



# Coronavirus: The Picture it Showed, the Message We Chose to Ignore!

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**Abstract**

Nature needs to shake off the dust built due to its exploitation by humankind. One such heavy blow was probably the current COVID-19 pandemic. The COVID-19 pandemic has enabled habitat restoration of various wildlife and natural resources, along side the economic challenges it has imposed with increased poaching in certain countries. Lockdown during such tough times has caused major economic, tourism, and educational instability. It is important to avoid exploitation of the natural habitat by deforestation, poaching, or meat consumption to avoid zoonotic disease outbreaks or transmission. However, the coronavirus has had temporary positive effects on ecology, wildlife, and biodiversity; while the fact of its probable long-term effect on the evolution of human life should not be neglected. The air quality in certain air quality stations in the Indian sub-continent has recorded significant improvement in its air quality index while most remained unchanged during the COVID-19-mediated lockdown and unlock periods. Here we discuss some of the lessons which the recent pandemic has left for us to learn and its long or short-term influences on the environment, ecology, and, evolution. It also focuses on the key points to be taken care of post-COVID pandemic life in order to sustain a healthy ecosystem and coordinate with nature.

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**Keywords:** COVID-19; Biodiversity; Wildlife; Air quality; Evolution; Environment.

**Abbreviations:** ACE2: Angiotensin-converting enzyme; AQI: Air Quality Index; ARDS: Acute Respiratory Distress Syndrome; COVID-19: Coronavirus disease 2019; CPCB: Central Pollution Control Board; NASA: National Aeronautics and Space Administration; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; WHO: World Health Organization.

## Summary

From December 2019 till now, the most used word must be COVID-19 or Corona unarguably. The pandemic has left us wondering and writing about the structure of the virus, its mode of transmission, the lockdown, mortality rates, and environmental changes. The COVID-19 pandemic turned out to be a self-repairing event for nature. It had left its mark on the evolution of

successful damage in males and females. But the less discussed areas are the witnessed effect and its long-term influence on biodiversity, the evolution of human life, air quality, etc., Here, we discuss the various effect on air quality (readings from certain air quality stations in India) during the COVID-19 mediated lockdown and unlock (normalcy) periods and also the long or short-term influences on the environment, ecology, and evolution. Restrictions on improper meat consumption and safe dis-



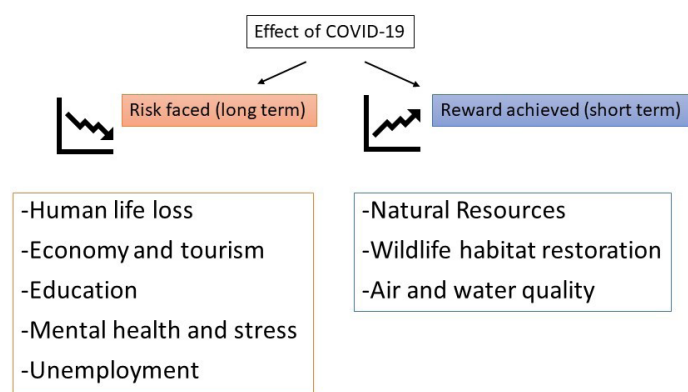
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posal of medical wastes were essential. The observed positive changes in our surroundings seem to be temporary. Post-COVID care for nature is the need of the hour for a sustainable future. We also address some of the lessons the pandemic has taught us and highlight the key points to be considered to sustain a healthy ecosystem and coordinate with nature. Thus, understanding these impacts is essential to deliver information to the general audience to understand the short- and long-term hazards of the pandemic.

### Highlights

- COVID-19 pandemic turns out to be a self-repairing event for nature.
- COVID-19 might have left its mark on the evolution of successful damage in males and females.
- Restrictions on improper meat consumption and safe disposal of medical wastes are essential.
- The observed positive changes in our surrounding seems to be temporary.
- Post-COVID care for nature is the need of the hour for a sustainable future.

