

Impact of COVID-19 on Agriculture, Livestock, and Biodiversity: A Review

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Abstract: *In November 2019, the world faced an unexpected outbreak of the novel coronavirus (COVID-19) in Wuhan city of China, which spread worldwide. This crisis posed a threat not only to human life and livelihood, but also to agriculture, livestock, and biodiversity. COVID-19 had an unexpected impact on livestock production. In response to the pandemic, the livestock industry and consumers have been left with fewer opportunities to purchase livestock products, resulting in no sales or low sales of livestock and their products. As with almost every sector, COVID-19 has adverse effects on agriculture also. Social distancing and the restrictions on traveling have prevented the farmers from sowing crops. Thus, farmers were deprived of agriculture, resulting in low or no crop yields contributing in a rise in the price of global food supply. The early stage of COVID19 seems to have been a time of benefit to nature and animals because humans did not interfere. However, it has become apparent that COVID-19 has sparked deforestation, illegal mining, poaching, etc, and therefore posed a threat to biodiversity.*

Keywords: COVID-19, China, Agriculture, Livestock, Biodiversity, Social Distancing, Global Food Crisis, Deforestation, Poaching, Threat, etc.

I. INTRODUCTION

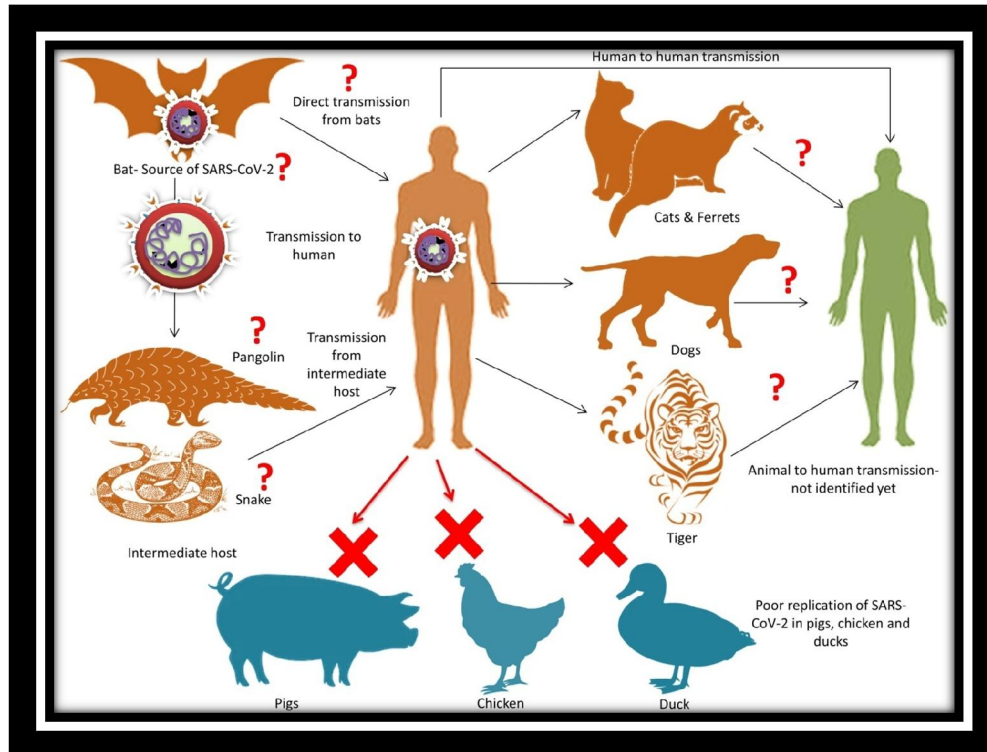
The Wuhan City, China, experienced an outbreak of pneumonia in November 2019. (Gibbons, D. W et al., 2022) The agent that caused the disease was a coronavirus, SARS-CoV-2 (Zhou et al., 2020), and the World Health Organization (WHO) named it COVID-19 There is strong evidence that the virus originated from a wild animal and may have been spread in China by wildlife traffickers (Borzée et al., 2020). Worldwide, governments have taken steps to reduce virus transmission, including quarantining citizens, employing social distancing measures, confining citizens via lockdowns, border controls, and limiting travel (Bates et al., 2020; Lecocq et al., 2020). Half of the world's population will be under some kind of sheltering order by July 2020 (Diffenbaugh et al., 2020). The impact of these measures has been substantial on human society. As a result of these sudden changes in socioeconomic status, social and human activities as well as the global economy have been severely disrupted, increasing the risk of food insecurity. Although it is still too early to draw a clear picture of COVID-19's impact on short- and long-term food security and the global economy, some effects have already been seen (<http://www.fao.org/3/ca8497en/ca8497en.pdf>).

