Peertechz

LIFE SCIENCES GROUP

GLOBAL JOURNAL OF Ecology

ISSN: 2641-3094 DOI: https://dx.doi.org/10.17352/gje

Mini Review

Assessing the impacts of COVID-19 pandemic on the environment: A correlation or causation?

Sikpaam Issaka Alhassan[1], Justice Delali Akoto[1], Michael Ackah[2], Stephen Mintah[3], Feiping Zhao[1,4] and Haiying Wang[1,4]*

[1]School of Metallurgy and Environment, Central South University, Changsha 410083, China

[2]Department of Molecular Biology and Sericulture Biotechnology, Jiangsu University of Science and Technology, Zhenjiang, China

[3]Department of Agriculture Economics and Extension, University for Development Studies, Tamale, Ghana

[4]Chinese National Engineering Research Center for Control and Treatment of Heavy Metal Pollution, Changsha 410083, China

Received: 21 September, 2020
Accepted: 05 November, 2020
Published: 06 November, 2020

***Corresponding author:** Haiying Wang, Chinese National Engineering Research Center for Control and Treatment of Heavy Metal Pollution, Changsha 410083, China, E-mail: haiyw25@yahoo.com

Keywords: COVID-19 pandemic; Environment; Pollution; Effluents; Impacts

https://www.peertechz.com

Abstract

The outbreak of the COVID-19 pandemic has severely impacted human lives, human activities, and the world economy. In response to curb its spread, pandemic risk reduction measures such as mass lockdowns, extensive travel bans, and mass quarantine were imposed globally. While the imposition of these measures has negatively impacted the world economy, its impacts on the environment could be described as a gain, as the ecosystem appears to be given a rebirth. During the mass lockdown (February to April 2020), air pollution worldwide has dropped significantly precisely, with a decline in the emission and concentration of pollutants. The emission of CO_2 globally declined by 8.8% during the first half of 2020. Additionally, both surface and underground water quality have been improved due to reduced industrial activities. Also, there has been an increase in carbon sink due to the decline in global bush fires. In a nutshell, the study recommends that as the world economy recovers from the impact of COVID-19, world leaders and policymakers should focus on measures that improve the environment and the ecosystem, such as the adoption of the green economy, production and use of fuel cells cars instead of gasoline cars and treating industrial effluents to WHO recommended levels before discharging them into water bodies.

An epidemic with an unknown etiology from Wuhan, the capital of Hubei province in China, was reported to the World Health Organization (WHO) on December 31, 2019 [1]. In 11 days after WHO had received the initial report from Wuhan China, the disease had spread to about 24 countries through human-human transmission. High infectivity coupled with the rising global death toll, uncertain incubation period, lack of pre-existing human immunity, and the potential for asymptomatic carriers led to WHO declaring it a Public Health Emergency of International Concern (PHEIC) on January 30, 2020 [2]. As such, it was named as Corona Virus Disease, 2019 (COVID-19) [2]. The disease is spread mainly from human-human contact or through fomites (contact with contaminated surfaces); meanwhile, the WHO has considered the potential or possibility for airborne transmission. Comparatively, the COVID-19 patient can transmit to an average of three (3) people in the absence of any intervention, 18 people for measles, and two people for Ebola [3]. The virus has 2-14 days incubation period and the symptoms range from mild clinical symptoms, chest pains, difficulty in breathing, and mental confusion

Citation: Alhassan SI, Akoto JD, Ackah M, Mintah S, Zhao F, et al. (2020) Assessing the impacts of COVID-19 pandemic on the environment: A correlation or causation? Glob J Ecol 5(1): 095-098. DOI: https://dx.doi.org/10.17352/gje.000027

to kidney failure in severe cases [4]. Various risk reduction measures such as cluster lockdown, social distancing, extensive travel bans, and mass quarantine were imposed in different countries. The situation has impacted both regional and global socio-economic growth [5]. Subsequently, the effects of these measures range from a surge in commodity prices, disruption of supply chains, less demand for imported goods and services, a decline in international tourism and business travel to increasing economic anxiety [6].

