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# 5. Environment and Covid-19

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**Abstract**:

The pandemic caused by Coronavirus infection (COVID-19) is having a worldwide impact that affects health, the economy and indirectly affects the air pollution in cities. This chapter analyses the indirect effect produced by this pandemic on environment. Recent research suggests greater COVID-19 prevalence in areas burdened with higher exposure to chronic air pollution, and socially disadvantaged populations are more likely to reside in communities located at the convergence of both COVID-19 and air pollution health risks. With the global lockdown, meteorological factors are highly studied for the transmission of COVID-19. Studies on several nations were used to explore the effect of temperature, absolute humidity and diurnal temperature range on COVID-19 transmission. The current coronavirus COVID-19 outbreak has had a substantial impact on many aspects of general life. The outbreak of COVID-19 raised numerous questions on the interactions between the occurrence of new infections, the environment, climate and health. COVID-19 has emerged as a chance to choose a better way forward in saving the environment and looking towards the solutions to save the mankind.

**Keywords:**

Environment; Covid-19; Air pollution; SARS-CoV-2; viral infection; Disease.

## 5.1 Introduction:

Corona Virus Disease 2019, also known as "COVID-19″, named by the WHO i.e., World Health Organization (Wu and Mc. Googan, & Zu et al., 2020), caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection has been confirmed as an acute respiratory infectious disease (WHO, 2020a; Huang et al., 2020; Yu et al., 2020). As a result of its fast and wide transmission world-widely, it has been recognized as a global pandemic (WHO, 2020b), which has infected 47,930,397 confirmed cases, including 1,221,781 deaths as of 5:00 pm CEST, 5 November 2020 (WHO, 2020c).

This worldwide pandemic is moderately partial by the change of ambient environment is tranquil a hot topic, which needs to be discussed always (Fu et al., 2021). This virulent disease (COVID-19) is having a universal bang that affects our health, the wealth and ultimately affects to the air pollution in all cities. In Portugal air pollution data was analysed from a period of movement control of the citizens by the government COVID lockdown period (March–May 2020 & also 2021) with data from baseline conditions (signify the mirrored periods from the five previous years (March–May from 2015 to 2019)).

Air quality data in particular NO2 and PM10 hourly concentration from approx 20 monitoring stations spread over mainland Portugal was used to perform this evaluation. The represent reduction observed on pollutant concentrations was higher for NO2 (41%) than for PM10 (18%). Intended for NO2 reductions were additional significant in traffic and surroundings urban sites than in rural stations. The reduction of NO2 concentration observed in traffic sites were compared to the opinion of traffic input by the incremental method, suggestive of latter come up to is not reliable and alert to the suspicious use of this approach in potential works (Gama et al., 2021).

Global studies that investigate whether racial minorities, socio-economically rundown inhabitants, and other susceptible groups are extensively more represented in counties where significantly higher COVID-19 incidence spatially coincides with higher respiratory health risks from outdoor coverage to HAP i.e., hazardous air pollutants. COVID-19 data from the Johns Hopkins Centre for Systems Science and Engineering database are correlated to respiratory risk estimates beginning the U.S. Environmental Protection Agency's National Air Toxics Assessment and variables from the 2018 American Community Survey. Bivariate local measures of spatial association are implemented to identify county clusters indicating relationships between COVID-19 incidence rate and respiratory risk from HAP exposure.

Significantly socio-demographic inequities symbolize the opening point for more detailed investigations of places facing the double burden of high prevalence and air pollution exposure, and also give emphasis to the urgent need to expand easing strategies for addressing both COVID-19 and chronic air pollution in socially exposed communities (Chakraborty, 2021).

In the midst of global lockdown, meteorological factors are highly discussed for COVID-19 transmission. Data sets from United Kingdom, Italy, Germany and Spain were used to look at the effect of temperature, unlimited humidity and diurnal temperature range on COVID-19 transmission. Results have shown that both the cold and the dry environment are likely to assist the COVID-19 transmission (Fu et al., 2021). The research clusters were identified based on a systematic content analysis of the studies.

The clusters are in four underlying such as: (Shakil et al., 2020).

a. Environmental degradation & COVID-19
b. Air pollution & COVID-19
c. Metrological factors & COVID-19 and,
d. Temperature & COVID-19

COVID-19 outbreak raised numerous questions on the interactions between the rate of new infections, the environment and health. The appearance and spread of SARS-CoV-2 to be related to locale destruction live animal trade, intensive livestock farming, global travel and urbanization. Significantly, the severity of COVID-19 depends on the interactions among the viral infections, ageing and chronic diseases like respiratory, cardiovascular diseases, metabolic and obesity which are they partial environmental stressors.