Globally, the pandemic is expected to cause the deepest recession since the 1930s (World Bank Group, 2021), as well as the first increase in global poverty since 1991 (Lakner et al., 2021). Many reports have documented COVID-19's impacts on biodiversity, conservation, and the environment (e.g., Bates et al., 2020; Bennett et al., 2020; Corlett et al., 2020; Diffenbaugh et al., 2020). Researchers cited in Evans et al., 2020, Hockings et al., 2020, Kavousi et al., 2020, Lecocq et al., 2020, Le Quéré et al., 2020, McNeely, 2021, Waithaka et al., 2021.

Origin of COVID-19

The disease is zoonotic and has intermediate hosts. We do not know where and how the organism originated and was transferred to humans. A possible intermediate host for SARS-CoV-2 is the pangolin or snake. Palm civet and camels are intermediate hosts for SARS-CoV.. The reserve host for all the three is bat. Bat carries so many viruses and around 200 corona viruses without getting sick. As a result, the primary mode of transmission is from bats to intermediate hosts to humans. So, the primary mode of transmission is from bats to intermediate hosts to humans.

Image 1: Zoonotic links of SARS-CoV-2. Bat has been reported as the reservoir source of SARS-CoV-2. The intermediate host is not yet elucidated clearly and presently snake and/or pangolins are reported to the intermediate host. Reports regarding the transmission of SARS-CoV-2 from human to animal have been speculated. Study also shows that SARS-CoV-2 replicate poorly in pig, chicken and duck while ferrets and cats are susceptible.



Credit: 5. Tiwari R, Dhama K, Sharun K, Iqbal Yattoo M, Malik Y, Singh R et al. COVID-19: animals, veterinary and zoonotic links. *Veterinary Quarterly*. 2020;40(1):169-182.

II. METHODOLOGY

Literature available in the public domain has been referred for the present review. I have cited the recent research papers and concluded this review.

III. DISCUSSION

IMPACT OF COVID-19 ON LIVESTOCK

Globally, the COVID-19 pandemic affected the food system directly through the change in the supply-demand system, and indirectly through a decrease in purchasing power, the capacity of food distribution, and increased healthcare demands. Due to the COVID-19 outbreak, many economic activities and industries are negatively impacted, and livestock production is among the worst affected (Poudel PB et al., 2020, Gortázar C 2020).

A farm animal, whether it is in a dairy, a beef, or an ewe system, plays an essential role in maintaining food security and addressing socioeconomic needs such as agricultural livelihoods and income. Globally, farm animals provide meat, milk, and eggs that contribute directly to food security and contribute indirectly to crop production through the provision of manure and transport (<http://www.fao.org/docrep/014/i2373e/i2373e00.html>). The lockdown and other restrictive measures taken to control the COVID-19 pandemic have negatively impacted the livestock industry, particularly the dairy and meat industries, and related processes (Seleiman MF et al., 2020, Galanakis CM 2020). It was difficult to move live animals and animal products (meat, milk, and eggs) to markets, and there were limitations to seasonal border crossings with ruminants.

There were also shortages of labor and professional services (<http://www.fao.org/3/ca9177en/CA9177EN.pdf>). Because of these obstacles, the livestock industry has been severely disrupted, resulting in a reduction in its efficiency and profitability (<http://www.fao.org/3/ca9177en/CA9177EN.pdf>).