Despite all the imbalances mentioned above that the outbreak of COVID-19 poses on the society and the economy, such as increased mortality and economic shutdown, we must see the silver lining out of the dark cloud. The COVID-19 pandemic outbreak has brought changes to human lives, such as improved personal and environmental hygiene. For instance, frequent washing of hands, the use of alcohol-based hand sanitizers, and frequent cleaning of our settings. Its impacts on our health and the economic downturns are expected to last for decades; what remains unclear is its impacts on the environment. Has the outbreak of COVID-19 waged some phenomenal gains on the environment? The global pandemic has influenced lives and daily activities and impacted our environment as the ecosystem appears to be given a rebirth with the control measures in place. Air pollutions around the world have dropped drastically as levels of harmful pollutants like NO_2 (nitrogen dioxide), CO (carbon monoxide), SO_2 (sulfur dioxide), and $PM_{2.5}$ (small particulate matter) have dropped while shutdowns continue. The impact of COVID-19 lockdown measures on both underground and surface water quality has been phenomenal. Due to the lockdown, it is expected that pollution loads to the environment would decrease. According to the Chinese Ministry of Ecology and Environment, the air quality increased by 11% in the category of " good" in 337 cities. Similarly, the Scripps Institute of Oceanography has indicated that the use of fossil fuel globally would decline by about 10% owing to the COVID-19 spread [7]. This has positive implications on our health, agriculture, and general wellbeing as it has significant impacts on the atmosphere, hydrosphere, and the lithosphere.

Again, it is projected that pollutants from major industries that affect aquatic ecosystems, such as industrial wastewater or effluents, crude oil, heavy metals, and plastics, would have stopped entirely hence a corresponding reduction in water pollution. For instance, the Grand Canal in Italy, where the COVID-19 crippled the whole nation, turned clear, giving life and providing a habitable environment to many aquatic species [8]. Similarly, a sacred but severely polluted river in India, after several lockdown days, turned cleaner at several places [9]. Moreover, Yunus, et al. [10] investigated surface water quality in India (Vembanad Lake, the longest freshwater lake in India) using Time-series analyses through remote sensing images. Results from the study indicated that suspended particulate matter (SPM) estimated based on established turbidity algorithm concentration during the lockdown period decreased by 15.9%. Additionally, a Time series analysis of satellite image collections collected from April 2013-April 2020 showed that the SPM quantified for April 2020 was the lowest for 11 out of 20 zones of the lake. Also, a recent study found out that the mean values of Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD) of the Ganga river were found to be (>6 mg/l) and (<2 mg/l) respectively, with a Total Coliform of 5000 per 100 ml and pH range of 6.5 to 8.5 [11]. This indicates an improvement in the surface water quality considering the PH, DO and the BOD, the study added. Similarly, the water quality at the famous religious site, Haridwar Ghats in India, has also improved during the lockdown with mean concentrations of DO, BOD found to be 8 mg/l and 2.1 mg/l respectively. The upstream's pH was 7.9 which was same as that of the downstream with an absolute DO (7.90) and BOD (2.1 mg/l) [12].

The imposition of extreme measures to control the virus has potentially led to a decrease of aerosols and atmospheric pollutants due to the reduction in the disruption of anthropogenic-based emissions. Aerosols either directly or indirectly contribute to both regional and global climate changes [13]. For instance, increased Aerosol Optical Depth (AOD) levels have enormous effects on atmospheric stability and precipitation, such as disturbance in the scattering and absorption of solar radiation and ultimately on vegetation growth. Additionally, aerosols can increase the risk of respiratory problems in humans and animals and decrease urban areas' visibility. In a study, Lal, et al. [14] observed that from February-to-March 2020 (thus during the period of partial-to-total lockdown), there was a significant reduction in the level of NO_2 (0.00002 mol m^{-2}), a low reduction in CO (b0.03 mol m^{-2}), and a low-to-moderate reduction in AOD (AOD: ~0.1–0.2) in the major hotspots of COVID-19 outbreak in China attributed to the mass lockdowns. In furtherance, Zhu, et al. [1] and Ogen, et al. [15] have also suggested some possible relationship between COVID-19 lockdown and the emissions of some pollutants (i.e., $PM_{2.5}$, PM_{10}, CO, NO_2, CO_2, and O_3). In the work of Zhu, et al. [1], daily estimates for country-level emissions of CO_2 for different sectors based on near-real-time activity data was investigated. The study indicates that the COVID-19 pandemic preventive measures such as mass lockdown and a halt to industrial and transportation activities led to a global reduction of about -1551 Mt CO_2 (Figure 1B), about an 8.8% decrease in global CO_2 emissions.

