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## Review

# Coronavirus lockdown helped the environment to bounce back

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### HIGHLIGHTS

- Vital environmental changes have been evidenced during COVID-19 lockdown.
- 500% decrease in sewage and industrial effluents in rivers.
- Dissolved oxygen(DO), Biological oxygen demand(BOD), pH of river water has been improved by 79%, 30% and 7.9 respectively
- Noise level was reduced up to 35% to 68% all over the world.
- Wild life gets a chance to reclaim their land.

### GRAPHICAL ABSTRACT



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### ABSTRACT

As the transmission of novel corona virus (COVID-19) increases rapidly, the whole world adopted the curfew/lockdown activity with restriction of human mobility. The imposition of quarantine stopped all the commercial activity that greatly affects the various important environmental parameters which directly connected to human health. As all the types of social, economic, industrial and urbanization activity suddenly shut off, nature takes the advantages and showed improvement in the quality of air, cleaner rivers, less noise pollution, undisturbed and calm wildlife. This research aims to discuss the COVID-19 effect on the global environment. The outcome of this research says that “*Although coronavirus vaccine is not available coronavirus itself is earth's vaccine and us humans are the virus*”.

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## 1. Introduction

COVID-19 is a new dangerous infectious disease that causes illness in animals or humans. History provides a record of epidemics such as plague, smallpox, measles, cholera, influenza, Ebola, AIDS, severe acute respiratory syndrome (SARS) and now COVID-19 (David, 2020). 2003 was the first known year of SARS illness caused by coronavirus in China as acute respiratory syndrome. A second outbreak was in 2012 in Saudi Arabia as Middle East respiratory syndrome (MERS). World Health organization (WHO) in Dec 31, 2019 named it SARS-COV-2 and the disease as COVID-19 (Cui et al., 2019; Lai et al., 2020; Peiris et al., 2004; WHO, 2020). Genetically the virus of COVID-19 and Severe Acute Respiratory Syndrome (SARS) are related to each other but disease caused by them is quite different.

World Health Organization gave the name of the disease as COVID-19 on Feb 11 2020. In the name of the disease COVID-19, CO stands for 'Corona', VI stands for 'Virus' D stands for 'Disease'. This disease is the first time introduce in the year of 2019 that is why it is called COVID-19. Again, this virus has not previously seen in humans so it is also called "Novel corona virus". The SAR-COV is a member of the  $\beta$ -coronavirus sub-group from coronaviridae family (Pyrce et al., 2007). The virus having crown like spikes on the outer surface of it that's why we called as corona virus. Its size ranging from 65 to 125 nm in diameter. The effect of the virus is an acute lung jury and respiratory distress syndrome that ultimately causes pulmonary failure and causes a fatality. The virus of COVID-19 is transmitted through contact with respiratory droplets instead of air. The main spreading way of this virus is through respiratory droplets expelled by the person suffering from cold and cough. By touching these droplets present on the surface around the person with COVID-19 is a strong reason for catching this disease. So it is very important to maintain a distance of around 1 m (3 ft) away from person who is sick. The symptoms of this disease are dry cough, fever, difficulty in breathing. Infants, older people and those with medical problems like high B.P., cancer, diabetes, heart problem, asthma are more prone to develop this disease (Arabi et al., 2019; Ashour et al., 2020; Dong et al., 2020; Zhou et al., 2020). As virus spreads COVID-19 so antibiotics do not work. Without much clinical experience, some already medicines such as hydroxychloroquine, azithromycin, lopinavir, ritonavir, corticosteroids, paracetamol, ibuprofen and certain nucleotide are proposed for the treatment of COVID-19 (Gautret et al., 2020; Colson et al., 2020; Zhonghua, J. H. H. X. Z. Z., 2020). Although there is no evidence that the above-proposed medicine can prevent or cure the disease surely. However, some traditional or home remedies may improve our resistance power for dealing with this virus. Since there is no effective antiviral medicines or vaccine is investigated until now so the most effective way to protect our self by social distancing. Social lockdown is considered the most effective measure to control COVID-19 (Das and Patial, 2020; Paital et al., 2020). The curve can be flattened by social distancing and this has been an incidental boon to the environment. So, in the throes of adversity, yet there is a reason to celebrate in COVID-19. It has been noticed that over a month in this lockdown, air and water pollution have been declined. During the lockdown period, the Ganga water quality improved remarkably. The COVID-19's gift to Ganga was seen within 10 days of nationwide lockdown. As per the data of the Central pollution control board (CPCB's) out of 36 various points of the Ganga river, the 27 points are found suitable for the propagation of wildlife and Fisheries. The dissolved oxygen (DO) values were found to 6.8 mg/ml from 3.8 mg/ml which is an

improvement of 79%. Dissolved oxygen (DO) value and Biological oxygen demand (BOD) levels are also increased up to 30%. Ganga water at Haridwar and Rishikesh in India was investigated fit for drinking due to 500% decrease in sewage and industrial effluents as per CPCB assessment report. Domestic sewage, industrial waste, cloth washing near ghats, bathing, fairs and tourism activities were curtailed. At the same time, water is not being lifted by industries, so more flow in the river will dilute the pollutants. The study of water quality monitoring of the Ganga on April 19, 2020 by Central pollution control board (CPCB's) reveals the drinking water standards such as the BOD <3 mg/l, DO >4 mg/l, pH 6 to 9, ammonia 0.49 mg/l. Improvement in Ganga water is a function of quality and quantity. So it can be stated that COVID-19 lockdown will serve as a ventilator not only for the river but also for the entire environment and wildlife. Due to the restriction of human mobility, air pollution reduces up to 44%. Present studies will focus on various aspects of COVID-19 on global environmental pollution and wildlife.