### Graphical Abstract



### Introduction

Coronavirus or COVID-19 (Corona Virus Disease of 2019) has probably been the most used word in late 2019 and almost the whole of 2020 period. SARS-CoV-2 causes COVID-19 and has almost shaken the ground of most countries of the world when they had least expected the transmission in their region. Further, the outspread was rapid and COVID-19 posed a major pandemic while all the developed countries and their labs have struggled in identifying a vaccine or treatment for this virus. COVID-19 has had a multi-dimensional impact on human society and their life in terms of food accessibility, economic problems, education, housing, shelter, and many more.

Moreover, in a short duration, the virus has affected large human populations and people were baffled by various myths, facts, confusions, potential treatment drugs, etc. Since now the myths and facts are cleared, the period between the outbreak of the virus and its alarming peak or severity, there are a lot of sectors of our daily life that was changed. Experiencing lockdown for an indefinite term in cities and countries witnessed some positive effects on the pollution rate and clear sky. Thus, the pandemic has shown that nature takes drastic acute steps to revive itself from its chronic degradation caused due to human activities. The air quality [1-4], surface water quality [5,6] have all improved during the pandemic due to reduced human

interference. However, these were immediate effects of the lockdown and have no certainty of its continuity during post-COVID eradication. Provided the status of the environment and natural resources are maintained with care, it might have a positive effect on ecology, and in the long term, on evolution. Hence, people must be made aware of this to avoid returning to a more damaged environment.

Interestingly, the worst-hit during this pandemic are all related to humans and their living. It has taken a toll on tourism, global and individual economy, mental health, and industries, albeit boosted pharma and healthcare (not a positive sign, as it is due to the pandemic), wherein has reduced the existing impact on biodiversity, wildlife exploitation, environmental degradation, and agriculture. We will focus on how the pandemic has affected evolution, ecology, and many other life forms of nature and whether the lifting of the lockdown has brought us back to the same place as before the lockdown. However, the details of the structure and survival of the virus in the host are beyond the scope of this discussion.

### Effect of COVID-19 on the environment

COVID-19 has been harsh on human populations and their survival but has been gracious enough to help the environment and its other life forms to thrive. Nature has always been self-regulating, and hence disease spread among wildlife is not as alarming as its transmission to humankind. Since lockdowns have been in effect, pollution and carbon-dioxide emissions have been reduced in many countries [7,8], while air quality in Delhi, India (reported as one of the polluted megacities by WHO; [9], references therein) has become better [9]. Apart from air quality, the water quality has also undoubtedly increased in many parts of the world including beaches in Spain, Mexico, and Italy [10,4] and the Ganges river in India [11,5], without the interference of industries and human activity.

To suggest the possibility of air quality before, during, and after the lockdown in India, the Air Quality Index (AQI) across certain monitoring stations was taken to assess the effect of COVID-19 mediated lockdown. The data used in the graphs were taken from the Central Pollution Control Board's (CPCB) air quality monitoring stations ([https://app.cpcbcr.com/AQI\\_India/](https://app.cpcbcr.com/AQI_India/)) located across India. The average AQI at 2 stations in Delhi (Alipur & Lodhi Road) and Chennai (Manali and Velachery Residential Area) over the entire period before lockdown (1-week data at 17:00 hr), during lockdown 1 (2-week data at 17:00 hr), unlock 1.0 (June) and Unlock 4.0 (September) were taken to assess air quality within cities. Interestingly, the AQI data reveals significant improvement in AQI during the lockdown and unlock 4.0 in Alipur, Delhi alone, but not the others showing that there isn't much difference in AQI across lockdown and unlock. In the case of two stations in Delhi, there was no difference in their AQI, but the two stations of Chennai showed significantly low air quality in the industrial area of Manali as compared to that of the Velachery residential area (Figure 1). Even though the initial phases of lockdown have benefited the environment, but as relaxations from a lockdown are implemented, the observed effect vanished slowly. Hence, people must be more sensitive to environmental changes and make essential lifestyle changes to achieve better environmental or air quality and ensure safe living.