Together the pandemic and the social response to the disease have elicited a range of behavioural and societal changes to might remain long after the pandemic and that might encompass extensive term health effects counting on mental health. Obviously, COVID-19 will have ongoing impact on the environmental health field and will open new research policy and perspectives needs (Barouki et al., 2021).

Although, COVID-19 cases worldwide there is no final conclusion on the meteorological impact over the continuously growing, it usually indicates that SARS-CoV-2 may be chiefly responsive to weather (Bashir et al., 2020; Kumar et al., 2020c; Liu et al., 2020; Tosepu et al., 2020). A preliminary laboratory test found that the survival time of new corona viruses decreased with increasing temperature and humidity (Van Doremalen et al., 2020). Besides, airborne based virus spread depends on the respiratory droplet size (Altamimi and Ahmed, 2020; Kumar et al., 2020b).

In statistical analysis, a lot of studies reported that meteorological factors were closely related to the confirmed cases of COVID-19. The cold and dry weather may reason for droplets drift and evaporation, which promote the dynamics of the infection transmission. (Chien and Chen, 2020; Halaji et al., 2020; Hon et al., 2020; Kumar et al., 2020a; Liu et al., 2020; Rabaan et al., 2020; Sahin, 2020).

Still, many analyses only obtained the conclusion in a simple regression model without controlling social factors and in a limited studying time period, which may lead to missed opportunities in understanding how the epidemic began and resolved.

It is well acknowledged too many countries have implemented changing degrees of traffic restrictions, public health measures, including restricted assembly, contact tracking and family isolation in order to prevent the spread of COVID-19 since its outbreak. Thus, it is necessary to adjust these factors like government responses before concluding the effects of meteorological factors on COVID-19 transmission. The environment or climate has also had a significant influence on COVID-19 transmissions and mortality.

The pros and cons of COVID-19 on the environment are evident in the literature. Moreover, studies have argued that temperature influences the COVID-19 transmissions, but have found mixed such as positive, negative and insignificant impacts on COVID-19 transmissions. Consequently, COVID-19 can influence the environmental factors and vice versa. While this investigating incident studies have focused on one side of the coin or the other. However, to the best of our facts, no studies have explored the bidirectional characteristics of COVID-19 and the environment. Being a promising study domain, a vital review of studies on the nexus between the COVID-19 and the environment can devise a current state of knowledge that can provide directions to future research (Fu et al., 2021).

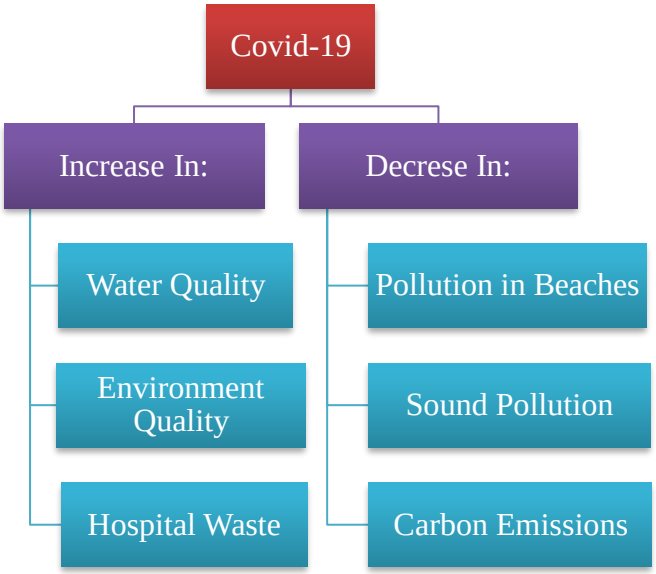


**Figure 5.1: Positive and negative impacts of Covid-19 on environment**

The world has been trapped on an unsustainable pathway, reinforced by mechanisms that oppose change, such as infrastructure with long lifespan, investment cycles on the order of decades, and cultural and political inertia (Otto et al., 2020). Crises, be they health, economic, or environmental, give rise to uncertainty and confusion that can act as windows of opportunity. Destabilizing the status quo can shift power structures and motivate actors to deviate sharply from existing policies and plans (Otto et al., 2020). The economic shock of COVID-19 should trigger policies and shifting norms that could deliver decarburization and progress towards other SDGs.