IMPACT OF COVID-19 ON AGRICULTURE

Food supply chains were disrupted and food prices spiked as a result of the uncertainty caused by the crisis, restrictions on interstate movements, and the absence of transportation (Kalsi et al., 2020) and reductions in farm output (Kalsi et al., 2020). Following the lockdown, pulses, wheat flour and milk prices were 1–5% higher; and edible oils and staple grains (rice and wheat) prices were 4–9% lower because of removing import restrictions and government interventions such as food distribution. Prices of tomatoes rose by 77–78% in a week and by 114–117% a month following the lockdown (for more details, see Cariappa et al., 2020a). Market reforms and distress sales led to increased arrivals in May, insulating farmers from lower prices (Varshney et al., 2020). Compared to urban areas, smaller cities and rural areas saw higher prices rise (Cariappa et al., 2020a; Narayanan and Saha, 2020).

IMPACT OF COVID-19 ON BIODIVERSITY

What is Biodiversity- Diversity of life on Earth can be referred to as biodiversity (from "biological diversity"). The term encompasses biodiversity at all levels and can include the ecological, cultural, and evolutionary processes that sustain life. In addition to species that are rare, threatened, or endangered, biodiversity also includes living organisms that we have little knowledge about, such as microbes, fungi, and invertebrates.

Does nature play any role in the spread of the disease?

Ecosystems in nature function similarly to the human body: When they are robust and healthy, which means they have diverse species and space for healthy animal populations, they are less likely to be sources of disease. As the global wildlife trade persists and human activities expand deeper into tropical forests, humans are increasing their exposure to wild animals and the diseases they may carry. When mining and logging degrade or destroy wildlife habitats, animals are forced into different or smaller areas and are more likely to become stressed or sick. They are also more likely to come into contact with people and domestic animals, driving the transmission of disease from wildlife to humans

IMPACT OF COVID-19 ON NATURE

In the midst of the COVID-19 epidemic, there is a misperception that nature is "getting a break.". However, widespread land grabbing, deforestation, illegal mining, and poaching are increasing pressure on rural areas in the tropics. Many people who lost their jobs in cities are returning to their rural homes, further increasing the pressure on natural resources and increasing the risk of COVID-19 spreading in rural areas. The world is witnessing an increase in deforestation in Asia, Africa and Latin America as illegal miners and loggers infiltrate indigenous lands, potentially exposing remote indigenous communities to the virus.

There have been disproportionate impacts of the pandemic on biodiversity research and conservation (see Cooke et al., 2020). Several studies around the world suggest that actions taken during the pandemic benefited the environment (e.g., improved air quality throughout major cities) (Lal et al., 2020; Mahato et al., 2020; Nakada and Urban, 2020). However, the deleterious effect outweighed the beneficial one (Muhumuza and Balkwill, 2013; Roe et al., 2015; Corlett et al., 2020).

IV. BENEFICIAL EFFECT ON BIO-DIVERSITY

- a) **Reduced Atmospheric Pollution** - Pollution and carbon emissions are concerns around the world. However, the challenge of pollution has decreased with improved air quality and the environment since the global Covid-19 pandemic began as industries and transport shut down (Corlett et al). At present, the pandemic has benefitted the atmosphere and the environment.

Locations	Period of study	Percentage decrease (%)	Data used	References
China	January–April, 2020	40	Tropospheric Monitoring Instrument (TROPOMI) on Sentinel-5, Ozone Monitoring Instrument (OMI) on Aura platform	Bauwens et al., 2020
China	1st January–25th February, 2020	25	NASA Satellite data	NASA Earth Observatory, 2020
Western Europe	January–April, 2020	20–38	TROPOMI, OMI	Bauwens et al., 2020
USA	January–April, 2020	20–38	TROPOMI, OMI	Bauwens et al., 2020
Global	January–February, 2020	6	NASA Satellite data	NASA Earth Observatory, 2020
Paris	January–February, 2020	54	NASA Satellite data	Bouillon-Minois et al., 2020
Po River Plain, Italy	January–February, 2020	Decreased (not specified)	NASA Satellite data	Mannucci, 2020

Credit: Akinsorotan O, Olaniyi O, Adeyemi A, Olasunkanmi A. Corona Virus Pandemic:

Table: Implication on Biodiversity Conservation. *Frontiers in Water*. 2021;3.