## 2. COVID-19 lockdown vs global environment

COVID-19 became the opportunity for the earth to build a clear blue sky and clean the air. During the period of lockdown across the world, the sight of the blue sky created a sense of optimism among the people towards a clean and better environment. Before COVID-19, all over the world are being suffered by a high level of urban air pollution especially in the form of CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>2</sub> and particulate matter. The major sources of pollution such as transport, industries, power stations are responsible for the increased output of all these pollutants. From years back (2001 to 2019) various agencies all over the world announced such as clean air programs to reduce particulate matter pollution levels. These programs also pointed out the air quality standards, these are much weaker than the world health organization (WHO) guidelines, and more evidence of the health impact of air pollution was investigated. A report of WHO indicates that almost 8% of total death in the world is due to air pollution (WHO, 2016). Many respiratory diseases such as hypertension, heart attack, cognitive and mental illness are already triggered by air pollution. The only difference is that those diseases may not be as immediately lethal as COVID-19 and not transmitted by person to person. It has been established that before COVID-19, emission of CO<sub>2</sub> was raised by 1% per year over the previous decade (Jackson et al., 2019). The positive effect of lockdown is to decrease the CO<sub>2</sub> emission by -17% (-11 to -25%) by 7th April 2020 (Quere et al., 2020) with respect to the mean level of emission in 2019. Air quality index (AQI) is the assessment of air quality. The lower the AQI value, the better is the air. The normal air quality index range is (100–200) and presently it is in the satisfactory range (50–100) category as reported by Gurfam being a scientist at SAFAR. Zambrano-Monserate et al. (2020) reported that the air quality index (AQI) is decreased by 44%, 33%, 29%, 15% and 32% in north, south, east, central and western India respectively. The same study also shows that from March 16th to April 14th, 2020, 22 cities of India show the reduction of PM<sub>10</sub> (Particulate material), PM<sub>2.5</sub>, CO, NO<sub>2</sub>, by 43, 31, 10 and 18%. During the quarantine period in COVID-19, the amount of NO<sub>2</sub> was decreased by 22.8  $\mu\text{g}/\text{m}^3$  and 12.9  $\mu\text{g}/\text{m}^3$  in Wuhan and China respectively. In 367 cities, the PM<sub>2.5</sub> fell by 18.9  $\mu\text{g}/\text{m}^3$ . As per the report of CAMS 2020 reduction of 20–30% of PM<sub>2.5</sub> is observed in a wide area of China. Mahato et al. (2020) investigated that after three weeks of lockdown period from 24th March 2020, pollution of the Delhi, India, has experienced a noticeable reduction of different air pollution causing materials in the following Table 1.

From the above table, the positive indirect effects lead to the reduction of PM level, NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub> concentration whereas high concentration of these gases are always been the greatest environmental problem for developed countries (Sharma and Dhar, 2018).

China Health Authority informed the WHO about the several cases of pneumonia of unknown etiology in Wuhan City in Hubei Province in central China on December 31, 2019. Since December 8, 2019, the various cases were reported from the patients who worked at or lived around the local Huanan Seafood wholesale market (Lu et al., 2020). Huanan Seafood Wholesale Market's role in spreading the virus is still unclear. Genomic studies provided the evidence for the virus introduced from some another unknown location, into this market where it blow-out more hastily, although human-to-human transmission may have occurred earlier (Yu et al., 2020). Medical workers confirmed the presence of person-to-person transmission occurrence among close contacts mainly via respiratory droplets produced by an infected person coughs or sneezes have confirmed from the group of infected family members and (Chan et al., 2020). Fomites may also be considered as a large source of transmission, as SARS-CoV has been found to persist on surfaces up to 96 h and other coronaviruses for up to 9 days (Kampf et al., 2020).