The most promising may include subsidies to decarbonize energy production and storage; carbon-neutral cities; divesting from fossil fuel assets; and increasing public perception of fossil fuel use as immoral Public support will be essential. The current model of responding to serial crises misses important opportunities for integrated solutions to multiple challenges. Instead, systemic, structural change through long-term, international cooperation is needed to accelerate progress towards the SDGs. Policy makers have a once-in-a-generation opportunity to use stimulus packages while reviving their economies to bring greenhouse emission reductions in line with the Paris agreement and to implement the SDGs rapidly. The stakes for selecting a radically more sustainable path forward could not be higher (Tonne, 2021).

## 5.2 COVID-19 and Geographical Origin Areas:

The existing COVID-19 pandemic caused by infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) diseases having an exceptional global impact at a human, social and economic stage, precipitating rising efforts by the scientific community to identify the exact pathogenesis of the infection and risk factors related with morbidity and mortality.

The U.K. and the U.S.A. have highlighted a possible organization between more severe disease in patients from ethnic minorities, although whether this may be due to individual genetic factors or socio-economic differences remains unclear (Williamson et al., 2020; Price-Haywood et al., 2020; Hsu et al., 2020; Knight et al., 2020). The objective of this study was to describe and compare the main clinical characteristics and outcome measures in hospitalized patients with confirmed COVID-19 according to geographical area of origin. These studies have included patients from non-Hispanic ethnic data and backgrounds for certain alternative groups have been under represented (Norman et al., 2021).

## 5.3 COVID-19 and Environment Linkage between Air Pollution:

In Wuhan city, China, A pneumonia disease of unidentified source caused a catastrophe. This disease spread around the globe affecting a wide range of people. WHO i.e., World health organization called it a pandemic and it was officially named as Severe Acute Respiratory Syndrome Corona virus 2 (SARS CoV-2), also called presently a Corona virus disease (COVID-19). More research is needed in order to set up linkage between COVID-19 spread and air pollution. Still, it can be partially recognized to both higher rate of population density and frequent exposure of population to enhanced levels of PM2.5 concentrations before lockdown period (Ali et al., 2021).

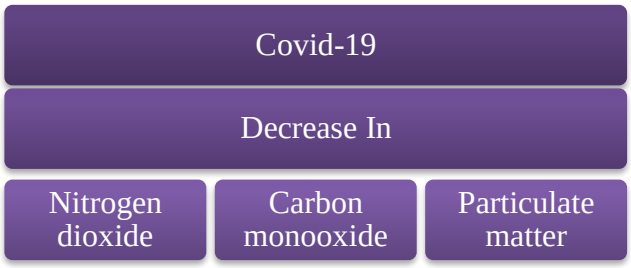


**Figure 5.2: Positive impact of Covid-19 on air pollution**

The genomic sequence of this disease showed that it is caused by a novel Corona virus, therefore, officially named as Severe Acute Respiratory Syndrome Corona virus 2 (SARS CoV-2) by ICTV i.e.; International Committee on Taxonomy of Viruses (Lai et al., 2020). Corona virus disease, also termed as COVID-19 is the fifth pandemic to have occurred after the Spanish Flu pandemic back in the year 1918. COVID-19 spread from China to other countries by human to human transmission (Liu et al., 2020) and mainly hits the respiratory system (Waris et al., 2020). This virus and its spread, affecting peoples in a small period of time

WHO announced SARS CoV-2 as a Public Health Emergency of International Concern (PHEIC) on (WHO Timeline, 2020). It is known that increased air pollution can result in viral respiratory diseases affecting 10%–20% of the population (Frontera, 2020). Exposure to criteria pollutants, for example, Nitrogen dioxide, Oxides of Sulphur, Ozone and Particulate matter (2.5 & 10) are known to caue respiratory and various other diseases (Saqlain et al., 2020).

How adversely a pollutant can affect health depends upon its morphology and residence time. PM2.5 is very small in size and its residence time is longer as compared to PM10, which makes it more convenient to penetrate in lungs, becoming part of blood circulation and reaching to other organs and causing more toxicity (Mehmood et al., 2018). PM2.5 can cause progressive and slow inflammation of the respiratory pathways producing more mucous and less ciliary movement which results in acute respiratory and viral infections in people exposed chronically to it. A recent study has found that increased level of PM2.5 also results in the transmission of influenza virus (Frontera, 2020). And this proposes a plausible linkage between COVID-19 and air pollution hotspots (especially areas with air pollutant immobility as a result of climatic conditions, local emissions and topography of that region).

