Pace International Law Review

Volume 35 | Issue 1 Article 1

December 2022

The Future of Pandemics: Land Use Controls as Means of Preventing Zoonotic Disease

Bailey Andree
Elisabeth Haub School of Law at Pace University, bandree@law.pace.edu

Recommended Citation
Bailey Andree, *The Future of Pandemics: Land Use Controls as Means of Preventing Zoonotic Disease*, 35 Pace Int'l L. Rev. 1 (2022)
DOI: https://doi.org/10.58948/2331-3536.1422
Available at: https://digitalcommons.pace.edu/pilr/vol35/iss1/1

THE FUTURE OF PANDEMICS: LAND USE CONTROLS AS MEANS OF PREVENTING ZOONOTIC DISEASE

Bailey Andree*

ABSTRACT

Zoonotic diseases are increasing in frequency as climate change worsens around the world, with the recent COVID-19 pandemic highlighting the inadequate mechanisms in place to counteract disease spread. This article reviews various zoonotic diseases and their patterns of spread, highlighting land use change as the key driver of disease to demonstrate the need for legal intervention. International land use law is a little-developed subsect of environmental law that holds the key to combating this disease spread, and this article proposes solutions through this legal lens. Land use techniques which may be used to combat disease spread include conservation laws, setback and buffer requirements, increased density in development, variances, environmental impact assessments, land-based financing, and variances, in addition to international treaties.

KEYWORDS

land use, zoonotic disease, disease, land use law, COVID-19, international law, international land use law

---

*Bailey Andree is a third-year law student at the Elisabeth Haub School of Law at Pace University in White Plains, New York, graduating in May 2023. She is the Managing Editor of Pace International Law Review, Research Assistant to Distinguished Professor John R. Nolon, and Senior Scholar of Housing at the Land Use Law Center.

Table of Contents

I. INTRODUCTION

The COVID-19 pandemic has brought to light the global lack of preparedness in combating widespread disease. With deaths in every country on the planet, we feel the effects of COVID throughout the world and in our own homes. SARS-CoV-2 is a zoonotic disease, or one that originates in animals or insects and is transmitted to humans.[1] A single organism spread the disease to the first human, and now 657,430,133 people worldwide have contracted it.[2] Land use change is a driver for 42% of past disease emergence events, with agricultural industry change and international travel and commerce as the next closest drivers at just 22% and 17%, respectively.[3] As such, zoonotic disease transmission increases with human development.[4] As habitats are reduced and more "edge" habitat is created, organisms are increasingly interacting with human settlements.[5] The planet is in desperate need of a reduction in the human-wildlife interface and land use controls are the means of doing so.

Land use law is a field that encompasses a wide range of land-oriented solutions to disease transmission. Land use changes are among the primary stressors to natural spaces and it is time that those in power use their authority to alleviate land-based pressure.[6] There is a wide scheme of international environmental law, but

---

[1] Note: SARS-CoV-2 will be referred to as "COVID-19" and "COVID" throughout this paper; The term "State" denotes nations or countries, while "state" refers to smaller regions of a particular country (i.e. New York is a state in the United States); Rebecca Lipman, *Zoonotic Diseases: Using Environmental Law to Reduce the Odds of a Future Epidemic*, 33 VA. ENV. L.J. 154 (2015).

[2] *WHO Coronavirus (COVID-19) Dashboard*, WHO, https://covid19.who.int/ (Jan. 5, 2021 1:35 PM).

[3] *See* Elizabeth H. Loh et al., *Targeting Transmission Pathways for Emerging Zoonotic Disease Surveillance and Control*, 15 VECTOR-BORNE & ZOONOTIC DISEASES 432, 434 (July 2015) (ranking drivers of emerging infectious diseases).

[4] *See Zoonotic Diseases*, CDC, https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html (last visited Oct. 3, 2022).

[5] *See* Patricia L. Farnese, *Searching for Wildlife: A Critique of Canada's Regulatory Response to Emerging Zoonotic Diseases*, 39 QUEEN'S L.J. 471, 477 (2014) (explaining "edge" effects and making the link between this and the stated proposition of reduction of habitats).