On January 7 WHO identified, a novel coronavirus, originally abbreviated as 2019-nCoV from the throat swab sample of a patient (Hui et al., 2020). Coronavirus Study Group has named the pathogen as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Gorbalenya et al., 2020) later it was renamed coronavirus disease 2019 (COVID-19) by the WHO. WHO declared the SARS-CoV-2 outbreak as a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, due to thousands of infected and suspected cases reported in China and other countries (Burki, 2020). The month of February lets the outbreaks continue to spread in Iran, Italy and other parts of the globe. Consequently, the epidemic turns into the great pandemic and by end of March half of the world population was under some form of lockdown (Tosepu et al., 2020). As of May 25, 2020, the total no of COVID-19 cases surpassed 5.5 million globally, with total deaths tolls more than 345,160 (CoronaTracker, 2020). As countries went into lockdown the industrial activities shut down globally. Among many other sectors, transport is the hardest hit sector due to lockdown. Road and air transport came to halt as people are not allowed or hesitate to travel. According to the report, air travel dropped by 96% due to COVID-19, lowest in 75 years (CNN, 2020). Furthermore, not only the transport sector but also industrial and manufacturing sector is heavily affected by the pandemic. Global oil demand declined drastically and prices cut down sharply, as industrial and transport sectors came to halt worldwide. COVID-19 has a severe negative impact on human health and the world economy, however, it also results in pollution reduction due to limited social and economic activities (Dutheil et al., 2020). Lockdown due to COVID-19 reduced transport activities which results in less energy consumption and lower oil demand. These changes in transport activities and oil demand exert a significant impact on environmental quality. NASA (National Aeronautics and Space Administration) and ESA (European Space Agency) released fresh evidence which suggests that environmental quality improved and the emission of NO<sub>2</sub> reduced up to 30%. NASA collects the data using OMI (Ozone Monitoring Instruments) on its AURA satellite. While ESA collects the data through Sentinel-5P satellite using TROPOMI (Tropospheric Monitoring Instrument). NASA and ESA release satellite images of various countries before and after lockdown (Muhammad et al., 2020).

**Table 1**  
Comparison between different pollutant present in air before and after lockdown.

	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	NO <sub>2</sub>	CO	O <sub>3</sub>	NH <sub>3</sub>
Before lockdown	176.07	80.51	16.08	42.59	1.03	34.05	33.93
After lockdown	84.79	37.75	13.19	20.16	0.72	34.32	29.75

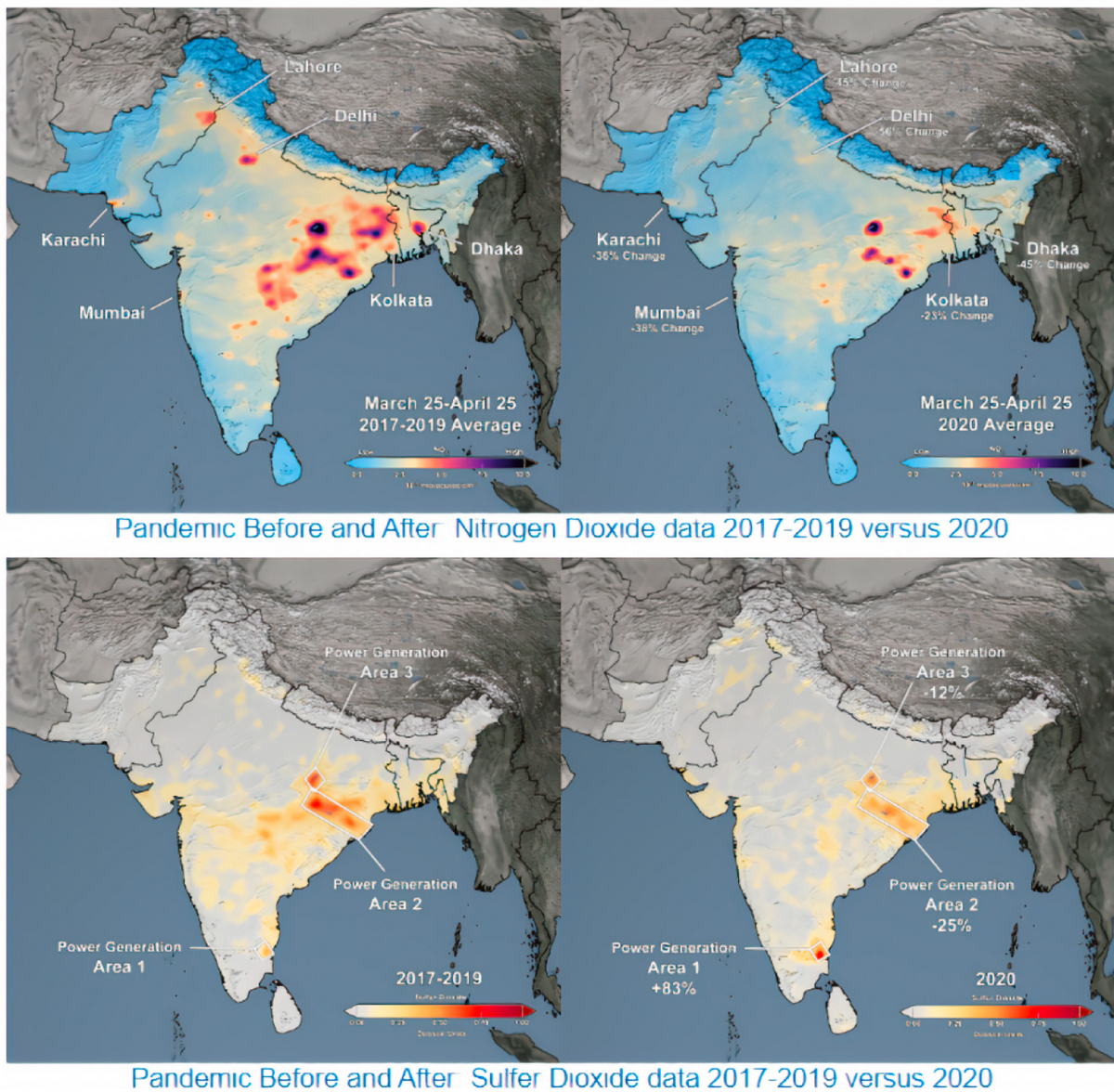
Reductions in Sulfur Dioxide & Nitrogen Dioxide Air Pollution over South Asia Associated with Efforts to Control the Spread of COVID-19. Aura's OMI data over South Asia show the means of the period in previous years, while comparing to the means for 2020, it is showing a vast improvement after the nationwide stay-at-home order for India's 1.3 billion citizens over South Asia for average of March 25 to April 25. The (Fig. 1a) images show the means of the period in previous years, while the bottom images show the means for 2020. Source: (NASA Air Quality Analysis, 2020).