### COVID-19 effect on biodiversity

Wildlife trade has to be banned or at least minimized to avoid

contracting further deadly microbes. Microbes exist among animals and birds, and nature would mediate their existence for the survival of the fittest and thereby evolution. Human interference by hunting and consuming the same probably poses a greater risk for zoonotic diseases, while nature becomes a mere spectator. It is, therefore, important to predict possible spread in the future and thereby prevent the same by stopping. Additionally, the COVID-19 pandemic has made us realize how tantalizing it is to be locked inside homes, and thereby thought of abolishing “zoo culture” has to be considered for the sake of stress and mental health of the animals. Overall, it is important to consider human health, life, economy, and biosafety and necessary actions and restrictions have to be taken to avoid future bio-disasters [11].

However, due to lockdown and no income among highly financially-challenged people of society has led to ill-treatment and poaching of various organisms in South Asia and Africa. This has to an extent influenced the exploitation of natural resources for food and money [12,13]. Tourism was protecting the wildlife in their natural habitats due to the presence of forest guards and wildlife volunteers and also due to financial assistance. Thus, people must be made aware of the potential risks that wildlife is facing because of their activities in exploiting wildlife habitats.

#### **Effect of COVID-19 on ecology and evolution**

Looking at the available reports (discussed earlier), it was evident that wildlife and humans have adapted for co-existence. But the problem arose once humankind tried to obtain the majority rather than maintaining their equality with wildlife. Unusual wildlife movement in urban areas and habitat restoration were some of the key points observed during the pandemic. The wildlife animal studies and population has to be surveyed post-lockdown to understand the effect of reduced human interference and its related factors. Hence, the interaction between humans and animals has to be scientifically investigated concerning the interactions of humans with wildlife [14].

Following wildlife-human interaction, it is highly important to note that cases of men contracting COVID-19 were higher than that of women. One side argument might be due to the exposure frequency of men involving several daily outdoor activities and travel or imbalance in the sex ratio of the population. But on the other side, the exposure risk for women was also equal as they were sharing the same living space daily and the transmission rate did not decrease. So, higher incidences of men contracting the COVID transmission might be due to the better immunity possessed by women over generations and as a part of evolution. This might be because the women care for the children or the off-springs pregnancy compensation hypothesis; [15] who ultimately are the next contributors to the gene pool. However, these hormonal imbalances put women at a higher risk for autoimmune diseases and diseases due to sedentary lifestyle changes [15]. However, long-term effects such as Acute Respiratory Distress Syndrome (ARDS), and heart damage were possible outcomes post-COVID recovery [16], even though experimental evidence needs to be presented. Thus, higher immunity exhibited by women might be an evolutionary trait and hence it is important to understand the evolutionary changes the pandemic had imposed.

Since pandemics can leave not only a lasting history but also traits of medical impact on human health and evolution. Interestingly, in India and the United Kingdom, some of the in-

dividuals have also experienced “silent immunity” for the virus, without even showing symptoms, because the clinical testing was based on sero-surveillance, done on the antibody’s levels (produced by B-cells), thereby underestimating the virus spread [17]. This can be seen in a significant number of people, wherein the fight was put up by the T-cells of our immune system and not the B-cells [18,19]. Pandemics led losses of millions of lives across the globe, which might influence evolution significantly if human loss were around their reproducible age. Furthermore, since around ~8% of the human genome makeup is of retroviral DNA, the infection might add up and might leave a permanent genetic effect on the genome [20]. It is also important to note that initial clinical studies have shown testicular COVID-19-positive patients [21]. This is probably because of the presence of higher ACE2 (Angiotensin-converting enzyme 2; which acts as a receptor for SARS-CoV-2) in the lungs, kidney and cells of the testis [22]. However, since no viral particles or load were observed in the biopsy or semen samples [23,21], it can be predicted that the inflammatory response mounted for the virus might have had a secondary effect on the tissues of the testicles leading to orchitis [24]. Hence, studies need to focus more on the reproductive health and function in COVID-19 recovered males especially in the reproductive age, as it will affect the individual and evolution as well.