[6] Loh et al., *supra* note 3, at 435–36.

existing treaties lack enforcement mechanisms and focus largely on pollutants and sustainable development rather than land use.[7]

This article seeks to address this hole in international governance and propose land use solutions to zoonotic disease spread. What exacerbates the threat of zoonotic disease spread can logically be used to create a solution, and the international scale is the most effective means of doing so. Part II will provide an introduction to zoonotic disease prevalence, spread, risk factors, processes, and causes. Part III discusses land use strategies and their use in zoonotic disease control. Part IV evaluates land use mechanisms employed internationally that can and should be used to combat zoonotic disease. Finally, Part V concludes.

II. INTRODUCTION TO ZOONOTIC DISEASE

A zoonotic disease originates in animals or insects and is transmitted to humans through a process called *zoonosis*.[8] This category of disease has stained many chapters of history books, with some of the worst diseases in recorded time originating in wildlife, including the Black Death, Smallpox, and AIDS.[9] The risk of zoonotic disease transmission has increased in modern times through the rapid globalization characteristic of the twentieth and twenty-first centuries, with epidemics and pandemics – particularly COVID-19 – calling attention to the vast threat that disease poses to mankind.[10] Through modern modes of travel and commerce, disease has never had an easier means of spread - as Richard Preston, author of *The Hot Zone*, stated, "[a] hot virus from

---

[7] *See Major Agreements & Conventions*, U.N. SUSTAINABLE DEV. GOALS KNOWLEDGE PLATFORM [hereinafter *Major Agreements*], https://sustainabledevelopment.un.org/index.php?menu=122 (last visited Oct. 3, 2022) (listing the most important environmental treaties in the United Nations treaty regime and the lack of focus on land use); *see* UNEP, *Environmental Rule of Law*, FIRST GLOB. REP. (2019), https://wedocs.unep.org/bitstream/handle/20.500.11822/27279/Environmental_rule_of_law.pdf?sequence=1&isAllowed=y.

[8] Lipman, *supra* note 1, at 154.

[9] *See* Nicholas LePan, *Visualizing the History of Pandemics*, VISUAL CAPITALIST (Mar. 14, 2020), https://www.visualcapitalist.com/history-of-pandemics-deadliest/ (providing an overview of history's deadliest pandemics).

[10] *See id.*; *see* Birgitta Åsjö & Hilde Kruse, *Zoonoses in the Emergence of Human Viral Diseases*, 16 PERSPECT. MED. VIROL. 15, 18–19 (2006).

the rainforest lives within a twenty-four-hour…flight from every city on earth."[11]

This statement articulates the importance of enacting controls to prevent disease spread, which COVID has proven possible in every place on earth.[12] Before global spread, however, is the transmission event, or *spillover*.[13] Spillover occurs when an animal, insect, or other wild organism spreads a virus, bacteria, or pathogen to a human for the first time.[14] For the zoonotic disease process to be stopped before it can ever begin, spillover must be prevented. Unfortunately, spillover is much more likely to occur as human-wildlife interactions increase in frequency due to habitat fragmentation, land use change, and more.[15] The modern landscape of land use change has and will continue to cause significant challenges with regards to natural threats facing mankind.[16]

For a zoonotic disease to succeed, it undergoes the process of *emergence*, which involves the introduction of the disease to a new host or vector and its subsequent spread through the species.[17] A *vector* is a species that can transmit a disease but not contract it, whereas a *host* species can transmit and contract the disease.[18]

---

11 RICHARD PRESTON, THE HOT ZONE 12 (Anchor Books, 1st ed. 1995).

12 *Id.* (explaining that a virus can live anywhere due to the interconnected web of Earth's cities via air travel routes); *see also Coronavirus News*, NAT'L L. REV., https://www.natlawreview.com/type-law/coronavirus-news (last visited Sept. 29, 2022) (showing how COVID-19 proves it is possible for a disease to spread everywhere on Earth).

13 Lipman, *supra* note 1, at 154.

14 *Id.*

15 *See id.* at 158 (explaining the factors that increase the likelihood of spillovers such as the increased exposure to wild animals as people seek to clear forests and develop land).

16 JunJie Wu, *Land Use Changes: Economic, Social, and Environmental Impacts*, 23 CHOICES 6, 10 (2008), https://www.choicesmagazine.org/UserFiles/file/article_49.pdf (displaying a graphical chart of the changes in major land use and use in the contiguous United States from 1982–2003); *see also Land Use*, EPA (Sept. 7, 2021), https://www.epa.gov/report-environment/land-use (showing examples of how land use change can threaten mankind).

