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Global emergence of infectious diseases: links with wild meat consumption, ecosystem disruption, habitat degradation and biodiversity loss

EMERGING INFECTIOUS DISEASES ARE A SIGNIFICANT AND GROWING THREAT TO GLOBAL HEALTH, ECONOMIES AND SECURITY.

- The frequency and economic impact of emerging infectious diseases is on the rise.
- Nearly three-fourths of emerging infectious diseases – and almost all recent pandemics – are zoonotic, that is they originate in animals, mostly wildlife.
- As with many other types of human-wildlife conflict, their emergence often involves dynamic interactions among populations of wildlife, livestock and people within environments that rapidly change due to human activities, especially:
 - Human population growth and urbanization, which encroaches into wildlife habitats, drive animal species into marginal environments, and result in direct competition for limited resources and land.
 - Expansion and intensification of economic activities (such as husbandry, agriculture, fishing, infrastructure development, mining and logging) increase human-wildlife interactions.

Given the extent of the direct and indirect costs caused by emerging infectious diseases, both health security and sustainable development solutions need to address their specific drivers to prevent and curtail their spread.

THERE IS EVIDENCE THAT LANDSCAPE CHANGES AND BIODIVERSITY LOSS ARE KEY DRIVERS OF THE (RE-)EMERGENCE OF INFECTIOUS DISEASES. MORE RESEARCH IS NEEDED TO UNDERSTAND ALL UNDERLYING INTERACTIONS AND CAUSES.

- Landscape changes – both permanent changes due e.g. to deforestation, mining or urbanization, or temporary changes due to flooding or drought – are major drivers of the (re-)emergence of a number of zoonotic diseases (e.g. malaria, dengue fever, Ebola, Lyme disease).

- Different mechanisms are involved that need to be further investigated:
 - Population growth and landscape changes bring people and livestock into closer contact with wildlife, increasing human-wildlife conflicts and the exposure and risk of disease transmission between them.
 - Landscape changes and biodiversity loss involve major shifts in the ecology of pathogens and the wildlife species they use as hosts and reservoirs, thus altering disease patterns.
 - Landscape changes and associated biodiversity loss could weaken the “dilution effect” – the ability of species-rich communities to mediate infection levels and disease.
 - A new hypothesis based on an evolutionary mechanism suggests that, as humans fragment and convert landscapes, habitat remnants act as islands, and the wildlife hosts and disease-causing microbes that live within them undergo rapid diversification, increasing the probability that any one of these diverse microbes may spill over to humans.
 - Disrupting areas of high biodiversity, measured in mammal species richness, may increase zoonotic disease risk.

More systematic research is needed to better understand the role of ecosystems in the regulation of diseases.

Effective implementation of the One Health approach, promoting coordinated multi-sectoral and multidisciplinary responses, has the potential to reduce disease transmission risks and improve health and well-being of all people, wildlife and livestock.

To date, most One Health efforts have invested primarily in the public health sector followed by the veterinary sector; however it has become apparent that better involving the forestry and wildlife sectors, as well as responsible land-use planning, are equally important.

WILD SPECIES CONTINUE TO BE AN IMPORTANT SOURCE OF FOOD, INCOME AND CULTURAL IDENTITY FOR MILLIONS OF INDIGENOUS AND RURAL PEOPLE, PARTICULARLY IN TROPICAL AND SUBTROPICAL REGIONS.

- Over 8 800 distinct wild animal species, including invertebrates, amphibians, insects, fish, reptiles, birds and mammals, are classed as being used for human food worldwide in the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN). And these figures are likely underestimated.
- A recent survey of nearly 8 000 rural households in 24 countries across Africa, Latin America and Asia has found that 39 percent of households harvested wild meat, and almost all consumed it. Wild meat thus represents the main source of vital protein, fat and micronutrients – as well as a key element in diet and income diversification for millions of rural people across the tropics and subtropics.
- Dependence on wild meat increases with poverty, including in places and at times when other food supply chains fail, making wild meat the sole or primary source of protein and income available, for instance during economic hardship, civil unrest or drought.
- The total annual value of wildlife harvesting around the world is estimated at USD 400 billion. This includes household hunting incomes of village-based hunters who catch wild

meat for family consumption and sell surplus, but also, in a much greater proportion, profits made by external commercial hunters supplying national and international urban markets.

- Hunting is increasing with population growth, improved hunting techniques and wild meat trade to urban areas. Unsustainable levels of hunting are affecting the customary traditions and food security of many indigenous peoples and rural communities. Wildlife populations are also declining and an estimated 285 mammal species are threatened with extinction due to hunting for wild meat.

Given that many indigenous peoples and rural communities depend on wild meat for their food security and livelihoods, any measures adopted should be mindful of this traditional source of food and income and promote sustainable and safe sourcing practices.

IN MANY PARTS OF THE WORLD, WILD MEAT REPRESENTS A LUXURY ITEM. THIS DEMAND CREATES MARKETS THAT ARE DRIVING HUNTING OF WILDLIFE TO UNSUSTAINABLE LEVELS AND INCREASES RISKS OF SPILLOVER OF WILDLIFE-RELATED PATHOGENS.

