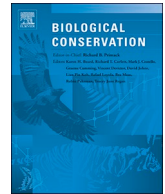




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Perspective

Addressing the illegal wildlife trade in the European Union as a public health issue to draw decision makers attention

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ABSTRACT

The European Union is one of the most important markets for the trafficking of endangered species and a major transit point for illegal wildlife trade. The latter is not only one of the most important anthropogenic drivers of biodiversity loss, it also represents a growing risk for public health. Indeed, wildlife trade exposes humans to a plethora of severe emerging infectious diseases, some of which have contributed to the most dramatic global pandemics humankind has endured. Illegal wildlife trade is often considered as a problem of developing countries but it is first and foremost an international global business with a trade flow from developing to developed countries. The devastating effects of the ongoing SARS-CoV-2 outbreak should thus be an unassailable argument for European decision makers to change paradigm. Rather than deploying efforts and money to combat novel pathogens, mitigating the risk of spreading emerging infectious diseases should be addressed and be part of any sustainable socioeconomic development plan. Stricter control procedures at borders and policies should be enforced. Additionally, strengthening research in wildlife forensic science and developing a network of forensic laboratories should be the cornerstone of the European Union plan to tackle the illegal wildlife trade. Such proactive approach, that should further figure in the EU-Wildlife Action Plan, could produce a win-win situation: the curb of illegal wildlife trade would subsequently diminish the likelihood of importing new zoonotic diseases in the European Union.

1. Introduction

The sixth mass extinction of species is underway with the current extinction rate for mammals, amphibians, birds and reptiles being faster than any rate recorded over the last million years (Barnosky et al., 2011). The major anthropogenic drivers of biodiversity loss are habitat destruction, climate change, and wildlife trade (Travis, 2003; Symes et al., 2018). The global trade for wildlife, including the bushmeat and the exotic pet trade, is not only responsible for a decline in biodiversity, it also represents a growing risk for public health (Chomel et al., 2007; Karesh et al., 2007). The current SARS-CoV-2 outbreak which originates from bushmeat wet markets in China, dramatically illustrates the risk for public health of not controlling the illegal wildlife trade (Lam et al., 2020; Lu et al., 2020). Other epidemics such as the human immunodeficiency virus (HIV) (Pike et al., 2010; Sharp and Hahn, 2010), Ebola (Leroy et al., 2004), monkeypox (Lebreton et al., 2006), simian T-cell lymphotropic virus (STLV) (Wolfe et al., 2005a), SARS-CoV-1 (Bell et al., 2004) were all fostered by consuming wild species. The large scale of the bushmeat trade combined with the ease and speed with which people and goods travel across continents, poses serious challenges for the control of emerging infectious diseases (EID; Wolfe et al.,

2005b; Chapman et al., 2006; Pike et al., 2010). Recent epidemics have reminded us how uncertain it is to predict future EID and how complex it is to mitigate them (Pike et al., 2010; Bloom et al., 2017). Current efforts, financed with billions of USD, still focus mainly on post-emergence outbreak control (Allen et al., 2017; Bloom et al., 2017) while little funding is allocated to prevent the emergence of new zoonotic diseases (Jones et al., 2008). Highlighting the considerable risks for public health and the global economy can be an alternative way to engage decision makers into the monitoring of illegal wildlife trade, particularly when they pay only little attention to demands from the scientific community and the public opinion to protect biodiversity. The socioeconomic costs of zoonotic diseases are so considerable that it undoubtedly justifies the means engaged to tackle the illegal trade for wildlife. The latter is often considered to only concern developing countries but it is first and foremost a global business with a trade flow from developing to developed countries (van Uhm, 2016). EU, as a major hub of the wildlife trade, has a pioneering role to play into the battle against this illegal activity. In light of recent renewed evidence that zoonotic diseases originated from wildlife represent a massive threat to global health, security, and economic growth, it is concerning that European decision makers are not more effective at preventing

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illegal bushmeat and exotic live animals importation into the EU. Beside enforcing policies and implementing stricter protectionist measures toward wildlife importation, EU should urgently strengthen investments into wildlife forensic science. Developing a network of forensic laboratories in Europe should be part of the EU's plan to address wildlife trafficking within the EU. If decision makers do not stick to this proactive strategy with the will of mitigating the international wildlife trade, they should at least incorporate these measures into the framework of public health politics. Ultimately, this opinion proposes an alternative approach to conservation that has the potential to mobilise the necessary funding to curb the decline of biodiversity and to offer endangered species a brighter future than their impending extinction.