Interestingly studies during February 2020, reported no intrauterine transmission of the virus to the neonates, wherein the patients had a caesarean section [25]. Later, shockingly a handful of studies showed that SARS-CoV-2-infected pregnant women in their later stages of pregnancy transfer the viral load to the fetus, wherein the neonates show placental infection followed by neonatal viremia due to transplacental transmission [26]. This is possibly due to the high levels of ACE2 in the cells of the placenta and fetal heart, lungs, and liver, even though the ACE2 levels were detected in mRNA levels [27]. This suggests the feasibility of vertical transmission between mother and fetus, wherein virus-specific antibodies IgM and IgG were detected in higher levels in neonatal blood and not the virus per se [28,29]. This shows that the viral load was probably not high, but the neonates were exposed to the virus wherein they produced the antibody IgM, which cannot be transferred across the placenta. Hence placental dysfunction or rupture has to be clinically monitored upon SARS-CoV-2 infection in mothers if observed during delivery of the fetus and thereby clinical studies need to be reported.

#### **COVID: lessons that we are likely to forget**

Reduced traffic, lower air pollution, the importance of savings, having a backup option for a career, the need for transparency from the government with preventive measures, and COVID-19 numbers are some of the key lessons the pandemic has taught us. However, the basic points of personal hygiene, sanitation, and regular health check-ups had to be merely followed to prevent the spread of the disease. But, people on the other hand chose to forget these in their busy lives and now have been reminded to follow the same. Apart from our own lives, we have barely noticed the changes in our environment, even if they had, they chose to ignore them. So, the question is whether have people really learned from the changes around them. No, they have instead picked up from where they had left before lockdown for various reasons- to cope up for a lost time, support family financially, go on a relaxing short vacation due to relaxed rules, etc., But nobody learned lessons from the series of events except for a few and definitely the researchers who

used most time writing about the changes (probably we were designed to observe). It is not sufficient for the world to run and to prevent future problems, because the public must have a serious concern for the same, but unfortunately, nobody seems to care. If this is the case, not only our offspring but even we may face another pandemic and there would be nothing surprising when it happens.

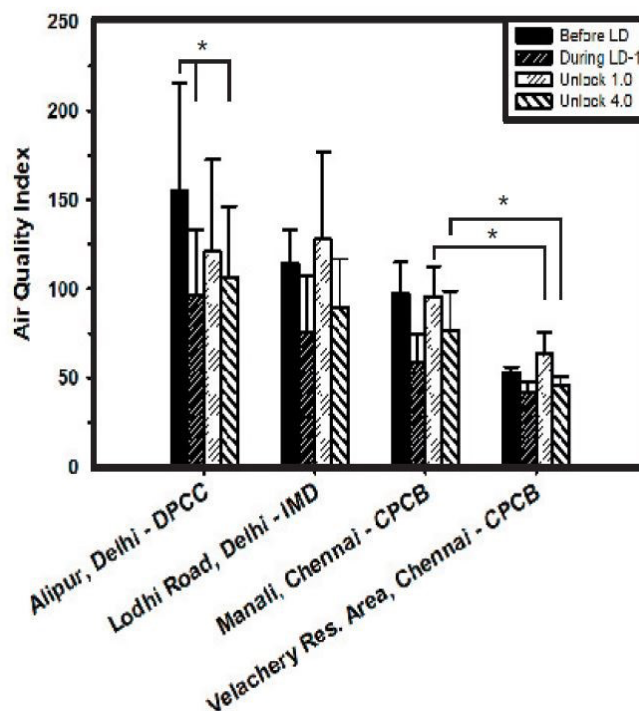
However, countries have imposed aggressive social distancing, lockdowns, mandatory quarantine, etc., as a measure to curb disease spread. But nothing seems to work, probably because of the population in the countries like India and the USA. Nonetheless, in the case of India, it is reported that the country passed the pandemic peak around September 2020, and it had taken approximately 6 months for the country to reach its peak [30]. As per the post-COVID-19 peak is concerned, the bell-shaped curve of the normal distribution can be taken to expect a further decline in the next 6 months and hence, it was assumed that India might reach its lowest by March 2021 [30]. Thus, it is also highly important for human beings across the globe to understand that the pandemic is far from over and the population has challenged the nationwide steps in curbing the virus.