- b) Reduced Stress on Wildlife-** Additionally, the 'anthropause' has benefited wildlife and allowed researchers to quantify anthropogenic impacts on biodiversity (Rutz et al., 2020). For instance, reduced human movements and activities near national parks have lowered the stress on wild animals). The majority of fishing fleets are now docked in ports and harbours, which has drastically reduced fishing pressure in the oceans (Gianni, 2020). However, cleaner environments (e.g., improved water quality, see Yunus et al., 2020) have increased the extinction rate of wild species.

V. DELETERIOUS EFFECTS ON BIO-DIVERSITY

- a. Loss of Habile Person and Funds-** The loss of highly trained staff to a pandemic is devastating for governments and conservation organizations in developing countries with limited conservation capacity.
- b. Less Attention Towards Wildlife during Covid 19-** The epidemic curve is escalating in India on a daily basis, making it one of the worst-hit countries (WHO, 2020). Although mainstream and social media report a brighter side for environment and wildlife, the lockdown has significantly reduced human mobility and various disturbances in nature. However, wildlife poaching cases have more than doubled during the lockdown (Badola, 20). A review of the impacts of COVID-19 on biodiversity research and conservation in India was conducted as academic and research-related field work is temporarily discontinued, labs are not fully functional, and education, training, and other communication have moved online (Corlett et al., 2020).
- c. Reduced Revenue and Staff Strength-** Protected area agencies receive funding from tourism. It can improve the living standards of local communities and make a country more prosperous (Anand and Kim, 2021). Tourism declines in protected areas lead to staff dismissals and non-organized monitoring programs (Weaver and Makiwa, 2020). The impact of the Covid-19 on tourism revenues in various countries is unknown at present.

What efforts should be taken by the Government?

In countries experiencing a rise in deforestation, illegal mining, and poaching, governments need to maintain enforcement efforts even during the COVID-19 pandemic. In addition, countries must plan for rebuilding their economies in a way that promotes green structural transformation, including long-term commitments to public spending and pricing reforms.

VI. CONCLUSION

This crisis posed a threat not only to human life and livelihood, but also to agriculture, livestock, and biodiversity. COVID-19 had an unexpected impact on livestock production, agriculture and bio diversity as a whole. Steps are and should be taken to overcome this crisis.