2. The scale of wildlife trade in EU

As a result of anthropogenic pressures, thousands of species are declining dramatically worldwide and many of them are facing a high risk of extinction (Hoffmann et al., 2011; Estrada et al., 2017). The magnitude of wildlife trade has become so important that it is one of the most prominent anthropogenic driver of species extinction (Scheffers et al., 2019). According to the International Union for Conservation of Nature (IUCN), 26% of the assessed terrestrial mammals are threatened with extinction (Ripple et al., 2016). Wildlife trade occurs in 65% of all terrestrial vertebrate families with mammals and reptiles showing the highest percentage of traded species (Scheffers et al., 2019). Global movement of live animals for the illegal exotic pet trade affects hundreds of millions of animals every year, including for example 40,000 live primates and four million live birds (Fèvre et al., 2006). Between 1998 and 2007, 30 millions CITES (Convention on International Trade in Endangered Species)-listed animals corresponding to 300 different species, were illegally wild caught in South-East Asia and exported worldwide (Nijman, 2010). The trade for wildlife involves also a wide range of animal products including bushmeat (Nijman, 2010). Bushmeat hunting is defined by the Convention on Biological Diversity (CBD) as “the harvesting of wild animals in tropical and subtropical countries for food and for non-food purposes, including medicinal use” (Secretariat of the CBD, 2011). Bushmeat hunting is also an important extinction threat of terrestrial mammals (Ripple et al., 2016). For example, roughly 200 millions and 12–35 millions of animals are harvested every year from the Congo and the Amazon basin respectively (Karesh et al., 2007). The illegal trade for wildlife is considered too often as a problem of developing countries but it is instead a global business. It ranks among the top three largest illegitimate businesses in the world (van Uhm, 2016) and represents a multibillion dollars' industry (Scheffers et al., 2019) comparable to the international trade of narcotics and weapons (van Uhm, 2016; Smith et al., 2017). More alarmingly, the international wildlife trafficking is one of the fastest growing illegal market worldwide (Sollund, 2016), particularly when it involves the use of animals for food and traditional medicine (Maher and Sollund, 2016). By ranking at the third largest worldwide consumer and transit point (Sollund and Maher, 2015) and the top global importer by value (Engler and Parry-Jones, 2007), the EU is largely concerned by international illegal wildlife trade. In Paris Charles de Gaulle airport, roughly 273 tons of bushmeat are reported to be imported every year on Air France routes from Central and West Africa and 7% of the searched passengers were found to be carrying bushmeat (Chaber et al., 2010). In 2018, EU member states reported 6012 seizures records, corresponding to 16,740 specimen of CITES-listed species (TRAFFIC, 2020). This figure should be considered cautiously as it is probably largely under-estimated compared to the global scale of wildlife trafficking reported in the scientific literature. Reported seizures can only be used as indicators if they are the expression of a genuine political will and if they are all scrupulously entered in specific databases (e.g. EU-TWIX) (Mundy-Taylor, 2013). Precise estimates of the illegal wildlife trade in EU are difficult to evaluate because of its