The magnitude of such a decline in CO_2 emissions is the highest ever recorded in the world's history, even higher than similar economic downturns such as world war two (-790 Mt) and the Spanish flu. In Figure 1 above, it could be seen that daily CO_2 emissions for 2020 have declined sharply owing to the COVID-19 spread as compared to 2019. However, by early May, the emission of CO_2 started increasing (Figure 1A) probably because most countries had relaxed their mass lockdowns and economic and industrial activities started picking up. Aside from the decline in the emissions of CO_2, other particulate matter ($PM_{2.5}$, PM_{10}) begun to increase by early May in China and parts of Europe as lockdown restrictions were relaxed and economic activities begun to recover. It is therefore not surprising that there is a decline in global emission of pollutants during the COVID-19 lockdown because most severely affected cities such as Wuhan in China, Lombardy

Citation: Alhassan SI, Akoto JD, Ackah M, Mintah S, Zhao F, et al. (2020) Assessing the impacts of COVID-19 pandemic on the environment: A correlation or causation? Glob J Ecol 5(1): 095-098. DOI: https://dx.doi.org/10.17352/gje.000027

in Italy, New York in the USA, and New Delhi in India are all industrial cities with a vast trading interest. While it is unclear if the emission of these pollutants in high proportions could have potentially contributed to the outbreak of COVID-19, what remains clear is that the outbreak of COVID-19 with its imposed lockdowns has led to a significant reduction in the concentration and emissions of pollutants and other dangerous chemicals on the environment. This benefit provides us with clean air, clean water, and clean soil better off than hitherto existed. This comes from the cut in the pollution emitted from burning fossil fuels in industries, transports, agriculture, and residential areas. Therefore, we could postulate that there is a causation between COVID-19 lockdown and the reduction in the emission of pollutants on the environment.

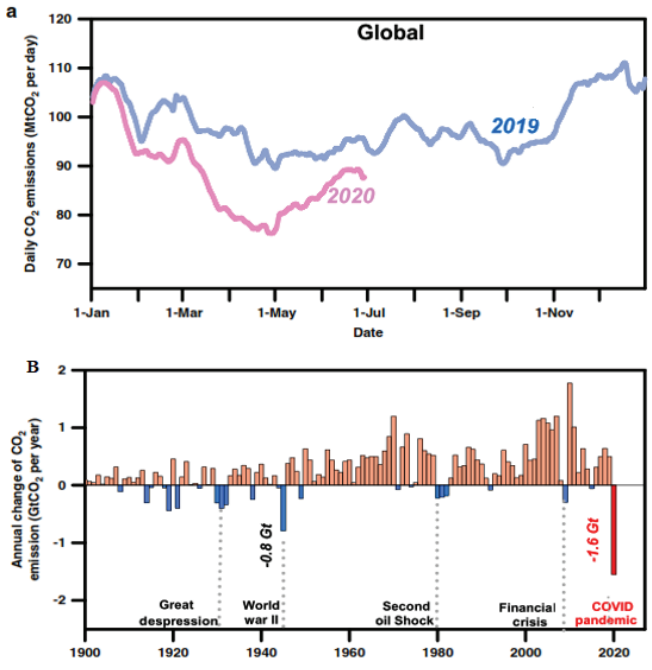

Figure 1: (A) Comparative analysis of daily CO2 emission for 2019 and 2020;1(B) Annual CO2 decline for five (5) economic downturns [Adapted from [1]].

Lastly, Li, et al. [16] undertook an air quality study during the COVID-19 lockdown period in China around the Yangtze river delta region (YRD). YRD is one of the main economic hubs in Eastern China with multiple industrial activities. The study showed that SO_2, NO_x, $PM_{2.5}$, and VOCs emissions reduced by approximately 16–26%, 29–47%, 27–46%, and 37–57% during level I (January 24 -February 25) and level II (February 26 -March 31) respectively. This further confirms satellite imageries published by the National Aeronautics and Space Administration (NASA) that the lockdown measures have led to a massive reduction in NO_2 hence improving the global air quality. In Figure 2 below, we can see that atmospheric pollution in China captured by satellite has reduced significantly during the lockdown (February 10-25) as compared to before the lockdown (January 1-20), a clear indication of the impact of lockdown on pollutant's emission. Similarly, a reduction in NO_2 levels was also observed in major cities across the world. According to the European Environmental Agency, the average NO_2 concentrations in Rome around March 2020 were 26 – 35 percent lower than the same period in 2019. Other European cities like Madrid and London have recorded 51 percent and 60 percent reduction in NO_2 respectively compared to the same period in 2019 [17].