REFERENCES

- [1] Akinsorotan O, Olaniyi O, Adeyemi A, Olasunkanmi A. Corona Virus Pandemic: Implication on Biodiversity Conservation. *Frontiers in Water*. 2021;3.
- [2] Anand, A., and Kim, D. H. (2021). Pandemic induced changes in economic activity around african protected areas captured through night-time light data. *Remote Sens*. 13:314
- [3] A.P. Yunus, Y. Masago, Y. Hijioka COVID-19 and surface water quality: improved lake water quality during the lockdown *Sci. Total Environ.*, 731 (2020), p. 139012, 10.1016/j.scitotenv.
- [4] Arun, MG (2020) Critical but stable. New Delhi. Available at: <https://www.indiatoday.in/magazine/nation/story/20200817-critical-but-stable-1708696-2020-08-08> (accessed 28 August 2020).
- [5] Barrett, CB (2020) Actions now can curb food systems fallout from COVID-19. *Nature Food* 1(6):319–320.
- [6] Bates, A. E., Primack, R. B., Moraga, P., & Duarte, C. M. (2020). COVID-19 pandemic and associated lockdown as a “global human confinement experiment” to investigate biodiversity conservation. *Biological Conservation*, 248, 108665.
- [7] Bennett, N. J., Finkbeiner, E. M., Ban, N. C., Belhabib, D., Jupiter, S. D., Kittinger, J. N., Mangubhai, S., Scholtens, J., Gill, D., & Christie, P. (2020). The COVID-19 pandemic, small-scale fisheries and coastal fishing communities. *Coastal Management*, 48, 336–347
- [8] Borzée, A., McNeely, J., Magellan, K., Miller, J. R. B., Porter, L., Dutta, T., Kadinjappalli, K. P., Sharma, S., Shahabuddin, G., Aprilinayati, F., Ryan, G. E., Hughes, A., Mutalib, A. H. A., Wahab, A. Z. A., Bista, D., Chavanich, S. A., Chong, J. L., Gale, G. A., Ghaffari, H. Zhang, L. COVID-19 highlights the need for more effective wildlife trade legislation. *Trends in Ecology & Evolution*. 2020. 35, 1052–1055
- [9] C. Rutz, M. Loretto, A.E. Bates, S.C. Davidson, C.M. Duarte, W. Jetz, M. Johnson, A. Kato, R. Kays, T. Mueller, R.B. Primack, Y. Ropert-Coudert, M.A. Tucker, M. Wikelski, F. Cagnacci COVID-19 lockdown allows researchers to quantify the effects of human activity on wildlife *Nat. Ecol. Evol.* (2020), 10.1038/s41559-020-1237-z
- [10] Cariappa AGA, Acharya KK, Adhav CA, et al. (2020a) Pandemic led food price anomalies and supply chain disruption: evidence from COVID-19 incidence in India. SSRN.
- [11] Corlett, R. T., Primack, R. B., Devictor, V., Maas, B., Goswami, V. R., Bates, A. E., Koh, L. P., Regan, T. J., Loyola, R., Pakeman, R. J., Cumming, G. S., Pidgeon, A., Johns, D., & Roth, R. (2020). Impacts of the coronavirus pandemic on biodiversity conservation. *Biological Conservation*, 246, 108571.
- [12] Diffenbaugh, N. S., et al., The COVID-19 lockdowns: a window into the earth system. *Nature Reviews Earth & Environment*, (2020). 1, 470–481.
- [13] Evans, K. L., Ewen, J. G., Guillera-Arroita, G., Johnson, J. A., Penteriani, V., Ryan, S. J., Sollmann, R., & Gordon, I. J. (2020). Conservation in the maelstrom of COVID-19—A call to action to solve the challenges, exploit opportunities and prepare for the next pandemic. *Animal Conservation*, 23, 235–238
- [14] Food and Agriculture Organization (FAO). Coronavirus Disease 2019 (COVID-19). Addressing the Impacts of COVID-19 in Food Crises. (2020). Available online at: <http://www.fao.org/3/ca8497en/ca8497en.pdf> (accessed July 8, 2020).
- [15] Galanakis CM. The food systems in the era of the coronavirus (COVID-19) pandemic crisis. *Foods*. (2020) 9:523. doi: 10.3390/foods9040523
- [16] Gibbons, D. W., Sandbrook, C., Sutherland, W. J., Akter, R., Bradbury, R., Broad, S., Clements, A., Crick, H. Q. P., Elliott, J., Gyeltshen, N., Heath, M., Hughes, J., Jenkins, R. K. B., Jones, A. H., Lopez de la Lama, R., Macfarlane, N. B. W., Maunder, M., Prasad, R., Romero-Muñoz, A., Ockendon, N. The relative importance of COVID-19 pandemic impacts on biodiversity conservation globally. *Conservation Biology*, 2022; 36(1).
- [17] Gortázar C, de la Fuente J. COVID-19 is likely to impact animal health. *Prev Vet Med.* (2020) 180:105030.
- [18] Hockings, M., Dudley, N., & Elliott, W. (2020). Editorial essay: COVID-19 and protected and conserved areas. *Parks*, 26, 7–24.
- [19] Imbert, C (2020) Webinar on inter-state migration in India in the time of COVID-19. India. Available at: <https://www.youtube.com/watch?v=XdVp2S4-hgQ> (accessed 9 September 2020).
- [20] Kalsi, SS, Sandoval, L, Sood, D (2020) COVID-19 in India – Trade Situation Update Report Highlights. Report No. IN2020-0017.