clandestine character. However, weak controls at EU borders further contribute to make the true scale of the illegal wildlife trade difficult to measure (Sollund and Maher, 2015). At Charles de Gaulle airport for example, only 2.5% of luggage are searched for products of animal origin which rather seems a cosmetic and ineffective measure (Noordhuizen et al., 2013). The illegal importation of bushmeat and live animals from CITES-listed species in EU happens despite the fact that CITES is ratified by all EU members states (CITES, 2020) and the European Union (EU, Policy Department of the European Parliament, 2016). CITES is an international agreement which aims to ensure that the trade of species does not threaten their survival. CITES regulations, which are implemented within the EU legislation through Council regulations EC No 338/97 and EC No 865/2006 (European Commission, 2010), should thus be an important line of defense to prevent illegal importation of endangered species in EU. Additionally, while the hazardous nature of the illegal wildlife trade for public health comes precisely from its clandestine and unregulated nature (Can et al., 2019), the lack of searched procedures for the illegal importation of bushmeat contrasts with strict measures and veterinary inspections for legal importation of live animals and products of animal origins (Noordhuizen et al., 2013). The EU, as one of the biggest market for wildlife trade, thus plays a contradictory role (Engler and Parry-Jones, 2007). On one side, it claims to be at the forefront of the fight against wildlife crime (European Commission, 2016) but on the other side, loopholes in enforcement policies, law penalties, and insufficient resources, demonstrate that the wildlife trafficking is not tackled appropriately (Wyatt and Cao, 2015; Maher and Sollund, 2016). Ultimately, the weakness of EU policies and inspection measures at EU borders are ineffective to both combat the international wildlife trade of threatened species and to reduce the risk of introducing harmful pathogens in EU (Noordhuizen et al., 2013).

3. Public health risks associated to wildlife trade

Microorganisms are a leading cause of human fatalities as they account for 17%–25% of the total number of deaths worldwide (Fauci et al., 2005; Muehlenbein, 2016). Two thirds of EID have zoonotic origins (Taylor et al., 2001) with a proven wildlife origin for 71.8% of them (Jones et al., 2008). Not only wildlife zoonotic diseases represent the most significant threat to global health but the number of events of EID is accelerating at an unprecedented rate since the last decades (Jones et al., 2008; Cutler et al., 2010; Morse et al., 2012). Although our understanding of the underlying mechanisms that contribute to the emergence of pathogenic agents from wildlife to humans remains rudimentary (Allen et al., 2017; Olival et al., 2017), the human-wildlife interface and the frequency with which humans are exposed to pathogens are critical in this process (Pike et al., 2010). Various factors such as land use change, extraction of natural resources, animal production systems, modern transportation, global trade, and drug usage in human and veterinary medicines, all play a role in cross-species transmission and spread of zoonotic diseases from animals to humans (Bengis et al., 2004; Rimoin et al., 2010; Karesh et al., 2012). The international wildlife trade, including bushmeat and exotic pet trade, are major factors that contribute to such disease transmission (Chomel et al., 2007; Karesh et al., 2007; Karesh et al., 2012). This is especially true for non-human primate species with which humans share close phylogenetic relationships and have the weakest species barriers (Wolfe et al., 2007). Although primate species represent only 0.5% of all vertebrates, they act as reservoirs for 20% of the diseases that affect humans (Wolfe et al., 2007). The hunting and the butchering of non-human primates led to the major pandemic of HIV (Pike et al., 2010) which contributed to the deaths of 35 million people worldwide (Bell and Bedford, 2017). Retroviruses such as human T-cell lymphotropic (HTLV) virus and simian foamy virus (SFV) have emerged into human populations because of the primate bushmeat trade (Wolfe et al., 2004; Wolfe et al., 2005a; Peeters and Delaporte, 2012). HTLV-1 is now a global epidemic

