

**A CONVERSE ASSOCIATION: HOW BIODIVERSITY AND WILDLIFE CONNECTED  
WITH COVID-19**

**Dr. Irin Hossain<sup>1\*</sup>, Dr. M. M. Aktaruzzaman<sup>2</sup>, Professor Dr. Manzurul Haque Khan<sup>3</sup> and  
Dr. Ashekur Rahman Mullick<sup>4</sup>**

<sup>1,4</sup>National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh.

<sup>2</sup>Dhaka Medical College and Hospital, Dhaka, Bangladesh.

<sup>3</sup>Directorate General of Health Services (DGHS), Dhaka, Bangladesh.

**\*Corresponding Author: Dr. Irin Hossain**

National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh.

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**ABSTRACT**

The diversity of life on Earth is indispensable to the healthy functioning of ecosystems. Habitat loss and overexploitation, driven by our express population growth, are the primary causes of biodiversity loss. COVID-19 has the potential to trigger enormous effects on biodiversity and conservation outcomes. This virus emerged due to wildlife exploitation, and the risk of new diseases increases with environmental degradation. Neither the proximate source nor a possible intermediate animal host of COVID-19 has been confirmed at this stage. As human activities continue to disturb ecosystems worldwide, we are likely to see more pathogens crossing from wildlife to humans in the future. The crisis provides us with a reset button on our affiliation with nature. International collaboration is paramount for the health of our nature, our economies, and our people. At this point, protected areas appear to be safe and, in many places, biodiversity is benefitting from reduced human activities. This may not be true everywhere, especially where enforcement has weakened but threats have not. The loss of conservation revenue caused by the COVID-19 pandemic does pose a major threat to conservation and anti-poaching activities long-term. We can pursue the opportunity to re-imagine and alter our relationship with nature while promoting community and global health. Linkages between biodiversity and human health present a broad range of opportunities for jointly protecting health and biodiversity, wildlife and for advancing human wellbeing.

**KEYWORDS:** Biodiversity, Wildlife, COVID -19.

**INTRODUCTION**

The Convention on Biological Diversity is the international instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable participation in the benefits derived from the use of genetic resources", which has been ratified by 196 countries. The appearance of COVID-19 has shown that when we destroy biodiversity we destroy the system that supports human life. The more biodiverse an ecosystem is, the more difficult it is for a pathogen to spread rapidly or dominate. Loss of biodiversity provides an opportunity for pathogens to pass between animals and people. Loss of biodiversity also means that we are losing, before discovery, many of nature's chemicals and genes, of the kind that have already provided humanity with tremendous health benefits. Traditional medicine continues to play an essential role in health care, especially in primary health care.<sup>[1]</sup>

While the world's attention is focused on controlling COVID-19, evidence points at the biodiversity crisis as a leading factor in its emergence. At first glance, the two

issues might seem unrelated, but disease outbreaks and degraded ecosystems are deeply connected.<sup>[2]</sup>

The world is observing International Day of Biological Diversity at a time when the coronavirus pandemic has led to lockdowns in many countries. With humans indoors, wild animals are roaming freely on the streets and air pollution has dramatically declined. 2020 has been designated as a super year for global biodiversity as governments were meant to agree on a target to reverse the environmental damages caused by human activities.<sup>[3]</sup>

**An overview of biodiversity****Prior terms**

"Biodiversity" is most commonly used to replace the more clearly defined and long established terms, species diversity and species richness.<sup>[4]</sup>

### Alternate terms

Biologists most often define biodiversity as the "totality of genes, species and ecosystems of a region".<sup>[5,6]</sup> An advantage of this definition is that it seems to describe most circumstances and presents a unified view of the traditional types of biological variety previously identified:

- taxonomic diversity (usually measured at the species diversity level)
- ecological diversity (often viewed from the perspective of ecosystem diversity)
- morphological diversity (which stems from genetic diversity and molecular diversity<sup>[7]</sup>)
- functional diversity (which is a measure of the number of functionally disparate species within a population (e.g. different feeding mechanism, different motility, predator vs prey, etc.<sup>[8]</sup>) This multilevel construct is consistent with Datman and Lovejoy.