- Although urban populations have access to a wide range of domestic sources of meat, wild meat consumption remains a customary practice for many people. Migration to urban areas is still relatively recent in developing countries, and urban people maintain strong links with their rural origins.
- In urban areas, wild meat is not a dietary necessity and is typically consumed as a luxury product or tradition in developing countries that are wild meat sources and abroad. However, with growing urban populations, wild meat consumption is increasingly driven by an urban demand for wild meat.
- Though wild meat typically comprises less than two percent of the animal source foods eaten by urban families in the tropics and subtropics, the aggregate consumption of millions of city dwellers is driving an unsustainable trade.
- Shifting urban consumers' desire to consume wild meat to culturally acceptable alternatives is key to increasing the overall sustainability of wild meat use.
- Sustainable livestock production and fish farming need to be encouraged to meet the growing demand for protein and to ensure that there are affordable and safe alternatives to consuming wild meat.

Reducing demand for wild meat as a luxury good for urban populations – whether in wild meat sourcing or wild meat consuming countries is urgently needed.

THE LEVEL OF EXPOSURE IS A KEY ELEMENT IN THE PROBABILITY OF CONTRACTING ZOO NOTIC DISEASES – BOTH IN THE NATURAL ENVIRONMENT WHERE HUNTING OCCURS AND IN MARKETS THAT PROVIDE WILD MEAT TO URBAN POPULATIONS.

- Hunter-gatherer communities are typically in contact with wild animals a few times a week and thus are usually more exposed to primary infection, especially when zoonoses affect several wildlife species; an example of this is Ebola. Introducing and enforcing good

hunting practices, hygiene and food safety measures in remote hunting communities and nearby provincial towns based on a One Health approach has proven to be efficient during past Ebola outbreaks to prevent both primary and secondary infections.

- When thousands or millions of urban dwellers buy and eat wild meat, the probability that at least one individual will be exposed to a wildlife disease increases substantially. In many countries, wild meat supply chains are informal – if not illegal – making prevention measures particularly difficult to organize.
- Currently, transmission of the SARS-CoV-2 virus causing COVID-19 is only reported to be transferred by human-to-human contact, but, preliminary research suggests some wildlife species may be reservoirs for SARS-CoV-2. However, so far, the involved wildlife species have not yet been identified with certainty, and the way transmission occurred between those species and humans in the early days of the outbreak still remains unknown. Knowing which wildlife species contributed to the virus spillover to humans and how the transmission took place remain critical questions to resolve in order to prevent the reappearance of outbreaks once the COVID-19 pandemic is under control.
- “Wet markets” – markets selling fresh meat and fish as well as live animals – are considered to be critical areas where pathogen spillover between humans, wildlife and livestock could occur. The proximity of live animals in these markets could allow the exchange of pathogens between wildlife and domestic species, which may lead to the evolution of wildlife-origin pathogens into new strains able to infect humans and livestock. This must be confirmed by science-based evidence.
- Following a precautionary approach, several countries have banned wildlife trade for some or all species and markets as part of COVID-19 crisis management. This measure may not be relevant to all countries depending on market management practices (e.g. live wildlife animals in west and central African wet markets are less common compared to what is observed in East Asia), and whether markets are formal/legal and already set up to address health and food safety risks, etc.
- To reduce the risk of zoonotic diseases, we must manage these interfaces. Potential measures include ensuring that good hygiene and food safety measures are in place, implementing international animal welfare standards, and enforcing appropriate controls in wildlife trade within and across countries, as well as on the sale of wild meat at wildlife markets in towns and cities.

Minimizing exposure of humans and livestock to wildlife-related pathogens all along the wild meat supply chain is a critical priority and requires tailor-made measures.

To tackle the complex and interrelated issues associated with wildlife habitat disruption, biodiversity loss and the spread of zoonotic diseases, Food and Agriculture Organization of the United Nations (FAO) promotes the following actions:

- Support and scale-up efforts to prevent, halt and reverse the loss and degradation of ecosystems and restore degraded ecosystems worldwide.
- Promote sustainable food and agriculture systems and practices.
- Promote and implement the One Health approach, co-led by FAO, the World Health Organization (WHO) and World Organisation for Animal Health (OIE), through diverse programmes (e.g. FAO’s Emergency Centre for Transboundary Animal Diseases programme).

- Support national governments to prevent and mitigate human-wildlife conflicts, through addressing the social, political and cultural root causes of them and taking into account different values local people attach to these conflicts.
- Help indigenous peoples to secure and exercise their territorial rights to sustainably manage the wild resources they depend on for food, income and cultural identity.
- Use targeted social marketing campaigns to change consumer behaviour in cities to reduce demand for wild caught animals.
- Support national governments to strengthen laws and regulations relating to hunting, wildlife management, trade and consumption, including food safety, veterinary public health and human public health considerations.

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