affecting 22 million people and causing life-threatening and incurable diseases (Edlich et al., 2000; Wolfe et al., 2005a). More generally, high level of contacts with a wide range of wild species fosters the emergence of zoonotic diseases in human populations. Several of the last Ebola outbreaks in Africa were due to the handling of dead animals and contacts with bat guano (Bengis et al., 2004; Leroy et al., 2004; Jacobsen et al., 2016). The 2014 Ebola epidemic in West Africa was responsible for 27,000 reported cases including more than 11,000 deaths (Carroll et al., 2015; Muehlenbein, 2016) although Ebola virus can be way more virulent depending on the strains (e.g., up to 90% of recorded mortalities: Feldmann and Geisbert, 2011). Ebola virus disease was also reported in countries such as USA, Spain, UK and Italy (Mann et al., 2015). The emergence of the severe acute respiratory syndrome coronavirus (SARS-CoV-1) in 2002–2003 was associated with the international trade of civets and bats (Wang et al., 2006; Karesh et al., 2007; Cui et al., 2019). Monkeypox virus, which causes fatal illness in humans in up to 10% of cases (WHO, 2016), occurred in the USA because of the importation of naturally-infected wild African rodents from Ghana to supply the wildlife pet trade (Karesh et al., 2007). In 2004, two crested hawk-eagles illegally smuggled from Thailand to Belgium that were seized at the airport, turned out to be positive for the highly pathogenic avian influenza H5N1 (Van Borm et al., 2005). Similarly, passerines imported from Asia to the UK in 2005 were also carrying H5N1 (Dudley, 2006; Karesh et al., 2007). H5N1 is highly lethal for wild and domestic birds but it also threatens humans due to potential cross-species transmissions and subsequent reassortment that could lead to a devastating pandemic (Ferguson et al., 2004). Birds are also responsible for psittacosis, a bacterial infection caused by *Chlamydia psittaci* and that can lead to severe pneumonia in humans, potentially fatal if left untreated (Smith et al., 2011). The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak in 2019–2020 originated probably from pangolin sold on wet markets in China (Zhang et al., 2020). About 10 months following the first discovered case of SARS-CoV-2, the virus has affected roughly 30 million persons worldwide and caused 940,000 deaths. These few examples demonstrate that the multiplication of human-wildlife contacts plays a primary role in pathogens' exchange and that leaving the illegal wildlife trade in its current state equals accepting the fact that other EID will likely becoming devastating threats to humans in the near future.

4. Reasons to change paradigm

The socio-economic burden of epidemics is so considerable that public health authorities and intelligence agencies have classified infectious diseases as “a non-traditional threat to national and global security” (Snowden, 2008) and during a general assembly of the United Nations (UN), it was stated that a disease such as HIV “may pose a risk to stability and security if left unchecked” (Heymann et al., 2015). Even though the HIV was first discovered about 40 years ago (Montagnier, 2002), the world is still struggling to contain this epidemic. About 37 million people live with HIV in the world (Platt et al., 2016) and about the same number of people have already died (Bell and Bedford, 2017). The amount of funding spent to control this epidemic has been considerable (Pike et al., 2010; Dieleman et al., 2018). Between 2000 and 2015, half a trillion USD was spent to tackle this pandemic (Dieleman et al., 2018) and estimates predict that the cost of combating HIV could reach 35 billion USD per year by 2031 (Hecht et al., 2009). Considerable investments should be engaged by governments to both control epidemics and avoid financial crises and recessions (Dixon et al., 2002; Mullan, 2015). The societal impacts of EID related to morbidity and mortality affect, indeed, labor supply (Dixon et al., 2002; Knobler et al., 2004), reduce labor productivity, competitiveness and profits of affected countries (Dixon et al., 2002). The World Bank estimated that the economic impact of zoonotic diseases that have occurred in specific countries between 1997 and 2009 has reached 80 trillion USD, which represents 5% of the global gross domestic product (Gebreyes et al.,