The highest SO<sub>2</sub> levels are over eastern India and primarily associated with electricity generation; the coal burned has sulfur impurities. Independent estimates indicate that electricity generation for India was down about 10% and 25% in March and April 2020, respectively, as compared to March and April 2019. One exception is in southern India which could be related to increased thermal power generation that came online before the stay-at-home order. However, there was not a similar increase in NO<sub>2</sub>, so possibly coal with higher sulfur content was used in 2020 relative to 2019 without a significant increase in coal consumed. NO<sub>2</sub> is primarily emitted from fossil fuel use. The images show that widespread decreases (~30–60%) in NO<sub>2</sub> levels have occurred over most of South Asia. The highest NO<sub>2</sub> levels are in eastern India and are primarily associated with electricity generation (Aura, 2020). NASA's Air Quality group is regularly producing images from data collected from the Ozone Monitoring Instrument aboard the Aura satellite showing how one air pollutant, nitrogen dioxide (NO<sub>2</sub>), is changing. Changes are driven by changes in human behavior as a response to evolving restrictions during the COVID-19 pandemic. The group also produces images of other air pollutants, such as sulfur dioxide (SO<sub>2</sub>). In India, The first case of COVID-19 reported in the state of Kerala is in the late January 2020, and the state undergoes lockdown on 25th March 2020 together with the other states when Prime Minister Modi ordered a nationwide stay-at-home order for India's 1.3 billion citizens in an attempt to slow the spread of COVID-19. As a consequence, fewer fossil fuels are being consumed and, subsequently, there is less air pollution (e.g., nitrogen dioxide, NO<sub>2</sub>, as shown in previous OMI images, Fig. 1b) in India and in neighboring countries, including Pakistan, Nepal, Bangladesh, and Sri Lanka (NASA Air Quality Analysis, 2020).

This positive impact on the environment may be temporary but governments and individuals should learn from this lockdown on how to reduce pollution on a long term basis. (Yunus et al. (2020) attempted to understand the effect of COVID-19 spread in a hydrosphere using remote sensing data products. They have selected one of the severely polluted freshwater lakes in India to evaluate the impact of the lockdown due to the COVID-19 spread on water quality. The analysis of SPM concentrations in Vembanad lake based on the Landsat-8 OLI data revealed that the concentrations during the lockdown period were lower than those in the pre-lockdown period by 15.9% on average (−10.3%–36.4%). The decrease was observed in 18 out of 20 zones of the lake. Eleven of the zones showed that the concentration was the lowest in April of 2013–2020. While non-industrial pollution (e.g. discharge of domestic wastewater) remained during the lockdown period, results suggested that pollution from industries and tourism had a severe impact on lake water quality.

### 2.1. COVID-19 lockdown vs ozone layer

The ozone layer is found in the upper atmosphere called the stratosphere between 10 and 50 km from the earth. The ozone layer acts as a natural sunscreen and plays a very important function by absorbing the harmful U—V rays from the sun. Ozone-depleting substances (ODS) are gases such as chlorine and/or bromine which breaks the ozone layer in the stratosphere. Various ODS are present in the environment are chlorofluorocarbon (CFCs), hydrochlorofluorocarbon (HCFCs), Methyl chloride and various halones. By the reaction with UV sunlight, these gases form chlorine and bromine and they are responsible for the depletion of the ozone layer. The international community signed the Montreal