### Wilcox 1982

An explicit definition consistent with this interpretation was first given in a paper by Bruce A. Wilcox commissioned by the International Union for the Conservation of Nature and Natural Resources (IUCN) for the 1982 World National Parks Conference. Wilcox's definition was "Biological diversity is the variety of life forms...at all levels of biological systems (i.e., molecular, organismic, population, species and ecosystem)."<sup>[9]</sup>

### Genetic: Wilcox 1984

Biodiversity can be defined genetically as the diversity of alleles, genes and organisms. They study processes such as mutation and gene transfer that drive evolution.<sup>[9]</sup>

### United Nations 1992

The 1992 United Nations Earth Summit defined "biological diversity" as "the variability among living organisms from all sources, including, 'inter alia', terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems".<sup>[10]</sup> This definition is used in the United Nations Convention on Biological Diversity.

### Gaston and Spicer 2004

Gaston & Spicer's definition in their book "Biodiversity: an introduction" is "variation of life at all levels of biological organization".<sup>[11]</sup>

### History of terminology

- **1916** – The term biological diversity was used first by J. Arthur Harris in "The Variable Desert," Scientific American, JSTOR 6182: "The bare statement that the region contains a flora rich in genera and species and of diverse geographic origin or affinity is entirely inadequate as a description of its real biological diversity."

- **1975** – The term natural diversity was introduced (by The Science Division of The Nature Conservancy in a 1975 study, "The Preservation of Natural Diversity.")
- **1980** – Thomas Lovejoy introduced the term biological diversity to the scientific community in a book.<sup>[12]</sup> It rapidly became commonly used.<sup>[13]</sup>
- **1985** – According to Edward O. Wilson, the contracted form biodiversity was coined by W. G. Rosen: "The National Forum on Biodiversity was conceived by Walter G. Rosen and Dr. Rosen represented the NRC/NAS throughout the planning stages of the project. Furthermore, he introduced the term biodiversity".<sup>[14]</sup>
- **1985** - The term "biodiversity" appears in the article, "A New Plan to Conserve the Earth's Biota" by Laura Tangle.<sup>[15]</sup>
- **1988** - The term biodiversity first appeared in a publication.<sup>[16,17]</sup>
- **The present** - the term has achieved widespread use.

### Importance of biodiversity

Biodiversity is important to most aspects of lives. The value of biodiversity has been considered for many reasons, some utilitarian, some intrinsic. This means value of biodiversity both for what it provides to humans, and for the value it has in its own right. Utilitarian values include the many basic needs humans obtain from biodiversity such as food, fuel, shelter, and medicine. Further, ecosystems provide crucial services such as pollination, seed dispersal, climate regulation, water purification, nutrient cycling, and control of agricultural pests. Biodiversity also holds value for potential benefits not yet recognized, such as new medicines and other possible unknown services.

**Economic:** Biodiversity provides humans with raw materials for consumption and production. Many livelihoods, such as those of farmers, fishers and timber workers, are dependent on biodiversity.

**Ecological life support:** Biodiversity provides functioning ecosystems that supply oxygen, clean air and water, pollination of plants, pest control, wastewater treatment and any ecosystem services.

**Recreation:** Many recreational pursuits rely on our unique biodiversity, such as bird watching, hiking, camping and fishing. Our tourism industry also depends on biodiversity.

**Cultural:** The culture is closely connected to biodiversity through the expression of identity, through spirituality and through aesthetic appreciation.

For example, Indigenous Australians have strong connections and obligations to biodiversity arising from spiritual beliefs about animals and plants.

**Scientific:** Biodiversity represents a wealth of systematic ecological data that help us to understand the natural world and its origins.

Finally, the value of biodiversity can also be understood through the lens of the relationships we form and strive for with each other and the rest of nature. We may value biodiversity because of how it shapes who we are, our relationships to each other, and social norms. These relational values are part of peoples' individual or collective sense of wellbeing, responsibility for, and connection with the environment. The different values placed on biodiversity are important because they can influence the conservation decisions people make every day.<sup>[18]</sup>

### Threats to biodiversity

Over the last century, humans have come to dominate the planet, causing rapid ecosystem change and massive loss of biodiversity across the planet. This has led some people to refer to the time we now live in as the "anthropocene." While the Earth has always experienced changes and extinctions, today they are occurring at an unprecedented rate. Major direct threats to biodiversity include habitat loss and fragmentation, unsustainable resource use, invasive species, pollution, and global climate change. There is some constrain of overpopulation and wasteful consumption that could push half of Earth's species to extinction in this century.