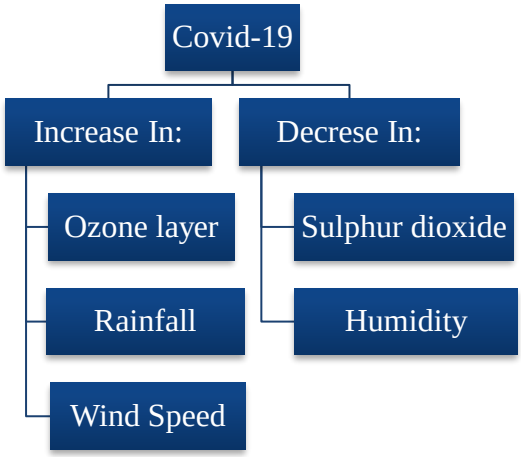


**Figure 5.3: Positive and negative impacts of Covi-19 on meteorological factors**

## 5.4 Global indirect effects of COVID-19:

COVID-19 has affected almost every country and there are many impacts of this pandemic that cannot be seen directly. The most direct and evident impact of COVID-19 is on the health of humans, which is the main focus throughout the world. This pandemic has also directly affected the sectors of transport, industry, tourism, education, and offices etc. however, the direct impacts on these sectors have created indirect impacts of COVID-19 on the environment. Many impacts of COVID-19 are short-term and long-term but mainly they are considered to have a positive impact on the environment like decrease in PM2.5 and NO2 concentrations, decreased noise pollution, and improvement of adaptation plans, better environmental monitoring systems, and better disaster risk management planning.

There are other negative indirect impacts also occurred due to this pandemic that include decreased waste management activities, impacts on ecological systems, and current challenges faced environmental monitoring and climate services. Other indirect impacts that may have long-term impacts like the effect of present pandemic situation on achieving Sustainable Development Goals (SDGs) (Zambrano-Monserrate et al., 2020; Cheval et al., 2020; Ali et al., 2021).

### 5.4.1 Positive Indirect Impacts:

### a. Improved Air Quality.

Sudden decrease in economic and industrial activities due to lockdown caused by COVID-19 has resulted in decrease of emissions of greenhouse gases, worldwide. This results in a considerably sensible improvement in the environmental quality and climate condition. Air quality mainly depends on the human activities, due to lockdown, there was a significant decrease in the air pollution in the cities of Italy, China, and New York and considerable decrease was projected in the greenhouse gases (GHG) emissions for the rest of the year. One of the sectors that was majorly affected by this pandemic was Aviation. Aviation contributes to 3–5% of global CO2 and 1–2% of the total greenhouse gas emissions in the environment (Cheval et al., 2020; Zambrano-Monserrate et al., 2020; Ali et al., 2021).

### b. Decrease in Noise Pollution:

Transport sector is one of the main causes for both greenhouse gas emissions as well as noise pollution. As the governments of many countries issued the lockdown and quarantine orders to protect the people from this pandemic, there was seen a considerable decrease in traffic flow on the roads. This not only resulted in the decrease of emissions of GHGs but also a significant amount of decrease in noise level was also observed that was produced from horn honking and other vehicles. Also, this reduction in noise levels resulted in improved detection of seismic waves and earthquake prone areas and the seismographic records were enhanced positively (Ali et al., 2021).

### c. Effect on Water Bodies:

Due to COVID-19 lockdown, in areas where there was boating travel a common means of transport e.g. Italy and various tourists locations have faced an immediate positive impact on water bodies by decrease in the water pollution as no such boating travel was being used (Cheval et al., 2020). A study performed on the Suspended Particulate Matter (SPM) in a freshwater lake, Vembanad Lake of India to find out if there was a change in SPM concentration during these lockdown conditions (Yunus et al., 2020) (Ali et al., 2021).

### 5.4.2 Negative Indirect Impacts:

### a. Decreased Waste Management Activities:

Majority population all around the world is in isolation and is staying at home due to which the domestic waste generation has peaked. Along with the domestic waste, the hospital waste has also increased. Discarding of Personal Protection Equipment (PPEs) on the roadsides and near the shoreline is increasing as the time of lockdown in this pandemic is increasing (Cheval et al., 2020). SEPA has the responsibility for the disposal of the hospital or otherwise hazardous waste so that none of the public is affected by it, but the organization has been inactive and no such measures has been taken as of yet (Ilyas, 2020; Ali et al., 2021).

### b. Effect on Ecological System:

Considering the ecological point of view, there can be a link between our society and the ecosystem. COVID-19 is the result of climatic alterations in the ecosystem because of habitat destruction of many species, introduction of invasive species, and changes in the distribution pattern of species. Around 300 animal welfare organizations wrote letter to World Health Organization (WHO) to consider the relationship between the occurrence of pandemics and animal markets.