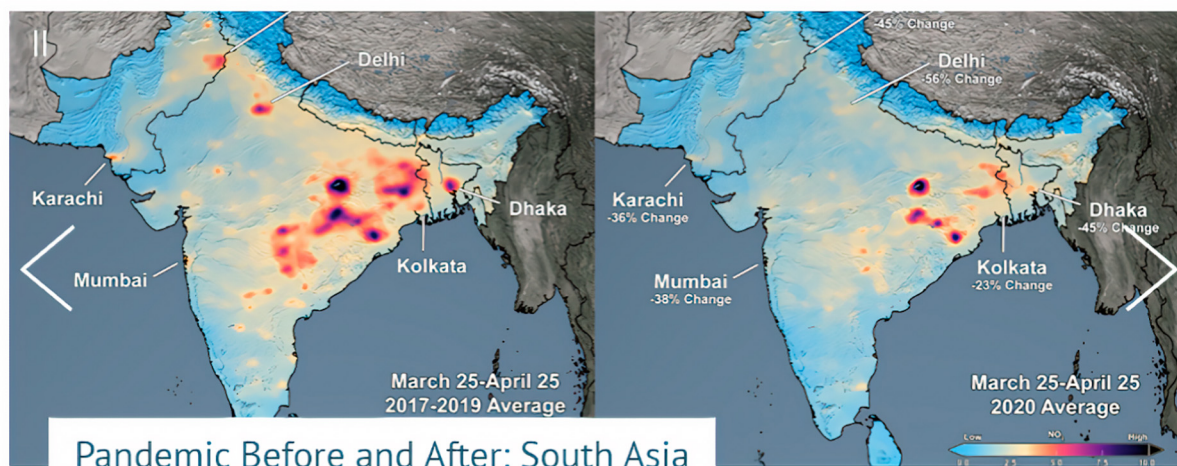
**Fig. 1a.** The images show Ozone Monitoring Instrument (OMI) data of SO<sub>2</sub> (left) and NO<sub>2</sub> (right) over South Asia as an average of March 25–April 25. The top images show the means of the period in previous years, while the bottom images show the means for 2020. Source: NASA Air Quality Analysis (2020).

Protocol on substances about the depletion of the ozone layer, 30 years ago. According to the protocol, the consumption and production of ozone-depleting compounds should be regulated. By banning chlorine-containing synthetic compounds the rate of depletion decline and scientists expect to recover back to the 1980 level up to 2070. As per the scientific data of 2018, the stratosphere recovered at the rate of 1–3% per decade since 2000. After the lockdown began on Jan 23, the particulate matter pollution decreased by an average of 35% and NO<sub>2</sub> decreased by an average of 60%. At the same period, scientists found the average surface ozone concentration increased by a factor of 1.5–2. Emission of ozone-depleting substances is also natural or man-made. All man-made emission is controlled because of lockdown during COVID-19. Production and consumption of ODS are also reduced. The World meteorological Organization (WMO) states that economic activity has been limited during COVID-19 which results in a decline in CO<sub>2</sub> emission. In 2019, As per NASA and NOAA reported that the south pole region of Antarctica has warm temperature in the upper atmosphere which caused a small ozone hole since it was first seen in 1982 (Fig. 2). On 23rd April 2020 Copernicus, atmospheric monitoring

services (CAMS) announced that the largest hole was ever seen in the ozone layer over the arctic has been closed. Although lockdown is surely showing the prominent sign of nature balance restoration of the ozone layer is not related to COVID-19. Scientist of Copernicus Atmosphere Monitoring Services (CAMS) reported that is because of strong and long-lived polar vortex and not related to change to air quality.

### 3. COVID-19 lockdown vs water pollution

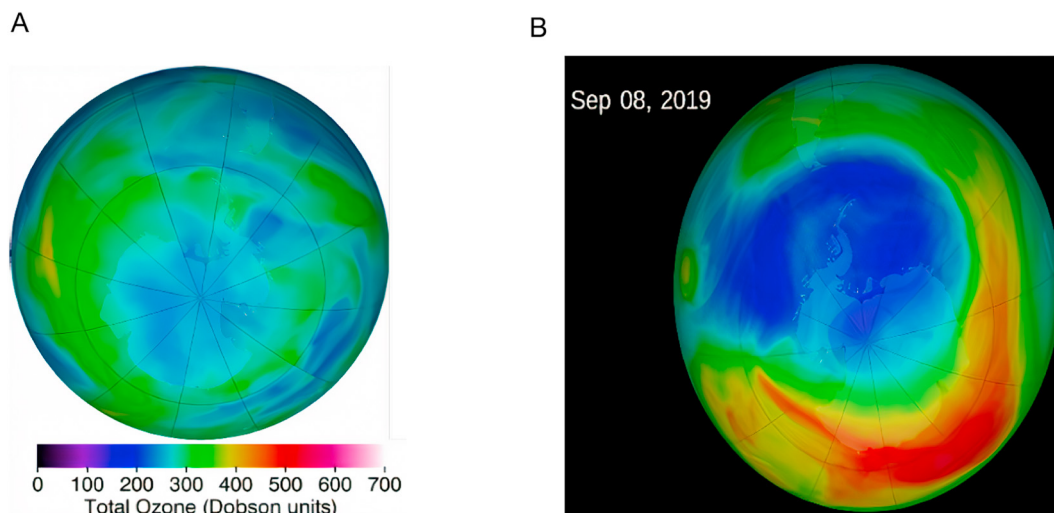
The research on water quality assessment of Ganga river and Yamuna river and factor controlling ionic chemistry of water were studied by a number of researchers in and around the world (Raymahasay, 1970; Abbas and Subramanain, 1984; Krishnaswami et al., 1992; Dalai et al., 2002; Chakrapani, 2005; Chakrapani and Subramanian, 1996; Bahukhandi et al., 2008; Bahukhandi and Bartarya, 2012; Bahukhandi and Bartarya, 2014; Bahukhandi et al., 2015; Bahukhandi et al., 2017; Dudeja et al., 2011; Thakur et al., 2018). It was found that the water quality of the Ganga and Yamuna rivers were deteriorated over the past few decades due to increased urbanization, industrialization and