17 Farnese, *supra* note 5, at 476.

18 *Vector-borne diseases*, WHO (Mar. 2, 2020) [hereinafter WHO, *Vector-borne diseases*], https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases (explaining that vectors spread disease to hosts, which are humans or animals).

Many wildlife reservoirs are vectors and can transmit the disease to humans, but not contract it themselves, limiting the harmful impacts to humans alone.[19] This can lead to disease spread through animal populations that, because reservoirs do not become ill, is largely unknown to humans until the spillover event occurs.[20] The threat that this unknown spread poses is demonstrated by the numerous novel diseases that have emerged with the rapid globalization characteristic of modern society.[21] Furthermore, zoonotic diseases cannot fully be eradicated with vaccines because the wildlife reservoirs will always host the disease, regardless of its presence in humans.[22] Even with dedicated management measures, this allows diseases to reemerge – a process which can best be prevented through land use-focused mitigation measures – which highlights the importance of stopping the disease transmission at the start by preventing spillover from ever occurring.[23]

Diseases of zoonotic origins comprise the majority of human infectious disease.[24] The United Nations Environment Programme found that 60% of all infectious diseases and 75% of all emerging infectious diseases are zoonotic.[25] *Emerging infectious diseases* are those that newly appear in a population or have existed but are rapidly increasing in range or incidence.[26] All infectious diseases

---

19 *Id.*; *see also Nurse Aide Infection Control, Module 2: Chain of Infection: Susceptible Host*, TEX. HEALTH & HUM. SERVS., https://apps.hhs.texas.gov/providers/NF/credentialing/cna/infection-control/module2/Module_2_Chain_of_Infection18.html (explaining, through a medical education module, that vectors are unharmed by the pathogens they carry).

20 *Cf.* Ron Jefferson, *20,000 Undiscovered Links Between Zoonotic Diseases and Humans Predicted by AI*, SCI. TIMES (June 29, 2021, 12:34 AM), https://www.sciencetimes.com/articles/31974/20210629/20-000-undiscovered-links-between-zoonotic-diseases-humans-predicted-ai.htm (discussing how AI technologies have been used to predict zoonotic pathways for emerging diseases).

21 LePan, *supra* note 9.

22 Lipman, *supra* note 1, at 156.

23 Anna Rovid Spickler, *Emergence and Reemergence of Zoonotic Diseases*, MERCK VETERINARY MANUAL (June 2016), https://www.merckvetmanual.com/public-health/zoonoses/emergence-and-reemergence-of-zoonotic-diseases.

24 L.H. Taylor et al., *Risk Factors for Human Disease Emergence*, 356 PHIL. TRANS. ROYAL SOC'Y B: BIOL. SCI. 983, 989 (2001).

25 *Id.*

26 Spickler, *supra* note 23.

were once emerging diseases, emphasizing the need to act early in the emergence process to prevent successful disease spread.[27]

Zoonotic disease transmission is a threat to human welfare, health, and safety.[28] As the COVID-19 pandemic has demonstrated, the stress that disease places on global public health, trade, and social systems is far beyond that which the world may combat on a regular basis.[29] Impacts of worldwide disease, though clearly affecting the public health system, has had significant repercussions for mental health, small businesses, transportation systems, social and domestic welfare, housing demand, and more.[30] Disease prevention is not only a public health protection measure, but contributes to social, economic, and other societal functions whose failure would have widespread impacts.[31]

When implementing measures to alleviate the risk of zoonotic disease spread, it is important to consider factors beyond the purely land use realm. The environmentalism movement, while seeking to respond to problems impacting all, is a movement centered in the white middle- and upper-class populations of developed countries.[32] For example, a study conducted on the early years of the environmental movement found that 98% of environmental activists were white.[33] Though this study demonstrates only the decades-past origins of the movement, a 2017 survey of American governmental and non-governmental organizations found that less

---

[27] Bayissa Chala & Feyissa Hamde, *Emerging and Re-emerging Vector-Borne Infectious Diseases and the Challenges for Control: A Review*, 9 FRONTIERS PUB. HEALTH 1, 1–2 (2021), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8524040/; WHO, *Vector-borne diseases*, *supra* note 18.

[28] *WHO, Vector-borne diseases*, *supra* note 18.

[29] *Global Health Security*, USAID, https://www.usaid.gov/global-health/health-areas/global-health-security (last visited Mar. 8, 2022).