**Post-COVID care for nature is the key to a better future**

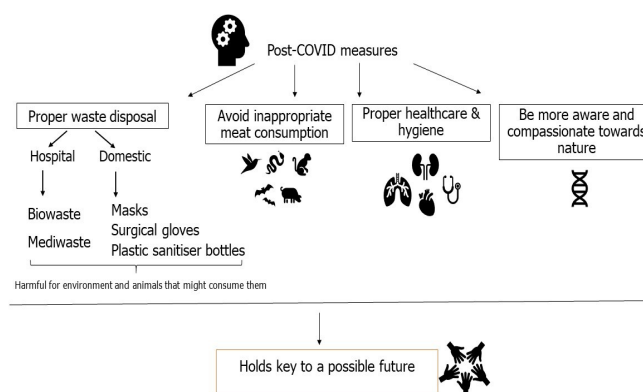
People must be educated enough and should have realized what changes have to observe during the lockdown in nature. Various environmental, industrial, and governmental policies have to be designed to maintain and enhance positive changes that have been observed. If this is not implemented with the utmost caution, then it might lead to permanent damage and habitat restoration would be lost. People must implement certain changes in our commute and lifestyle to bring overall benefits for humankind and its surrounding even including the ecosystems, wildlife, and natural resources [14]. Various steps as to how the field works post-pandemic can be conducted to understand the ecosystem and its biodiversity alongside its interaction with humans [14]. Avoidance of natural habitat exploitation for meat and wood might help in minimizing the risk of zoonotic diseases, as healthy ecosystems can potentially decrease their transmission [31]. It is high time to realize the steps taken, we need a better future and so does nature (Figure 2).

**Conclusion**

We focused on the 3 E's (Ecology, Environment, and Evolution) essential to ensure life survival. The COVID-19 pandemic has caused human loss, a straight blow to tourism, the economy, and employment. Moreover, the percentage of infected people in some major states of the USA, Brazil, and India suggests population intensity-induced spread. But on the brighter side, the pandemic-mediated lockdown had acutely decreased certain air pollutants in major cities and improved the air quality in different cities but probably no chronic effect was observed. It has restored the surface water quality in many parts of the world alongside restricting wildlife exploitation. However, certain lessons from the pandemic and many post-COVID measures have to be undertaken to avoid any such outbreak in the future. Overall, we must understand that the continuing exploitation of nature can cause larger and more common disease outbreaks not in the future, but rather in the nearer future. Hence, to ensure a sustainable environment for our future generations, substantial efforts from the current generation are mandatory.



**Figure 1: AQI before, during, and after the lockdown period in certain stations of India.** The AQI in the stations of Delhi and Chennai show no significant difference except in Alipur, Delhi. The data used in the graphs were taken from the website of the Central Pollution Control Board's (CPCB) air quality monitoring stations in India. 20-March- regular weekday, LD-lockdown, Unlock-when the restrictions were gradually lifted over 3-4 weeks (Unlock 1.0-June, Unlock 4.0-September).



**Figure 2: Post-COVID-19 care and measures.** Proper waste disposal, abstaining from inappropriate meat consumption, maintain hygiene and being sensitive towards changes in the environment are key to a possible future.

**Author contributions**

S. K. and P. Y. conceived the concept and have drafted the manuscript. Both authors have read the manuscript carefully, revised it, and approved the final version of the manuscript.

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