement addresses the delicate balance between the positive and negative impacts on wildlife conservation.

### Surge in Single-Use Plastics and Disruptions in Waste Management:

**Problem Statement:** The surge in single-use plastics, driven by the demand for personal protective equipment (PPE) and changes in consumer behavior, presents a pressing challenge to waste management systems.

**Context:** The increased reliance on single-use plastics during the pandemic, including disposable masks and packaging, has led to a surge in plastic waste. Ensuring effective waste management and exploring alternatives to mitigate the environmental impact of this surge form the core concerns of this problem statement.

### Implications for Global Climate Change Mitigation Goals:

**Problem Statement:** The shifts in global energy demand during the pandemic prompt concerns about the potential setbacks or opportunities in achieving long-term climate change mitigation goals.

**Context:** The pandemic-induced changes in energy consumption patterns offer a unique lens through which to examine their implications for global efforts to mitigate climate change. Addressing this problem is essential for understanding whether the pandemic has inadvertently hindered or accelerated progress towards climate goals.

### Interconnected Environmental Challenges:

**Problem Statement:** Recognizing the interconnected nature of the identified environmental impacts presents a challenge in developing holistic and sustainable solutions.

**Context:** The interdependence of air quality, wildlife conservation, waste management, and climate change mitigation requires a comprehensive approach. Understanding how these factors influence each other is crucial for formulating effective strategies that account for the complex relationships within the ecosystem.

# Hypothesis:

Formulating hypotheses provides a structured framework for the research, enabling the systematic testing of assumptions and predictions. In the context of the impact of COVID-19 on the environment, these hypotheses serve as informed propositions that guide the investigation into the identified problems and objectives.

### 1. Air Quality Improvements:

**Hypothesis 1:** The lockdown measures imposed during the COVID-19 pandemic led to a significant improvement in air quality.

Rationale: The hypothesis stems from the observed reduction in industrial emissions and vehicular traffic during lockdowns. It suggests that the temporary decrease in anthropogenic activities resulted in measurable enhancements in air quality, which can be substantiated through comprehensive air quality index data and pollutant concentration analyses.

**Hypothesis 2:** The improvement in air quality is directly correlated with the duration and stringency of lockdown measures.

Rationale: This additional hypothesis posits that the extent of air quality improvement is proportional to the duration and strictness of lockdowns. Testing this hypothesis helps establish a temporal relationship between lockdown measures and air quality changes.

### 2. Impact on Wildlife:

**Hypothesis 1:** Reduced human presence during lockdowns positively impacted wildlife, leading to observable changes in behavior and patterns.

**Rationale:** The hypothesis is grounded in the premise that diminished human interference allowed wildlife to reclaim natural spaces, influencing their behavior. This can be substantiated through direct observation, satellite imagery, and

ecological studies conducted during lockdown periods.

**Hypothesis 2:** Conservation efforts faced challenges during lockdowns due to restricted access and reduced resources.

**Rationale:** Acknowledging the potential challenges conservationists may have faced during lockdowns, this hypothesis explores the notion that despite positive changes in wildlife behavior, conservation efforts were hindered due to limitations in fieldwork and funding.

### 3. Surge in Single-Use Plastics:

**Hypothesis 1:** The demand for personal protective equipment (PPE) during the pandemic led to a surge in single-use plastics, causing disruptions in waste management systems.

**Rationale:** The hypothesis derives from the increased use of disposable masks, gloves, and other PPE, contributing to a rise in plastic waste. This can be substantiated through waste composition studies, tracking the surge in single-use plastics during the pandemic.

**Hypothesis 2:** Waste management challenges were exacerbated by the surge in medical waste.

**Rationale:** Recognizing the distinct challenges posed by medical waste, this hypothesis posits that the increase in medical waste further strained waste management systems, requiring specific attention and solutions.

### 4. Implications for Global Climate Goals:

**Hypothesis 1:** The shifts in global energy demand and production during the pandemic had temporary effects on climate change mitigation.

**Rationale:** The hypothesis suggests that the pandemic-induced changes in energy consumption patterns temporarily influenced global efforts to mitigate climate change. This can be assessed through a thorough analysis of energy consumption data and its alignment with established climate goals.