[30] *See* Elaine Larson, *Social and economic impacts of infectious diseases – United States*, CLINICAL PERFORMANCE & QUALITY HEALTH CARE (1997), https://pubmed.ncbi.nlm.nih.gov/10164997/ (explaining that there are major disparities among minority groups that have an impact on various social and economic factors).

[31] *Id.*

[32] Adeline Wells, *Glass Houses: Exclusion in the Environmental Movement*, SIERRA CLUB (Nov. 5, 2017), https://www.sierraclub.org/wisconsin/blog/2017/11/glass-houses-exclusion-environmental-movement.

[33] *See id.* (noting that the study was conducted in 1972 and does not speak to today's demographics).

than 16% of environmental organizations' boards are members of minority groups, despite the United States having a 38% minority population.[34] The environmental movement, with its roots entrenched in the exclusivity of class and race, still has a long way to go in the name of equity, both domestically and abroad.

The movement has also spawned an abundance of "eco-friendly" products and practices in which the majority are more expensive than accepted norms.[35] The green movement is built for the rich and often disregards the inability of people of lower means to afford the changes being made.[36] For example, in the United States, it could cost up to $40,000 to install a full solar panel system on a house, and the transition from city water, via installation of a well and septic tank, costs $13,000.[37] One study from England found that the average "eco-friendly" shopper spends £2,000 more than the average shopper each year.[38] While switching from harmful to sustainable products is beneficial in the long run, it requires substantial short-term expenditures that many households cannot afford to meet. The harsh reality of the climate crisis is that the rich are adaptable and the poor are not.

Those of us born into families that are food secure and have sustainable housing were given an advantage – climate change adaptation for us is buying more sustainably, recycling, and driving less. Those of us who can't afford to do these things are more likely to live in communities where basic needs are being threatened by the climate crisis – adaptation is moving away from floodplains yet not having the means to do so, being unable to pay

---

[34] *Id.*

[35] Eric, *Why Are Eco-friendly Products More Expensive?*, SUSTAINABLE LIVING GUIDE (Apr. 19, 2021), https://thesustainablelivingguide.com/why-are-eco-friendly-products-expensive/.

[36] Stefan Dercon, *Is Green Growth Good for the Poor?*, 29 WORLD BANK RSCH. OBSERVER 163, 163 (2014).

[37] *See* Salman Zafar, *What is the True Cost of Sustainable Living in the US?*, BIOENERGY CONSULT (Dec. 10, 2021, 11:33 PM), https://www.bioenergyconsult.com/cost-of-sustainable-living-in-us/ (citing figures that show the initial cost of installing eco-friendly home systems and arguing that these investments have long-term value).

[38] *See Shoppers are spending nearly £2,000 a year more on 'green' shopping to be eco-friendly*, EXPRESS (Mar. 13, 2020, 1:37 PM), https://www.express.co.uk/life-style/life/1254673/cost-green-shopping-eco-friendly (comparing figures that show the average cost of sustainable shopping for UK families is higher than non-sustainable shopping).

the increased food prices for failing crops, and dying from extreme heat events because of lack of climate control.[39] While this article argues the need for global land use change, it is important to remember that the effects of these problems go far beyond our own convenience and require comprehensive and inclusive solutions in order to work.

It is also important to note that zoonotic disease transmission, like many other public health problems, disproportionately affects minority communities and people of color.[40] While this article does not delve into this complicated and important aspect of disease transmission, any solution to minimize spillover should also take into consideration the equity factors that are so frequently overlooked in public decision-making. People of color and minority groups have long experienced disproportionately negative impacts of natural hazards in areas like poor air quality, increased heat stress, and hazardous substance exposure.[41] Whatever the solution implemented to combat zoonotic disease spread, it must include a thorough examination of the threats these communities face and impose strong protections to prevent zoonotic disease from becoming another area that disproportionately impacts these groups. In the era of Black Lives Matter and Stop AAPI Hate, it is imperative that historically underserved groups are adequately protected from the threats of zoonotic disease spread.

The intricate connection between climate change and land use creates a conundrum – do we "fix" the issue now to prevent future harms, or do we focus on the present harms and "fix" it later? Fixing now overlooks the plight of those affected today and fixing tomorrow overlooks the plight of those coming after us.

Before delving into the complexity of zoonotic disease, it is important to note that reducing zoonotic disease transmission is a double-edged sword. While human interaction with wildlife is the

---

[39] Helen Adams & Karen E. McNamara, *Climate change mitigation and adaptation of the poor*, UNEVEN EARTH (Mar. 17, 2018), http://unevenearth.org/2018/03/climate-change-mitigation-and-adaptation-of-the-poor/.