Conclusion

This paper presents a brief overview of the impacts of the COVID-19 pandemic on the environment to postulate the possible relationship between COVID-19 preventive measures such as mass lockdown and the environment. While we admit that the outbreak of COVID-19 has had enormous impacts on

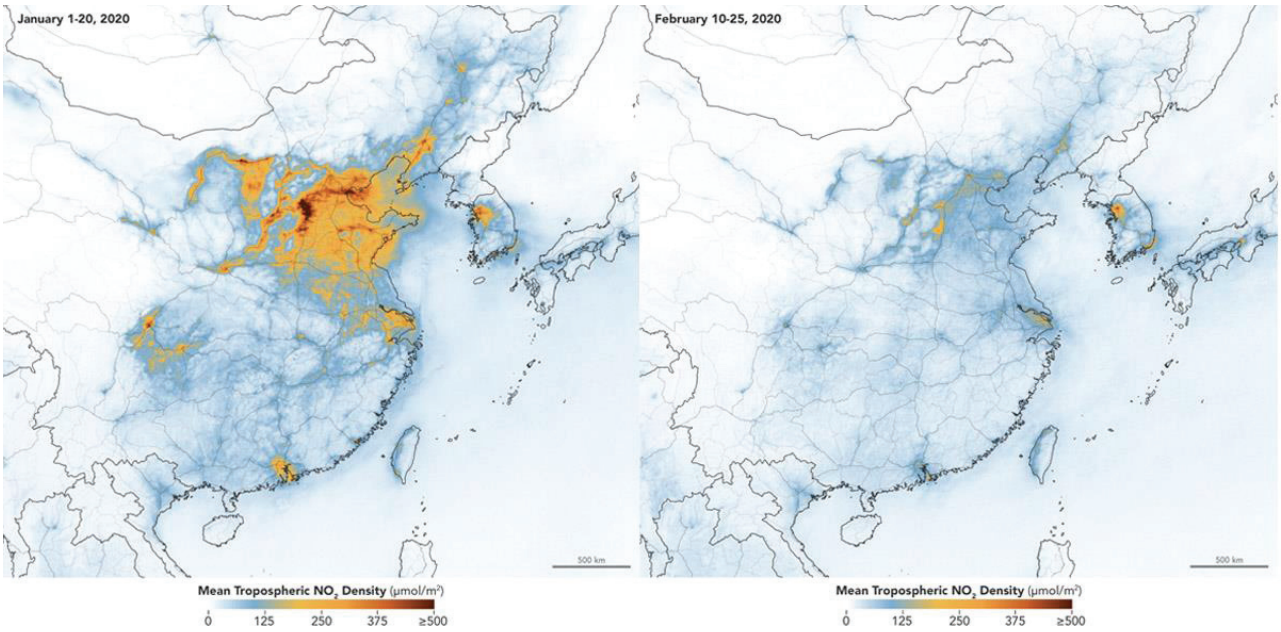

Figure 2: Satellite image showing NO2 values across China from January 1–20, 2020 (before the quarantine), and February 10–25 (during the quarantine). Image adapted from NASA Earth Observatory 2020 [15].

Citation: Alhassan SI, Akoto JD, Ackah M, Mintah S, Zhao F, et al. (2020) Assessing the impacts of COVID-19 pandemic on the environment: A correlation or causation? Glob J Ecol 5(1): 095-098. DOI: https://dx.doi.org/10.17352/gje.000027

our health and the world economy, which may take decades to recover fully. It is also essential to note that the lockdown has impacted positively on our environment in innumerable ways such as improved air quality due to a decline in the emission of pollutants such as CO_2, CO, NO_2, $PM_{2.5}$, improved underground and surface water quality, and increase in carbon sink due to decline bush fires. While pollution of water bodies from domestic activities remained the same during the lockdown, industrial pollution and pollution from tourism significantly reduced, leading to improved air and water quality. The overall effects of this on our society are that it leads to a decline in climate change with improved air, water, and preservation of aquatic life. Lastly, the emergence of the COVID-19 pandemic has underscored the fact that when we destroy the environment or the ecosystem, we destroy the system that supports human life. As such, world leaders should formulate a policy that would ensure that every country observes at least a partial-to-total lockdown on world environment day (5^{th} June) every year to minimize the effect of human activities on the ecosystem.