### Biodiversity loss is attributable to several causes as below

**Habitat destruction:** Damaging human activity continues to encroach on natural environments, thereby destroying the habitats of countless species.

**Overexploitation:** Relentless consumption of resources by Humankind's is continuing to destroy natural habitats around the globe. There is also enormous pressure on populations of wild species, both by hunting animal in the developing world and by large-scale industrial fishing in our seas.

**Agricultural Intensification:** Humanity has developed agricultural systems which rely on monocultures, artificial fertilizers and pesticides to meet the unsustainable consumption patterns. The using of pesticide destroys insect populations indiscriminately. Moreover, an increasing proportion of agricultural land is farmed intensively due to the growing pressure on food supplies. Deforestation, runoff from farms pollutes water bodies and causes harmful algal blooms; these are ruining the fish stock.

**Climate emissions:** Our planet has been suffering from climate crisis due to our endless production of

greenhouse gases including carbon dioxide and methane. Species are going to be decline due to global temperature increase. Every half a degree of warming has a huge knock-on effect on ecosystems.

**Pollution:** Our oceans are becoming polluted by plastic waste, hazardous chemical killing millions of animals, from sea turtles to whales. The human activities, noise, light and chemical pollution can disrupt wildlife behavior. Light from human activities makes it harder for predator species to catch their prey. Noise pollution interrupts both hunting and mating signals in many species, disturbing natural behavior.

**Invasive species:** People are travelling across the world and have a very large emissions footprint but it has also allowed the spread of invasive species, both accidental and intentional. As a result of the introduction of non-native species to some areas, such as rabbits and cats in Australia, goats on St. Helena, and American mink in Great Britain. Thus many vulnerable ecosystems are at risk, threatening native species and diminishing biodiversity.<sup>[18]</sup>

### The impact of human activity

Human activities have significantly changed three quarters of land surface and two thirds of ocean area. Between 2010 and 2015 alone, 32 million hectares of forest disappeared; and in the last 150 years, live coral reef cover has been reduced by half. Glacial ice is melting at astonishing rates while ocean acidification grows, threatening the ocean's productivity. Wildlife species are disappearing tens to hundreds of times faster now than in the past 10 million years; and within the next 10 years, one out of every four known species may have been wiped off the planet.

We are on the verge of a mass extinction; and if we continue on this path, biodiversity loss will have severe implications for humanity, including the collapse of food and health systems.<sup>[19]</sup>

### Biodiversity and Zoonotic Disease

About 60% of infectious diseases are zoonotic, meaning that they are spread from animals to humans and 72% of these zoonosis originates from wildlife. COVID-19 is just the last in a long list of zoonosis originating from wildlife. Other recent outbreaks include SARS, Ebola, avian influenza and swine influenza. As human activities continue to disturb ecosystems worldwide, we are likely to see more pathogens crossing from wildlife to humans in the future. This should serve as a call to better manage our relationship with nature in general, and wildlife in particular.<sup>[2]</sup>

### Biodiversity Loss and Covid-19

The emergence of COVID-19 has made it clear that, when we destroy biodiversity, we destroy the system that supports human life. By upsetting the delicate balance of nature—encroaching on wildlife, reducing the genetic

diversity within animal populations, causing climate change and extreme weather events—we have created ideal conditions for the spread of viruses between animal and human populations. Nature is sending us a message.<sup>[19]</sup>