[40] Naomi Priest & David R. Williams, *Structural Racism: A Call to Action for Health and Health Disparities Research*, 31 ETHNICITY & DISEASE 285, 286 (May 2021).

[41] Associated Press, *EPA tackles environmental threats in minority communities*, GRIO (Jan. 28, 2022), https://thegrio.com/2022/01/28/epa-environmental-threats-minority-communities/.

primary mechanism through which zoonotic disease spillover can occur, and separation of humans from nature is the main method of prevention, this separation also leads to creation of parks and other public spaces through which humans may *still* interact with nature.[42] By initial separation between human and wildlife living spaces, disease prevention can be achieved, but humans will still be interacting with wildlife as they enter these green spaces.[43]

This method of disease transmission is secondary to the habitat fragmentation caused by development, though, and reduction in habitat fragmentation poses the single greatest solution to preventing spillover.[44] It also cannot go without mentioning that the threat of disease goes both ways. While animals have infected humans with countless diseases, so too have humans infected animals.[45] To name a few, mountain gorillas in Rwanda have been infected with scabies and measles, baboons in Tanzania were infected with yaws and intestinal parasites, and chimpanzees in Congo and Tanzania were found to have polio.[46] While land use solutions should be implemented as an effort to protect humans from zoonotic diseases, so too must this effort include the reverse.

Therefore, while the solutions in this article represent but one side of the story, they also act towards resolving the greatest threat to disease prevention – habitat fragmentation leading to increased human interaction with wildlife. Human-wildlife interaction can occur at the park and public spaces level, but it is not nearly as severe as that caused by habitat fragmentation.[47] The stresses of disease on the human-wildlife scale threaten the face of modern-day medicine and demonstrate the immense need for mechanisms by which to fight back.

---

[42] Spickler, *supra* note 23; Katherine Gallagher, *Human-Wildlife Conflict: Implications and Solutions*, TREEHUGGER (Mar. 11, 2021), https://www.treehugger.com/human-wildlife-conflict-5114590.

[43] Gallagher, *supra* note 42.

[44] *See* Loh et al., *supra* note 3, at 436.

[45] UNEP, *Zoonoses: Blurred Lines of Emergent Disease and Ecosystem Health*, Frontiers 2016 Report: Emerging Issues of Environmental Concern 18, 23 (2016) [hereinafter *Zoonoses*], https://wedocs.unep.org/bitstream/handle/20.500.11822/32060/zoonoses.pdf?sequence=1&isAllowed=y.

[46] *Id.*

[47] *See generally* Gallagher, *supra* note 42 (discussing common causes of human-wildlife conflict and manners to mitigate their impacts).

Unfortunately, climate change is expected to exacerbate these stresses.[48] Climate influences the environment and everything within, including species and habitats, and therefore plays a role in disease transmission.[49] The effects of climate change on the vectors, hosts, prevalence, virulence, and means of transmission for zoonotic diseases are expected to increase as the earth warms, carbon dioxide concentrations increase, and natural disasters become more commonplace.[50] This growing threat poses a significant challenge for the means of land use control that authorities may implement.[51] It also provides an opportunity to change the current system of land governance and undergo a process of growth for the sake of humanity's health and, ultimately, survival.[52]

With the burgeoning climate crisis, the earth will only experience an increase in the prevalence of zoonotic disease.[53] For example, in 2016 a child died in Russia from anthrax, a greatly infectious bacterial illness that has largely been removed from the wild.[54] The anthrax is believed to have originated in a 75 year-old reindeer carcass that was unearthed as a result of melting permafrost in the Russian tundra.[55] Presumably, multiple reindeer fed off of the carcass, eventually leading to a mass die-off of over 2,300 reindeer, infection of 70 people, and the death of the child.[56] The outbreak occurred on the Yamal Peninsula, located within the

---

48 *Vector-borne Diseases*, NAT'L INST. ENV'T HEALTH SCIS. (June 6, 2022) [hereinafter NIEHS, *Vector-borne Diseases*], https://www.niehs.nih.gov/research/programs/climatechange/health_impacts/vectorborne/index.cfm.

49 *Id.*

50 *See generally id.* (discussing how seasonal changes in temperature affect the life stages of vectors and pathogen replication within hosts).

