

**The Wildlife Trade and Zoonotic Emergencies**

Sangapillai Rajendran and Dr. Devender Kumar Namdev

<sup>1</sup>Research Scholar, Department of Zoology, SunRise University, Alwar, Rajasthan (India)<sup>2</sup>Associate Professor, Department of Zoology, SunRise University, Alwar, Rajasthan (India)**Corresponding author Email:** [sangapillairajendran2@gmail.com](mailto:sangapillairajendran2@gmail.com)

**Abstract:** Illegal wildlife trade is defined as illegal activities including illicit trade, smuggling, poaching, and capturing of protected wildlife species. Illegal wildlife trade (IWT) is one of the common causes of the transmission of zoonotic diseases and also causes economical losses. The products of the illegal wildlife trades can be used as fashion, exotic pets, medicine, and food. Illegal wildlife trade brings wildlife species or their products close to humans and increases the chances for spillover of zoonotic infections. These zoonotic infection can be transmitted through hunting, capturing, and consuming wildlife products. During 2021- 2022, the outbreak of SARS-CoV-2, also known as COVID-19, causes huge losses. Although the exact origin of the virus is still unknown, many studies suggested that the source of virus transmission exists in the Wuhan wet market (Wuhan seafood market), where bats and other wild animals are closed for sale of the live animal and their products. Similarly, investigations showed that the outbreak of the Ebola virus in 2014 occurred due to consumption of wildlife bushmeat. Thus, to avoid the spillover of zoonotic diseases with IWT strict action should be taken to lower the IWT, which is only possible by improving the documentation methods, improving the transport sectors, discouraging corporate gifting, and taking the help of armed forces at free trade and economic zone. Furthermore, the scientific community should address the general public about the complications associated with IWT and develop innovative methods of digital surveillance.

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**INTRODUCTION** In May 1998, the US Fish and Wildlife Services and US Customs Service completed Operation Jungle Trade, exposing the illegal trade and smuggling of birds and other wildlife animals. The operation was conducted in the US and other commonwealth countries, including New Zealand, Australia, South Africa, Costa Rica, and other well-developed countries. This operation illustrates illegal wildlife trade throughout the globe (Zimmerman 2003). Unfortunately, the black-market trade of wildlife and wildlife products is widespread in developing countries and developed countries (as exposed by Operation Jungle Trade). Several studies have proved that billions of wildlife species are killed or captured for the legal and illegal wildlife trade. The major purpose of wildlife bartering is to produce goods and services. Human consumes wild animal products in several forms, including medicines, fabrics, meat products, etc. Wildlife birds can also be captured as pets because of their beauty (Dutton et al. 2013; Wyatt et al. 2022). Climate change, poverty, and human activities, including deforestation and illegal wildlife trade, are the most potential threats to global health and risk factors for emerging infectious diseases. Almost onequarter of the deaths are caused by infectious diseases, and nearly 60% of these can spread from animal to human (zoonotic diseases).

Most zoonotic diseases (71.8%) enter the human community by direct contact with the wildlife animal or by consuming the products of the wildlife. In simple words, the wildlife trade is a potential threat to the spread of Emerging Infectious Diseases (Jones et al. 2008). Multiple examples explain the illegal wildlife trade as a gateway to zoonotic Emerging Infectious diseases (EID) and their devastating effects on the economy and public health. SARS, Ebola, influenza H5N1, and even SARSCoV-2 have close links with the illegal wildlife trade (Kan et al. 2005). Similarly, many studies link the emergence of HIV infection with the consumption of non-human primates. Before further discussion, let's explain what illegal trade and emerging infectious disease.

**Zoonoses:** an introduction As the world is in the grip of COVID-19, there has been a renewed focus on emerging infectious diseases, particularly regarding those emanating from animals, and the pathogenic risks encountered at the wildlife-human interface. A zoonosis is any disease or infection that is naturally transmissible from vertebrate animals to humans and vice versa. Infectious pathogens usually naturally live and reproduce in a population of host organisms called the reservoir. Pathogens and their natural reservoir have co-evolved in a way that the pathogen often causes no or only mild disease symptoms in the