2014). It is still too early to make an assessment of the economic impact of the ongoing SARS-CoV-2 outbreak but according to the United Nations (UN), it will cost at least 8.5 trillion USD to the world economy over the next two years and the EU needs to provide financial assistance of up to 100 billions € to protect jobs and workers affected by the SARS-CoV-2 outbreak and avoid a major economic crisis. Additionally, epidemics have demonstrated our vulnerability, unpreparedness and inability to prevent and control such events (Pike et al., 2010; Bloom et al., 2017). Therefore, it is crucial for global health security that we carefully evaluate the lessons learned from current and previous major disease outbreaks (Pike et al., 2010; Heymann et al., 2015). Pandemics are inherently unpredictable (Morse et al., 2012). Indeed, despite intensive surveillance of EID, scientists have never managed to predict a single pandemic before it starts infecting humans after a cross-species transmission (Lloyd-Smith et al., 2009; Morse et al., 2012). International efforts were not sufficient to predict SARS-CoV-1 in 2002–2003 (Wang et al., 2006), the Middle East respiratory syndrome (MERS) in 2012, the Ebola outbreak in 2014–2015 (Troncoso, 2015; Jacobsen et al., 2016), and the SARS-CoV-2 in 2019. Humans will continue to be assailed by new emerging and reemerging zoonotic diseases (Wolfe et al., 2007) and each of them will represent a unique challenge (Morens et al., 2013). While a few pathogens such as the smallpox virus were eradicated, and others, such as poliomyelitis or measles, significantly controlled, it is very unlikely that most of the emerging diseases will be eradicated in the near future (Fonkwo, 2008; Morens et al., 2013). Because of their short life-cycles and elevated replication rates, pathogens evolve rapidly, enabling them to escape host defense mechanisms and environmental changes (Morens et al., 2013) and sometimes to mutate into more virulent strains (Fonkwo, 2008). Further major epidemics will emerge in unpredictable times and places or in places where the surveillance systems and infrastructures are lacking (Heymann et al., 2015). By adding in 2018 the “disease X” on the shortlist of EID that represent the greatest risk of becoming pandemic, the World Health Organization (WHO) acknowledged that global health policies must be prepared to a future world pandemic caused by a hypothetical and unknown pathogen (WHO, 2018). Coronavirus disease 19 (COVID-19) caused by SARS-CoV-2 might well be the first “disease X”. Our answer to epidemics is currently reactive and not proactive (Allen et al., 2017; Bloom et al., 2017), focusing on post-emergence outbreak control with the establishment of quarantine protocols and the development of diagnostics, drugs and vaccines (Morens et al., 2013). This approach is not sustainable on the long run because it is highly cost-intensive (Bhutta et al., 2014) and often ineffective (Bloom et al., 2017) due to the delays in detection and response (Allen et al., 2017). Even if some scientists offer hopes to deliver a COVID-19 vaccine within a record time (Kim et al., 2020), vaccine development is usually measured in years or decades with the most accelerated procedures (Bloom et al., 2017; Graham, 2020). Yet, in the case of HIV, 35 years after the beginning of the pandemic, no successful vaccine has been developed (Pike et al., 2010). For these reasons, the wait-and-response approach will not be sufficient for controlling emerging and reemerging infectious diseases (Pike et al., 2010), and it is imperative that EU decision makers change their paradigm by switching from a “reactive” model to a “proactive” model (Jacobsen et al., 2016). Strengthening a network of public health agencies in several countries in order to detect and contain epidemics is often suggested to improve global health security, but this solution is still far from reality and alternative measures should be developed (Pike et al., 2010; Heymann et al., 2015; Hyatt et al., 2015; Jacobsen et al., 2016). Controlling and restricting the human/wildlife interface is most probably the best defense to prevent the emergence of infectious diseases (Karesh et al., 2007; Pike et al., 2010; Jacobsen et al., 2016) and rather than deploying efforts and money to combat novel viruses, conservation interventions, biodiversity preservation and trade regulation should be emphasised instead (Hyatt et al., 2015; Muehlenbein, 2016; Di Marco et al., 2020).