**Fig. 1b.** NO<sub>2</sub> pollution before and after lockdown in India and its neighboring countries. Source: NASA Air Quality Analysis (2020).

changing the land use pattern (Chakrapani and Subramanian, 1996; Dudeja et al., 2011; Bahukhandi et al., 2017). Around 10% of toxic load comes from industries that constitute around 700 MLD per day discharge in the Ganga river as per the report of Singhal and Mato. It is estimated that in the Ganga river around 6500–6700 million liters per day (MLD) in its UP stretch were discharged and 30% of the total BOD load was due to industries along the river, which include 130–150 tons per day (CPCB). More than 80% of pollution in the Ganga is due to domestic sewage from surrounding towns and villages. The rest is contributed by industrial waste. This is also the fact that the surface water quality of i.e. Ganga river and Yamuna river improved drastically in the past few months. The industries were closed down after lockdown 1, Lockdown 2 and Lockdown 3 in India and the majority of the industrial effluent which were discharged in these rivers were also stopped. The water quality of all the major river of India has been improved due to shut down of industries (Singhal and Matto, 2020). An assessment of Ganga water quality at Rishikesh was carried. Among anions HCO<sub>3</sub><sup>-</sup> was the most dominant (73%) followed by SO<sub>4</sub><sup>2-</sup> (15.4%), Cl<sup>-</sup> (6.6%), NO<sub>3</sub> (4.8%), F<sup>-</sup> (0.6%) and PO<sub>4</sub> (0.3%) and among cations, Ca<sup>2+</sup> is the most dominant (71%) followed by Mg<sup>2+</sup> (19%), Na<sup>+</sup> (7.7%), and K<sup>+</sup> (2%) (Bahukhandi et al., 2017). The mean value of pH, TDS, Bicarbonate, Nitrate, Calcium were 7.9, 169 mg/l, 109 mg/l, 1.5 mg/l and 32 mg/l

respectively at various sampling location at Ganga River at Haridwar. The water quality of the Assan river, which is sub tributaries of the Yamuna river was investigated. In Yamuna river the concentration of EC (Electric conductivity) were ranged from 54.2 micro Siemens/cm to 135micro Siemens/cm, TDS ranged from 91 mg/l to 553 mg/l, HCO<sub>3</sub><sup>-</sup> were ranged from 21.0 mg/l to 366 mg/l and pH were ranged from 6.0 to 8.7 in all sampling location (Bahukhandi and Bartarya, 2014). Assessment of Major ion chemistry and spatial variation of Ganga river at Haridwar were carried out and abundance of various ions in the sample was in order of HCO<sub>3</sub><sup>-</sup> (63.8 mg/l) > Ca (19.2 mg/l) > Mg (5.9 mg/l) Na (3.05 mg/l) > Cl (1.6 mg/l) > K (0.5 mg/l). The pH value was ranged from 6.2 to 7.5 with a mean value of 6.5. The EC was ranged from 89 μs/cm to 485 μs/cm with a mean value of 166.2 μs/cm. To clean Ganga river one of the biggest initiatives was taken by Government of India that is Namami Gange Project under National Mission for Clean Ganga Mission and number of effort being done to improve the quality of the Ganga River. Due to lock down the tourism industry also stopped this affected influx of tourism. Tourism was considered one of the important sources of pollution in the Ganga River. Due to tourism all markets near the Ganga river site at Haridwar, Rishikesh, Allahabad were affected. Hotel, shops, lodges, the restaurant all were discharged sewage waste in the Ganga river. In 2015, the biggest-ever initiative, Namami



**Fig. 2.** a and 2b. The map of hole in the ozone layer over Antarctica on 23rd May 2020 and September 08, 2019 respectively.