References

1. Liu Z, Ciais P, Deng Z, Lei R, Davis SJ, et al. (2020) Near-Real-Time monitoring of global CO2 emissions reveals the effects of the COVID-19 pandemic: Nature Communications 11: 5172. Link: https://go.nature.com/2Ju4FdV
2. World Health Organization (2020) Coronavirus Disease 2019 (COVID-19): Situation Report. World Health Organization 81.
3. Liu Y, Gayle AA, Wilder-Smith A, Rocklöv J (2020) The reproductive number of COVID-19 is higher compared to the SARS coronavirus. J Travel Med 27: taaa021. Link: https://bit.ly/38e8BKf
4. CDC (2020) Coronavirus Disease 2019 (COVID-19), Symptoms. Centers for Disease Control and Prevention Link: https://bit.ly/3k1Q0Dx
5. Long HW, Feng WJ (2020) Research Report on 'Companies' Survival and Development Strategy during a Novel Coronavirus Epidemic. UIBE Press, Beijing.
6. Boone L, Haugh D, Pain N, Salins V (2020) Tackling the fallout from COVID-19. Econ.Time COVID-19 37.
7. SCRIPPS (2020) Research in the time of COVID-19. Link: https://bit.ly/3erNNjz
8. Clifford C (2020) The Water in Venice, Italy's Canals Is Running Clear amid the COVID-19. Lockdown — Take a Look. Link: https://cnb.cx/3p3h6ho
9. Mani KS (2020) The Lockdown Cleaned the Ganga More than 'Namami 'Gange' Ever Did. Link: https://bit.ly/3mY6IVY
10. Yunus AP, Masago Y, Hijioka Y (2020) COVID-19 and surface water quality: Improved lake water quality during the lockdown. Science of the Total Environment 731: 139012. Link: https://bit.ly/2TWhBLI
11. Mandal I, Pal S (2020) COVID-19 pandemic persuaded lockdown effects on the environment. Sci Total Environ 732: 139281. Link: https://bit.ly/3kZAU2w
12. SANDRP (2020) Ganga-Yamuna-Cauvery Flow Cleaner in Lockdown: what Can We Learn?" DRP News Bulletin, South Asia Network on Dams. Rivers and People (SANDRP). Link: https://bit.ly/34Zuz1y
13. Huang J, Wang T, Wang W, Li Z, Yan H (2014) Climate effects of dust aerosols over East Asian arid and Semiarid regions. J Geophys Res Atmosphere 119: 11398-11416. Link: https://bit.ly/34WMRjX
14. Lal P, Kumar A, Kumar S, Kumari S, Saikia P, et al. (2020) The dark cloud with a silver lining: Assessing the impact of the SARS COVID-19 pandemic on the global environment. Science of the Total Environment 732: 139297. Link: https://bit.ly/2GtAZwm
15. Ogen Y (2020) Assessing nitrogen dioxide (NO2) levels as a contributing factor to coronavirus (COVID-19) fatality. Sci Total Environ 726: 138605. Link: https://bit.ly/3oYXXNg
16. Li L, Li Q, Huang L, Zhu A, Xu J, et al. (2020) Air quality changes during the COVID-19 lockdown over the Yangtze River Delta Region: An insight into the impact of human activity pattern changes on air pollution variation. Science of the Total Environment 732. Link: https://bit.ly/3oWUNtr
17. ESA (2020) Coronavirus lockdown leading to a drop in pollution across Europe. European Space Agency. Link: https://bit.ly/3l4cViE

Citation: Alhassan SI, Akoto JD, Ackah M, Mintah S, Zhao F, et al. (2020) Assessing the impacts of COVID-19 pandemic on the environment: A correlation or causation? Glob J Ecol 5(1): 095-098. DOI: https://dx.doi.org/10.17352/gje.000027