**Hypothesis 2:** Post-pandemic recovery measures will influence the long-term trajectory of climate change mitigation.

**Rationale:** This hypothesis considers the potential long-term impact of recovery measures on climate goals, examining whether post-pandemic policies and practices contribute to sustained climate change mitigation.

### 5. Interconnected Environmental Challenges:

**Hypothesis 1:** Recognizing the interconnected nature of environmental impacts, addressing one aspect positively influences others, contributing to a holistic and sustainable ecosystem.

**Rationale:** This overarching hypothesis posits that integrated strategies considering the interconnectedness of air quality, wildlife conservation, waste management, and climate change mitigation result in more effective and sustainable solutions.

# Research Methodology:

The research methodology section delineates the systematic approach employed to gather, analyze, and interpret data, ensuring the rigor and reliability of the research findings. The methodologies chosen are tailored to address each specific objective and hypothesis outlined in the earlier sections.

## 1. Data Collection for Air Quality Improvements:

**Data Sources:**

- Utilization of air quality monitoring stations worldwide.
- Analysis of satellite imagery depicting changes in pollution levels.
- Examination of official air quality indices and pollutant concentration data.

**Sampling and Period of Study:**

- Selecting specific cities or regions with diverse air quality scenarios.
- Studying air quality trends during distinct lockdown phases and post-lockdown periods.

**Data Analysis:**

- Statistical analysis of air quality index data to assess variations.
- Comparing pollutant concentrations before, during, and after lockdown periods.

## 2. Wildlife Impact Assessment:

**Data Sources:**

- Field observations from ecological researchers and wildlife conservationists.
- Satellite imagery and remote sensing data to track wildlife movement.

- Studies on conservation challenges and successes during lockdowns.

**Sampling and Period of Study:**

- Selection of diverse ecosystems and wildlife habitats.
- Comparative analysis of wildlife behavior during pre-pandemic, lockdown, and post-lockdown periods.

**Data Analysis:**

- Qualitative analysis of observed changes in wildlife behavior.
- Quantitative assessment of conservation challenges using relevant metrics.

### 3. Analysis of Single-Use Plastics and Waste Management:

**Data Sources:**

- Collection of waste composition data from municipal waste facilities.
- Studies on the surge in medical waste during the pandemic.
- Surveys and reports from waste management organizations.

**Sampling and Period of Study:**

- Focusing on urban and suburban areas with varying waste generation patterns.
- Examining waste data from distinct phases of the pandemic.

**Data Analysis:**

- Quantifying the increase in single-use plastics in waste streams.
- Assessing the challenges faced by waste management systems through case studies.

### 4. Evaluation of Global Climate Goals:

**Data Sources:**

- Analysis of global energy consumption data.
- Reports from energy production and distribution agencies.
- Studies on the impact of the pandemic on renewable energy initiatives.

**Sampling and Period of Study:**

- Selecting countries with diverse energy consumption profiles.
- Assessing energy trends during the peak pandemic period and recovery phases.

**Data Analysis:**

- Comparative analysis of energy consumption patterns against climate goals.
- Examination of policy shifts and recovery measures impacting climate initiatives.

### 5. Interconnected Environmental Challenges:

**Data Integration:**

- Cross-referencing data from air quality, wildlife impact, waste management, and climate studies.
- Identifying correlations and patterns among interconnected environmental factors.

**Comparative Analysis:**

- Assessing the collective impact of measures taken to address individual environmental challenges.
- Formulating recommendations for holistic and integrated environmental policies.

### 6. Ethical Considerations:

- Ensuring adherence to ethical guidelines in wildlife studies, respecting animal welfare and conservation protocols.
- Safeguarding the privacy and confidentiality of individuals and organizations contributing data.
- Citing sources and respecting intellectual property rights in the analysis of existing studies and reports.

## Conclusion:

In the wake of the COVID-19 pandemic, the environmental impact remains a complex and evolving narrative. The temporary improvements in air quality and the resilience of nature underscore the delicate balance between human activities and the health of our planet. As we navigate the path to recovery, integrating sustainable practices and building resilience will be crucial for fostering a harmonious coexistence between humanity and the environment. The lessons learned from this global crisis can shape a more sustainable and environmentally conscious future for generations to come.