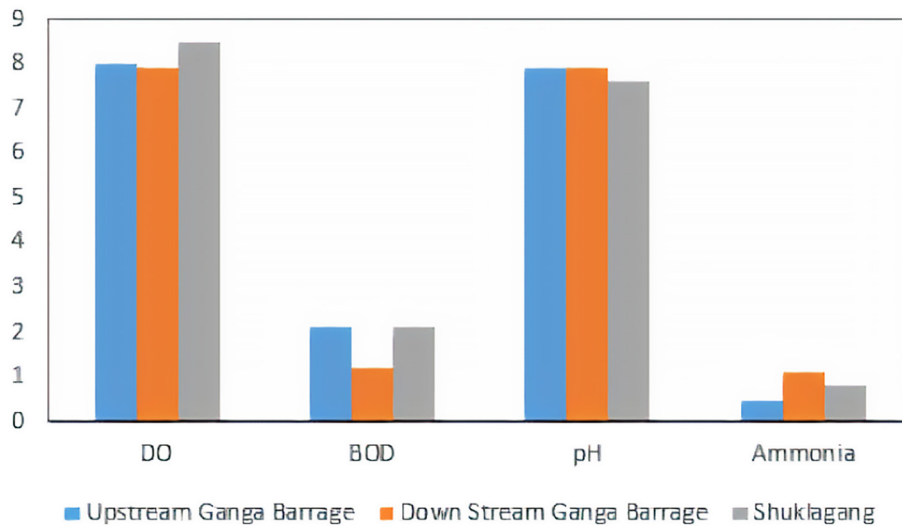


Fig. 3. Impact of Covid 19 on Water quality of Ganga on (Source CPCB 28th March 2020).

Ganga was launched with a budget of over Rs 20,000. Despite numerous programs and huge funds were allocated for the lean Ganga mission but the number of pollutants keeps on increasing in the Ganga river. The Ganga water at Haridwar and Rishikesh were found clean and safe for drinking due to 500% decrease in sewage and industrial effluents after lockdown due to COVID 19 pandemic. A drop in the number of visitors at Ghats in Haridwar also helped in improving river water quality. The mean concentration of DO, BOD, were found respectively 8 mg/l, 2.1 mg/l, pH 7.9 in upstream Ganga Barrage, while in down-stream of Ganga barrage were DO (7.90), BOD (2.1 mg/l) and pH (7.9) during lockdown period due to COVID 19 of March 2020 (Source CPCB). The Uttarakhand state is the source of the Ganga river and it enters Uttar Pradesh in Bijnor district and passes through major districts such as Meerut, Bulandshahar, Aligarh, Kanpur, Allahabad, Varanasi, among others. The nationwide lockdown was imposed on March 25, 2020, and within 10 days the quality of the Ganga river improved significantly. The concentration of DO at Varanasi's Nagwa Nala was significantly improved from 3.8 mg/l on March 6 and increased up to 6.8 mg/l on April 4 during the lockdown period after COVID 19 and thus it showed 79% improvement in DO concentration. Other activities such as tourism, fairs, bathing and cloth washing near the ghats were also reduced. The water quality of the Ganga River improved by 40–50% during the lockdown period which was imposed after the outbreak of COVID 19 (The New India Express 2020). The mean value of DO was (>6 mg/l), Biological Oxygen Demand (BOD (<2 mg/l) and Total Coliform 5000 per 100 ml) and pH ranged from 6.5 to 8.5 (Mandal and Pal, 2020). The TDS concentration has significantly reduced in surface water after lockdown and was reduced from 2457 mg/l to 987 mg/l (Mandal and Pal, 2020) (Fig. 3).

#### 4. COVID-19 lockdown vs noise pollution

The noise comes under the National Ambient Air Quality standard and considered one of the major pollutants as per the Air (Prevention and Control of Pollution) Act, 1981. Noise is an unwanted sound that causes a disturbance in communication (Berglund et al., 1999). Noise consists of unpleasant obtrusive, annoying, distracting, or persistent sounds that interfere with sleep or the ability to concentrate or enjoy life. The noise level should be 30db during the night for good sleep as per WHO guidelines. Several scientists have conducted studies on Noise pollution and found motor vehicular noise is predominant sources of noise pollution in India. Several studies have been conducted in various parts of the country to assess the ambient noise level. The

majority of the total environmental noise is caused by motor vehicles (Banerjee et al., 2008). Day time noise levels measured along roads between two campuses of a University in Bangalore, Orissa, ranged from 70.1 dB(A) to 120.4 dB(A) which are above the permissible limits for road traffic noise (70 dB[A]). Long term exposure of high noise level can cause irritation, stress, mental disorders, annoyance, stress, hypertension, loss of concentration, sleeplessness, etc. (Ohrstrom, 1989; Rabinowitz, 2000; WHO, 2005; Stansfeld et al., 1996; Chakraborty et al., 1998). The ambient noise level in major cities of India i.e. Bangalore, Calcutta, Chennai, Delhi, Hyderabad and Mumbai were ranged from 45 db to 86 db during day time, 37 db to 76 db during night time in a residential area, 63 db to 90 db during day time, 46 db to 78 db during night time in commercial area, 50 to 89 db during day time, 40–70 db during night time insensitive area however in Industrial area the noise level ranged from 44 db to 86 db during day time and 42 db to 70 db during night time (sources NIUF 2000). The level of noise pollution was decreased drastically in a different part of globe including India. It has been estimated that the Noise level was reduced up to 35% to 68% from 8 am to 4.00 pm. The noise pollution at Govindpuri metro station which earlier recorded the noise level 100 db now after lockdown the noise level reduced up to 50% and constituted 50 db noise level (Times of India 23rd April 2020). Most of the residential area of New Delhi the Noise level reduced from 55 db to 30–35 db. The noise level was found reduced up to 30 to 40% during the lockdown period and in most of the places of over stone quarrying and crushing areas, entire study units fall under the noise level < 65dBA (Mahato et al., 2020). COVID 19 also affected noise pollution and coral reef (Florina Jacob 30/4/20). The sources of noise pollution in the marine ecosystem are classified into two categories natural and anthropogenic sources (Hildebrand, 2009). Natural sources include tides, tsunami, earthquake, sea breeze rainfall and cyclone etc. The anthropogenic sources include navigation, commercial shipping, traffic noise and industrial around the coastal area, ship for commercial activities and recreational activities. In some places, radar is also used for fishing (Slabbekoorn et al., 2010). Noise pollution also harms wildlife. It is estimated that most of the marine noise that is derived from human activities is of low-frequency (Hildebrand, 2009). The coral reef is also found to be a noisy ecosystem (University of Rhode Island, 2001). Boat noise causes some negative effects on the coral reef and causes a decrease in the recruitment of reef fish and coral larvae, possibly due to greater difficulty in “listening” and finding a reef to settle in (Hollies and Stephen, 2013). Due to COVID 19 the lockdown also affected the marine ecosystem (Fig. 4), all transport processes in the marine ecosystem also