Deforestation is also another cause that increases the interaction of human to wild animals that may also result in transmission of some alien virus or specie that can cause such a catastrophic effect as caused by this COVID-19 pandemic and the ones before it. The pandemic has affected the ecological research and field work that has resulted in the limitation of research activities causing consequences for the species and habitat conservation. This has resulted in the assessment of the long-term practicality of various wildlife conservation programs e.g. Global Environment Fund (Cheval et al., 2020; Ali et al., 2021).

### c. Challenges in Environmental Monitoring and Climate Services:

The COVID-19 has highlighted that there must be better preparedness for the monitoring of environmental and climatic services. The sustainability issue this pandemic has identified has caused the environmental scientists to strengthen the monitoring capability. Climate services along with the ocean and remote area observations have also been biased by this pandemic. Better monitoring can help many countries to study and identify the spread of this novel COVID-19. The tools established now, lessons and data from the present, can be used in the future to efficiently combat the spread of such a disease (Cheval et al., 2020; Ali et al., 2021).

## 5.5 Long-Term Effect of COVID-19 on SDGs:

It is expected that the current situation of COVID-19 can affect the future environmental and economic policies on an international scale. “Transforming our World: the 2030 Agenda for Sustainable Development” include 17 SDGs which focus mainly on attaining sustainability by 2030 and removal of poverty. These SDGs have faced a direct effect due to COVID-19 and are expected to experience long-term effects as well. Many of these SDGs are directly related to the health of population and urban areas (Cheval et al., 2020; Ali et al., 2021).

## 5.6 Relationship between Environmental Factors and the Spread of COVID-19:

There have been a few cases in history where the spread of viruses such as the West Nile virus in Europe has been linked with meteorological conditions, i.e. weather, temperature variations, etc. That is why researchers are interested in studying the link between the spread of COVID-19 and meteorological conditions i.e. temperature variations and other weather conditions changes such as humidity.

After the initial spread of the COVID-19 virus in mid-December, the virus quickly spread from China to regions with cooler weather conditions such as Europe and North America. After the research on the initial spread, the findings indicated that like pneumonia, COVID-19 also causes respiratory disorder closely associated with variations in weather and climatic conditions between different regions (Mazhar et al., 2020). According to Shi et al. (2020), increased temperature resulted in a decreased rate of transmission, outbreak magnitude, and rate of infections. Other meteorological parameters are also important for studying the spread of similar respiratory diseases like influenza and Severe Acute Respiratory Syndrome (SARS). A study in China explored the relationship between the death rate caused by COVID-19 and the varying environmental conditions i.e. varying temperature and humidity. A positive relationship was observed between the death rate and diurnal temperature range while anti-correlated with relative humidity (Ma et al., 2020).

Therefore, determining the potential influences of meteorological/environmental parameters is mandatory in order to retrain the spread of COVID-19 and other precautionary measures. It can be speculated that the spread of COVID-19 in the areas where the pollutant concentrations were higher than other areas caused more health impacts derived from this pandemic. A sharp decline in pollutant emissions (GHG and other toxic gases) has been observed during socio-economic lockdown after the COVID-19 outbreak, and such a decline in global emissions have not been observed in the past 25 years. This decrease in global emissions might have consequences for the entire planet, causing a possible cooling effect.

However, this depends upon the already accumulating concentrations of carbon dioxide and other atmospheric greenhouse gases. While the growing impacts of climate change have long demanded a reduction in global emissions, this pandemic has lowered global emissions more successfully than ever in the past. It is uncertain whether this pandemic will help reduce long term carbon emissions and hence cause a cooling effect, or the world will bounce back to its previous emission concentrations (Sheikh, 2020). There are many things that countries can gleam from their battle against the COVID-19 virus and incorporate them into the fight against climate change. There is an urgent need and demand from the scientific community to work on it in order to suggest the intensity and frequency of lockdowns without compromising on socio-economic development (Ali et al., 2021).

## 5.7 Conclusions:

This study concludes that various factors are involved in alleviating the spread of COVID-19. Both the cold and the dry environment also likely facilitate the COVID-19 transmission after controlling the bias from population density, government response policies, air pollutants and other factors. Strong scientific evidence has been found for the importance of cold weather effect on COVID-19 transmission with the arriving colder season. Studies covering the entire earth for a longer period are urgently needed to quantify the collective effects of meteorological factors and policy interventions on the spread of COVID-19. There is a strong relationship between the spread of Covid-19 and the environment. Covid-19 has affected the environment, societal conditions, economic conditions and human activities. Now is the time to realise the importance of environment for the survival of human beings, plants and animals; and take necessary steps to save our environment.

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