reservoir itself, so as not to compromise its survival in the host (for example, Herpes viruses in humans). When a pathogen is transmitted to a new host population, this is called spillover. In an event of spillover, humans represent dead-end hosts to the majority of animal pathogens. Occasionally though, after a virus has crossed the animal-human species barrier, it adapts to human-to-human transmission, thereby diversifying away from its source species with the potential of becoming an epidemic (Weiss & McMichael 2004). Some pathogens even become exclusive to humans and have evolved into specialized human pathogens, such as measles, mumps, syphilis and HIV/ AIDS (Wolfe et al 2007). Almost two thirds (60.3 %) of global emerging infectious diseases (EID) are zoonoses. The majority of EIDs (71.8%) originate in wildlife, and the emergence of zoonoses has been increasing significantly over time (Jones et al. 2008). Zoonoses can emerge at any human-animal interface. Viruses are particularly critical in the context of zoonoses; 80% of viruses pathogenic to humans were found to be of animal origin, followed by bacteria (50% zoonotic origins) (Taylor et al. 2001). Also, a disproportionate number of diseases that reach epidemic or pandemic proportions are viruses (Morse et al. 2012). Researchers have estimated that there are between 650,000 and 840,000 viruses with zoonotic potential; meaning they could possibly cross the species barrier but have not yet done so (Carroll et al. 2018). Indeed, a pandemic such as is happening at the moment caused by the SARS-CoV-2 virus has been predicted by scientists for over a decade, as a consequence of human population growth, resource use, urbanization, land use change (i.e. deforestation for agricultural expansion), and global trade and travel (e.g. Weiss & McMichael 2004, Jones et al. 2008, Horby.

**ILLEGAL WILDLIFE TRADE** Illegal wildlife trade (IWT) is one of the most serious green or environmental crimes that are defined as "illegal activities including illicit trade, smuggling, poaching, and capturing of the protected wildlife species (flora and fauna) or their products for some financial benefits." Illegal trade is the fourth most common illegal activity and the cause of several zoonotic infections (Wyatt 2009; Mozer and Prost 2023). IWT not only causes the transmission of zoonotic diseases but also causes substantial economic losses by affecting livestock and harming the ecosystem. According to a study, 4 million live birds, 350 million tropical fish, and nearly 40,000 primates are traded throughout the globe annually. The daily flow

of these animals in the trading center involves direct contact with humans and dozens of other species, increasing the chances of spreading infectious diseases from animals to humans (Karesh et al. 2005).

**EMERGING INFECTIOUS DISEASES** Emerging Infectious Diseases (EID) are defined as infectious diseases that newly appeared in the population or a rapid increase in already existing diseases. In the past few decades, novel pathogens have affected the human population, and most of these infections are zoonotic. Globalization, environmental changes, and illegal trade have increased the interaction between animals and humans, ultimately leading to the emergence of highly infectious pathogens. IWT acts as a major gateway for the spread of the EID and poses a severe threat to public health, the environment, and economic stability (Rush et al. 2021). IWT acts as a major gateway for the spread of EID and poses a severe threat to public health, the environment, and economic stability.

#### **Emergence of zoonoses**

In past 30 years several zoonotic diseases viz. ebola, SARS, MERS, Nipah, Hendra, HIV, Hanta viral infection, West-nile disease, Scrub typhus, Tularemia, Lyme disease, Covid-19 have emerged or re-emerged (Woolhouse et al., 2002; Smolinski et al., 2003; Yee et al., 2020). As defined by WHO, an emerging zoonoses is defined as 'a zoonosis that is newly recognized or newly evolved, or that has occurred previously but shows an increase in incidence or expansion in geographical, host or vector range.' While OIE defines re-emerging zoonoses as 'an already known disease that either shifts its geographical setting or expands its host range, or significantly increases its prevalence.' Increase in interaction at human-animal interface due to increased anthropogenic intervention at the interface has resulted in increase in exposure of human to novel pathogen or existing pathogen with enhanced virulence.

#### **Emergence of zoonoses at human animal interface**

Around 6 million to 11 thousand years ago transmission of zoonotic disease at the interface began with human alteration of environment with beginning of agricultural activities. Establishment of agricultural activities might have led to increase in activities of rodents around the establishments. Around 10 thousand years ago domestication of animals began. All these alteration of human activities created a scope of increased exposure of human to animal pathogens (Dobson and Carper, 1996; Wolfe and Dunavan, 2007). It has been

hypothesized that recent established human diseases at some point of time originated from animal pathogen. For example human measles originated from rinderpest like virus, smallpox virus originated from camelpox/cowpox like virus having rodent borne ancestor, and similarly pertusis virus originated from ovine or porcine source (Weiss, 2001; Gubser et al., 2004). As identified by WHO/FAO/OIE, six major factors which are associated with emergence or re-emergence of zoonoses are habitat destruction, bushmeat consumption, intensification of animal agriculture, long distance transport of animals, live animal market, and increased demand for animal protein (WHO/FAO/OIE, 2004). Role of each factor is described in detail in the context below.