5. Engaging EU in a new conservation paradigm

Even though human-to-human transmissions facilitated by travel and global tourism remain, so far, the most recurrent drivers implicated in infectious disease events in EU (Semenza et al., 2016), it is unreasonable to wait for the next epidemic to be caused by the illegal wildlife trade to implement mitigation strategies preventing this illegal activity. For example, the potential for introduction and transmission of a highly pathogenic virus, such as Ebola, through illegally imported bushmeat into EU, is considered to be low, but the public health consequences of only one introduction would be devastating (EFSA, 2014). Because the EU is a hotspot for EID (Jones et al., 2008) and is a major hub of the wildlife trade, it has a critical role to play in restricting the human/wildlife interface. There is an urgent need to implement stricter protectionist measures toward wildlife importation and to drastically enforce policies. EU should first review its own environmental crime legislation to ensure that wildlife crime is consistently treated with harmonised rules and with the seriousness it deserves (EFFACE, 2016). In this regard, EU member states should criminalise acts of wildlife crime that are not in accordance with environmental rules (EFFACE, 2016). Second, specialised police forces prosecutors' offices and judges, expert in environmental crime, should be developed as they will grant environmental crimes a high priority and treat them in an efficient way (EFFACE, 2016). To improve coordination and collaboration between member states, the latter should also have the obligation to communicate on the number of violations and prosecutions. Without independent records of illegal trade activity entered in specific electronic databases and enforcement, no conclusion can be drawn from these records about a country's effort or progress in controlling illegal wildlife trade (Rosen and Smith, 2010). Additionally, a better control at border check points is a prerequisite to any attempt to counter wildlife trade. It would indeed help to accurately assess the scale of the illegal wildlife trade entering EU, determine its scope in terms of species, volume and origin and subsequently improve regulatory frameworks within EU and orientate conservation strategies in countries of origin. EU policies for biodiversity preservation should be framed into an international conservation context with, for example, independent scientific evaluations to ensure that they do not make the wildlife trade worse nor generate a geographic redirection of it, and to be adjusted if necessary (Cardador et al., 2017). Concomitantly, EU should better control the surge of its legal wildlife trade market, finance programs that improve the livelihood of local communities living in epicenter regions of trade species, finance protected area management, engage changes in consumer behaviours by organizing awareness campaigns to reduce the demand for wildlife. Control procedures at EU border crossing points could be improved by increasing the amount of personal committed to searching for illegal bushmeat including online wildlife crime intelligence officers, and by increasing the number of detection tools such as scanning gears and sniffer dogs (Chaber et al., 2010; Rosen and Smith, 2010; Jansen et al., 2016). Understanding and monitoring the wildlife trade require that traded species can be accurately identified (Gaubert et al., 2015). In some cases, such as for bushmeat which is often smoked or processed (Willcox et al., 2007; Minhos et al., 2013), the visual identification of the species involved is impossible or inaccurate (Gaubert et al., 2015). As wildlife crime investigators must be able to link a suspect to a crime, strengthening investments into wildlife forensic science and developing a network of forensic laboratories in Europe should be a cornerstone of the EU's plan to address wildlife trafficking within the EU. Over the past 30 years, the field of forensic science has become an important conservation tool to tackle wildlife trafficking (Ogden et al., 2009) and genomic technologies are increasingly being used to provide evidence of illicit wildlife trade (Alacs et al., 2010; Ogden, 2011). Geneticists can recover DNA from almost any tissue (e.g. meat, bones, feathers) (Ogden et al., 2009; Alacs et al., 2010) and genetic identification of species by DNA sequencing is employed worldwide for many species (Ogden, 2011). Wildlife forensic relies on finding