### Biodiversity and Climate Change

Global warming is a major threat to global biodiversity.<sup>[20,21]</sup> For example, coral reefs, which are biodiversity hotspots will be lost within the century if global warming continues at the current rate.<sup>[22,23]</sup> Climate change has proven to affect biodiversity and evidence supporting the altering effects is widespread. Increasing atmospheric carbon dioxide certainly affects plant morphology<sup>[24]</sup> and is acidifying oceans,<sup>[25]</sup> and temperature affects species ranges,<sup>[26-28]</sup> phenology,<sup>[29]</sup> and weather,<sup>[30]</sup> but, mercifully, the major impacts that have been predicted are still potential futures. We have not documented major extinctions yet, even as climate change drastically alters the biology of many species. In 2004, an international collaborative study on four continents estimated that 10 percent of species would become extinct by 2050 because of global warming. "We need to limit climate change or we wind up with a lot of species in trouble, possibly extinct," said Dr. Lee Hannah, a co-author of the paper and chief climate change biologist at the Centre for Applied Biodiversity Science at Conservation International.<sup>[31]</sup> A recent study predicts that up to 35% of the world terrestrial carnivores and ungulates will be at higher risk of extinction by 2050 because of the joint effects of predicted climate and land-use change under business-as-usual human development scenarios.<sup>[32]</sup> Climate change has advanced the time of evening when Brazilian free-tailed bats (*Tadarida brasiliensis*) emerge to feed. This change is believed to be related to the drying of regions as temperatures rise. This earlier emergence exposes the bats to greater predation increased competition with other insectivores who feed in the twilight or daylight hours.<sup>[33]</sup>

### Paradigm shifts resulting from covid-19

The pandemic has had an impact on every aspect of the economy:

**Climate Change:** Some governments are tying bailouts to climate targets, while the European Commission has underscored the need for a green new deal to be tied to recovery packages. The European Green Deal provides a roadmap to boost efficiency of resources by moving to a clean, circular economy, which also restores biodiversity and cut pollution.

**Corporates:** The localisation of supply chains will shape things in the months and years ahead. Governance challenges will be important too – environmental requirements should not be rolled back, while there should be safety nets and metrics to prevent the crisis being used as an excuse.

**Personal behaviour change:** During the crisis, consumers shifted their consumption habits, and some of those habits – such as local food sourcing and domestic tourism will stick.<sup>[34]</sup>

**Preventive health policies:** The current crisis calls for a paradigm shift in public and global health policies; and in the in the nexus between local, national and global health policies and systems.

### Importance of protecting biodiversity

At present, economic development focuses on continuous growth devoid of considering the conservation of natural systems. The Coronavirus crisis is most probably one of the many challenges our society will have to face in the forthcoming decades as an indirect consequence of the impact of climate change on the ecosphere through many mechanisms, including diminishing species habitats, altering species distributions and an increasing influx of alien hostile species.

Active promotion and implementation of certain strategies could tip the balance in favor of positive biodiversity outcomes. We can restart economies while protecting humans and nature by redesigning trade networks and supply chains to localize and better support sustainable consumer options.

We can also fortify environmental-protections, improve environmental monitoring through better use of automation, and ensure that conservation funding schemes remain active. COVID-19 is having an impact on animals. Great apes, of which seven species are already threatened by extinction, are potentially vulnerable to this new virus. Lockdowns and the loss of tourism revenue also create challenges for protecting wildlife.

Many endangered species, such as rhinos, manatees, and eagles, require constant protection and management to prevent their going extinct. In many national parks, park rangers prevent poachers from killing wildlife and similarly enforce regulations that protect wildlife. For example, in New England, park rangers prevent people and vehicles from entering areas where endangered birds are nesting, such as terns on Cape Cod. With enforcement cut back, these endangered animals might be at increased risk. There is also the likelihood of increased illegal logging and pollution in many areas, and a danger that many past efforts to protect species and ecosystems will be reversed.<sup>[35]</sup>

### CONCLUSIONS

Finally, the lifestyle choices of individuals and communities can have a large effect on their impacts on biodiversity and the environment. While we might not be able to prevent all negative human impacts on biodiversity, with knowledge we can work to change the direction and shape of our effects on the rest of life on



Earth. Environmental policy has already progressed in both directions. In some places, environmental protections have weakened, in others; governments have banned animal trade and tend to restrict supply chains to increase resource security. Comprehensive wildlife trade bans are not the answer, but appropriately nuanced strategies that incorporate such measures should be encouraged. As we move into a post-COVID-19 world, recovery strategies can be optimized to benefit biodiversity conservation and protect human health.

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