**Fig. 4.** Coral reefs relax from decrease in noise pollution during COVID-19 lockdown period.

stopped and the pollution level caused by human activities also reduced drastically.

### 5. COVID-19 lockdown vs wild-life

As per the wildlife experts “The animal-borne disease is the outbreaks of the destruction of nature”. Human confinement during lockdown gives space to animals and birds which was usually occupied by a human and their activities. It was noticed that many animals around and coming into the spotlight during the coronavirus period globally. Deer, peacocks, monkeys, elephants, birds, dolphins, etc. are the best examples during lockdown who came out in notice much more frequently and greater in number (Fig. 5a).

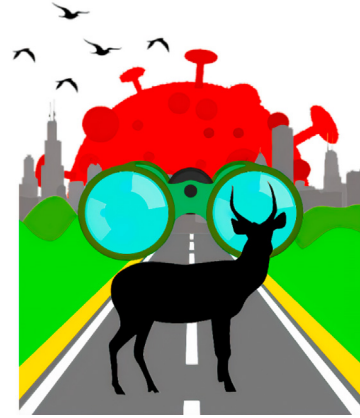
Some experts say that during this period few birds spreading their wings and breeding in the human-occupied areas which is now-a-day's having no activity. Migratory birds are returning to lakes and water bodies more in number. During this period we could see the difference in how birds communicate. As traffic noise is reduced so we can hear the perceived quality of their songs with more chirping sound. Now migratory birds can fly freely without human interference. All the fishing activity has stopped so dolphins do come closer to the shore.

Lockdown Wildlife Tracker app (Fig. 5b) on [play.google.com](https://play.google.com) by Wildlife Institute of India (WII) was the great initiative to witness the real-time data using an app to share comfortable wildlife movement in human restricted zones (Wild Life Institute of India, 2020).

Ample evidence found in the various part of the globe to indicate the use of man-zones by wildlife. *Coyote (Canis latrans)* is a species of canine native to North America. It is smaller than its close relative, the gray wolf



**Fig. 5a.** An African penguin walks in the parking lot of an empty restaurant, close to popular Boulders Beach in Cape Town, South Africa, on April 14, 2020. The beach closed during the lockdown across South Africa, due to the COVID-19 pandemic. Credit: Rodger Bosch Getty Images.



**Fig. 5b.** Lockdown wildlife tracker app. by wild life Institute of India.

that normally timid of traffic. It has been observed that coyote found near the Golden Gate Bridge in San Francisco, USA (Fig. 5c).

Deer is pasturing near Washington homes which is just a few miles away from the White House. Italy, Barcelona and Bergamo witnessed wild boar becoming more bolder. Peacocks have strutted through Bangor and goats through Cap Town and sheep in Wales (Loring, 2020). A civet is a small, lean, mostly nocturnal mammal native to tropical Asia and Africa, especially the tropical forests. Due to the COVID-19 lockdown, Meppayur in Kozhikode (India) had an unusual visitor one afternoon: a small Indian civet. Some policemen got the attention that the civet used a zebra crossing (Singh, 2020). At last, we can say that nature has pressed the reset button and rejuvenate its wildlife during the lockdown. Although this is a short-term improvement, one day we go to back to business-as-usual, so we have to restore it. We have to find ways of using natural resources and live in harmony with it permanently.

### 6. Conclusion

This study finds the impact of lockdown on the global environment including various types of emission, on the ozone layer, water, industrial and noise pollution. The impact of COVID-19 on wildlife is also considered. Overall this research direct the India and cross-country investigation for better insight of COVID-19 and how current lockdown effects the various parameter of the environment during COVID-19. So, we can conclude that if we do climate deterioration than the mother-nature is trying to bounce back, also we should understand the world climate can anticipate. There is a chance that when the lockdown period is over environmental pollution can be back with more pace so human effort towards saving the environment can do everlasting effect.



**Fig. 5c.** Coyotes taking over the empty streets of SF by Johnny Funcheon.



## Declaration of competing interest

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