short standardised species-specific DNA sequences that vary across species and are conserved within species (Ogden et al., 2009; Alacs et al., 2010; Tobe and Linacre, 2010). Two methods using these species-specific genetic markers - DNA barcoding and single nucleotide polymorphism (SNP) - are predominantly used by wildlife forensic scientists for species identification. One of the challenges to further integrate wildlife DNA forensics into law enforcement's toolkit, is that both the cutting-edge technology and data from scientific research must be available to produce clear and unequivocal evidence that can be used by law enforcement staff and in courtrooms (Ogden et al., 2009). With adequate political will, it becomes conceivable to develop platforms to combat illegal importations of wildlife and wildlife products, just like the FishPopTrace project funded by an EU framework programme to address illegal, unreported and unregulated fishing (Martinsohn and Ogden, 2009). Using array-based SNP assays, the FishPopTrace project allowed the monitoring of illegal fishing of four commercial species: cod (*Gadus morhua*), hake (*Merluccius merluccius*), herring (*Clupea harengus*) and sole (*Solea solea*) (Martinsohn and Ogden, 2009). Even though several large-scale projects are already developed to restrain illegal wildlife trade in species with high economic value such as fish and wood, few projects are dedicated to endangered wildlife species (Ogden, 2011). In the recent years, progress has been achieved in the development of metabarcoding strategies for CITES-listed species even though genetic barcodes of such species are still under-represented (Staats et al., 2016). Wildlife forensic science promises to bridge the gap between illegal wildlife trade and law enforcement; however there is now an urgent need of financing comprehensive research on wildlife forensic science to enrich databases with reference DNA libraries of endangered and illegally traded species. Continued efforts of initiatives such as the Consortium for the Barcode of Life (CBOL) are essential. The CBOL aims to identify species, assess genetic diversity, and monitor the illegal wildlife trade (Eaton et al., 2010) by creating a cloud-based data storage and analysis workbench to support the use and assembly of DNA barcode data (Ratnasingham and Hebert, 2007). With ever decreasing costs of high-throughput sequencing technology, molecular barcodes for thousands of taxa can be generated simultaneously (Shokralla et al., 2015). This show great promises to address the immense task of sequencing standardised species-specific DNA sequences that are still missing in DNA libraries. Generalising the use of DNA barcoding for wildlife forensic science in EU border-crossing points also requires cutting-edge technology to be affordable, fast, easy to use by non-research scientists (e.g. custom officers) and feasible in the absence of well-equipped facilities (Minhos et al., 2013; Menegon et al., 2017). Until recently, the prohibitive cost of high-throughput sequencing machines was a significant disadvantage precluding their use for screening samples at borders in a large extent. But the recent advent in inexpensive mobile laboratory DNA sequencing technologies such as MinION, developed by Oxford Nanopore Technologies (University of Leicester, 2016; MinION, 2017) brings hopes to facilitate future investigations at EU border check points (Krehenwinkel et al., 2019). Policies that promote comprehensive research to make this technology even more cost efficient and less labor intensive (e.g. sample preparation) would eventually open up the potential of generalising its use at EU border check points.

6. Conclusion

Illegal wildlife trade and bushmeat trade not only lead to the loss of biodiversity and to major ecosystem dysfunctions, they also expose humans to a plethora of severe EID, some of which have contributed to the most dramatic global pandemics humankind has endured. These zoonotic pandemics threaten global health, trigger major economic crises, and unleash political instability. Risks to public health and to a larger extent, the socio-economic burden of EID, should be unassailable arguments for decision makers to combat the illegal trade for wildlife more efficiently. Mitigating the risk of spreading EID into EU should

actually be part of any sustainable socioeconomic development plan. The EU which is currently one of the major destination markets for the illegal wildlife trade and a hub for trafficking in transit to other regions of the globe, should show a leadership in policies to combat this illegal activity. This is all the more true since EU, as one of the largest wealthy economic entities with a strong technology expertise, has probably also a moral duty in addressing the illegal wildlife trade to bear a part of the global burden associated to EID consequences which do not recognise geopolitical borders. Effective enforcement of existing legal instruments and more stringent scrutiny at EU border-crossing points have key roles to play in mitigating the illegal wildlife trade. In many cases, linking a suspect to a wildlife crime scene requires the use of wildlife forensic science. This criminal investigation field depends strongly both on the development of novel technologies and on researches in conservation genetics to produce reference DNA-databases for all CITES-listed species. This field of investigation offers great potential for mitigating wildlife trafficking and should become a high priority issue funded with substantial investments. The EU Wildlife Action Plan 2016–2020, adopted by the European Commission and which sets out a comprehensive blueprint to address the illegal trade for wildlife in EU does neither mention “wildlife forensic science” as a research area to prioritise nor a field of applications to promote. This should be addressed.

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