#### **Habitat destruction**

As per global forest resource assessment it has been reported that more than half of global tropical forest has been destroyed till now with an average loss of 2-3% per year (Pimm and Ayres, 2001; Patz et al., 2004) The principal reason behind habitat destruction is population blast. Current world population is estimated to be around 7.6 billion and it is expected to increase around 9.8 billion in 2050 and 11.2 billion in 2100 (UN, 2017). It has been estimated that availability of forest land per capita has decreased to 0.6 ha per person in 2015 as compared to 0.8 ha per person in 1990. The net global forest annual loss has decreased from 7.7 million ha during 1990-2000 to 3.3 million ha during 2010-15. Although the rate of forest loss has decreased over the years, however contribution of planted forest to net global forest as compared to natural forest is gradually increasing (FRA, 2015). Another form of habitat destruction is habitat fragmentation, which arises due to establishment of human habitation or establishment of commercial venture inside natural forest. This results in expansion of ecotone zones which helps in transmission of zoonotic agents at the interface. For example emergence of lyme disease in Connecticut, USA which was due to expansion of forests around agricultural lands thereby increased exposure to vectors and natural reservoirs of the pathogen (Goldberg et al., 2008; Laurance et al., 2013). Similarly emergence of Nipah in Malaysia was due to destruction of forests inhabiting bats, which subsequently fled to pig farm establishments and led to escalation of nipah outbreak in Malaysia. Migrations of bats are hypothesized to be behind emergence and re-emergence of several pathogen viz. west Nile virus, avian influenza, hendra virus disease, SARS syndrome.

#### **Bush meat consumption**

Bushmeat refers to meat derived from wild animal intended for human purpose (MilnerGulland and Bennett, 2003) Bushmeat consumption is popular in African countries, where in Congo and Amazon river basin the bush meat consumption activity is reported to be 4.5-5 million tonnes per year Fa et (2002). Hunting of wild animals poses a great risk of acquiring zoonotic pathogens as personnel involved in bush meat processing activities come in direct contact with blood and tissue of wild animals. Sick and clinically ill animals remain more susceptible to hunting. Among animal species, bats and primates pose greatest risk to human health (LeBreton et al., 2006; Subramanian, 2012; Taylor et al., 2015). Increased bushmeat consumption is associated with increased incidence of several zoonotic diseases. Zoonotic diseases associated with consumption of bush meat species are mentioned in Table 1 Kurpiers et al., (2016). Acquired immune-deficiency syndrome, caused by HIV- 1 virus was first recognised in USA around 1981. Later the emergence was associated with increased trade activity in forest cover, which along with resulted in increased bush meat trade (Weiss and Wrangham, 1999; Larkin, 2000). Bats due to certain important characteristics play an important role as reservoir and dissemination of zoonotic pathogen. Despite, its small size bats have a life span upto 40 years. Bats can disperse over a long range and can traverse over continents, which results in dissemination of pathogens over a wide geographical area. Bats usually roost in a large density over a small area, and due high concentration of reservoirs it facilitates random spill over of zoonotic pathogens to humans during close encounters. Bats maintain a high body temperature, which facilitates co-evolution of febrile resistant virus. Bats immune system developed in such a way that it allows multiplication of virus without development of clinical symptoms (Munshi-South and Wilkinson, 2010; Streicker et al., 2010; O'shea et al., 2014). Bats acts as common reservoir for betacoronavirus family viruses such as Covid19, SARS CoV and MERS CoV (CDC, 2020)

#### **Prevention of emergence of zoonoses**

Strengthening of human-ecosystem integrity by building national parks, protected areas with strict enforcement of rules will prevent spill over of zoonotic pathogen to domestic animals and human (Ryan and Walsh, 2011). Inclusion of molecular epidemiology in research can help to identify range of reservoirs of pathogen, its genetic variability and source of infection in an outbreak associated with zoonotic or food borne pathogen (Sonyaolu et al.,

2016). Along with researches should be conducted for identification risk factors associated with presence and distribution of pathogen. Studies of these kinds will help in control of active outbreaks and prevention of future outbreaks (Liverani et al., 2013). One of the most important factors in imbalance of natural ecosystem is blast of population size. Hence controlling population growth rate can help to prevent habitat loss and can help to maintain natural integrity of ecosystem (National Research Council, 2010). An intersectorial collaboration between different sectors is crucial and strategies should be formulated with an one health approach for prevention of emergence of zoonoses (WHO, 2019).

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