- [21] L.Y.K. Nakada, R.C. UrbanCOVID-19 pandemic: impacts on the air quality during the partial lockdown in São Paulo state, Brazil *Sci. Total Environ.*, 730 (2020), p. 139087
- [22] Lakner, C., Yonzan, N., Mahler, D. G., Aguilar, R. A. C., & Wu, H. (2021). Updated estimates of the impact of COVID-19 on global poverty: Looking back at 2020 and the outlook for 2021. Washington DC: World Bank. Retrieved from <https://blogs.worldbank.org/opendata/updated-estimatesimpact-covid-19-global-poverty-looking-back-2020-and-outlook-2021> (accessed March 2021)
- [23] Lecocq, T., Hicks, S. P., Van Noten, K., Van Wijk, K., Koelemeijer, P., De Plaen, R. S. M., Massin, F., Hillers, G., Anthony, R. E., Apoloner, M.-T., ArroyoSolórzano, M., Assink, J. D., Büyükkapınar, P., Cannata, A., Cannavo, F., Carrasco, S., Caudron, C., Chaves, E. J., Cornwell, D. G., Xiao, H. (2020). Global quieting of high-frequency seismic noise due to COVID-19 pandemic lockdown measures. *Science*, 369, 1338–1343.
- [24] Le Quéré, C. et al. (2020). Temporary reduction in daily global CO₂ emissions during the COVID-19 forced confinement. *Nature Climate Change*, 10, 647– 653.
- [25] Mcneely, J. A. (2021). Nature and COVID-19. The pandemic, the environment and the way ahead. *Ambio* 50, 767–781
- [26] Narayanan, S, Saha, S (2020) Urban food markets and the lockdown in India. *SSRN Electronic Journal* 1–25. DOI: 10.2139/ssrn.3599102
- [27] P. Lal, A. Kumar, S. Kumar, S. Kumari, P. Saikia, A. Dayanandan, D. Adhikari, M.L. KhandThe dark cloud with a silver lining: assessing the impact of the SARS COVID-19 pandemic on the global environment*Sci. Total Environ.*, 732 (2020), p. 139297
- [28] Poudel PB, Poudel MR, Gautam A, Phuyal S, Tiwari CK, Bashyal N, et al. COVID-19 and its global impact on food and agriculture. *J Biol Today's World.* (2020) 9:221.
- [29] S. Mahato, S. Pal, K.G. Ghosh Effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, India *Sci. Total Environ.*, 730 (2020), p. 139086
- [30] S.J. Cooke, W.M. Twardek, A.J. Lynch, I.G. Cowx, J.D. Oldene, S. Funge-Smith, K. Lorenzen, et al.A global perspective on the influence of the COVID-19 pandemic on freshwater fish biodiversity*Biol. Conserv.*, 253 (2020), p. 108932
- [31] Seleiman MF, Selim S, Alhammad BA, Alharbi BM, Juliatti FC. Will novel coronavirus (Covid-19) pandemic impact agriculture, food security and animal sectors? *Biosci J.* (2020) 23:36. doi: 10.14393/BJ-v36n4a2020-54560
- [32] Varshney, D, Roy, D, Meenakshi, JV (2020) Impact of COVID-19 on agricultural markets: assessing the roles of commodity characteristics, disease caseload and market reforms. *Indian Economic Review* 55:83–103
- [33] Waithaka, J., Dudley, N., Álvarez, M., Arguedas Mora, S., Chapman, S., Figgis, P., Fitzsimons, J., Gallon, S., Gray, T. N. E., Kim, M., Pasha, M. K. S., Perkin, S., Roig-Boixeda, P., Sierra, C., Valverde, A., & Wong, M. (2021). Impacts of COVID-19 on protected and conserved areas: A global overview and regional perspectives. *Parks*, 27, 41–56
- [34] Weaver, C., and Makiwa, T. (2020). Covid-19 Threatens the Legacy of Long-Term Investment and Success in the Community-Based Conservation Programme of Namibia. Available online at: <http://www.ccf-namibia.org/urgent-appeal-for-support-for-community-game-guards> (accessed August 31, 2020).
- [35] Wildlife & Countryside Link. (2020). Environment and conservation organisations coronavirus impact survey report. London: Wildlife & Countryside Link. Retrieved from https://www.heritagefund.org.uk/sites/default/files/media/attach_ments/Coronavirus%20eNGO%20survey%20analysis%20report_1.pdf (accessed August 2020)
- [36] World Health Organisation WHO Coronavirus Disease (COVID-19) Dashboard <https://covid19.who.int/region/searo/country/in/> (2020)
- [37] Zhou, P., Yang, X.-. L., Wang, X.-. G., Hu, B., Zhang, L., Zhang, W., Si, H.-. R., Zhu, Y., Li, B., Huang, C.-. L., Chen, H.-. D., Chen, J., Luo, Y., Guo, H., Jiang, R.-Di, Liu, M.-. Q., Chen, Y., Shen, Xu-R, Wang, Xi, ..., Shi, Z.-Li. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*, 2020; 579, 270–273.