51 Diarmid Campbell-Lendrum et al., *Climate change and vector-borne diseases: what are the implications for public health research and policy?*, 370 PHIL. TRANS. R. SOC. B. 1, 2 (2015), https://pubmed.ncbi.nlm.nih.gov/25688013/.

52 *See, e.g.*, *id.* (discussing how improvements to surveillance and warning systems can reduce exposure and susceptibility of vector-borne diseases in exposed populations).

53 *Id.*

54 Jonathan Lovvorn, *Climate Change Beyond Environmentalism Part I: Intersectional Threats and the Case for Collective Action*, 29 GEO. ENV'T L. REV. 1, 1-2 (2016).

55 *Id.*

56 *Id.*

Arctic Circle and home to permafrost over 1,000 feet thick in certain places.[57] With the last seven years being the hottest years on record, these soils thawed for the first time in years, exposing this anthrax-infected carcass to thousands of people and animals.[58]

The Bubonic Plague, spread largely by fleas on the backs of black rats, will also increase in prevalence with increasing temperature.[59] The rats tend to move indoors when outside temperatures become too hot for comfort; with a 1ºC rise in temperature, prevalence of Plague in hosts is expected to increase by 50%.[60] Because the Intergovernmental Panel on Climate Change predicts a 1.5ºC global temperature increase at the minimum, this would drastically alter the trajectory of current infectious disease transmission.[61]

Incidents such as this are expected to continue as the planet's temperature increases, which, following current trends, will continue for decades.[62] With the positive feedback loop associated with permafrost melt – increased temperatures lead to melting permafrost, which leads to the release of high quantities of carbon dioxide, which leads to increased temperatures, and so on – this problem will only persist.[63] This indicates that the diseases of the past thought to have largely been eradicated – the Black Death, the Plague, anthrax, and more – have the potential to reemerge into the twenty-first century.[64] Compounded with climate change, the land

---

[57] Michaeleen Doucleff, *Anthrax Outbreak In Russia Thought To Be Result Of Thawing Permafrost*, NPR (Aug. 3, 2016, 8:32 PM), https://www.npr.org/sections/goatsandsoda/2016/08/03/488400947/anthrax-outbreak-in-russia-thought-to-be-result-of-thawing-permafrost.

[58] *Id.*; *2021 joins the top 7 warmest years on record: WMO*, U.N. NEWS (Jan. 19, 2022), https://news.un.org/en/story/2022/01/1110022.

[59] WARREN A. ANDIMAN, ANIMAL VIRUSES AND HUMANS 139 (Paul Dry Books 2018).

[60] *See id.* at 139 (explaining that black rats move indoors when it gets too hot outside, increasing their proximity to humans).

[61] IPCC, *Special Report, Global Warming of 1.5ºC* (2018), https://www.ipcc.ch/sr15/.

[62] Lovvorn, *supra* note 54, at 9.

[63] Erin Flanagan, *The Global Carbon Budget and Permafrost Feedback Loops in the Arctic*, ARCTIC INST. (Feb. 25, 2021), https://www.thearcticinstitute.org/global-carbon-budget-permafrost-feedback-loops-arctic/.

[64] *See, e.g.*, Jocelyne Piret & Guy Boivin, *Pandemics Throughout History*, 11 FRONTIERS MICROBIOLOGY 1, 3 (2021),

use changes driving disease emergence pose some of the most pressing public health threats mankind has ever faced.[65] Increases in the human-animal interface will only exacerbate this threat.[66]

Zoonotic diseases have appeared throughout recorded history and likely existed long before.[67] Conservative estimates attribute zoonotic diseases as the cause of 377,012,920 deaths throughout history, not including COVID-19.[68] The Bubonic Plague is the largest of these with 200 million estimated deaths.[69] Other diseases like smallpox, the Plague of Justinian, and the Flu of 1918 each caused roughly 50 million deaths.[70] Historically, significant factors in zoonotic disease spread included globalization, overcrowding, and lack of sanitation.[71] This allowed diseases to spread rapidly through urban areas, contributing to high death rates, such as the Bubonic Plague's killing of two-thirds of Europe's fourteenth-century population.[72] The vectors, fleas, would bite humans and rats, introducing the disease into urban areas and rapidly spreading through the overcrowded slums that were characteristic of the time.[73]

The expansion of global trade along the Silk Road facilitated this spread by bringing these vectors throughout Eurasia and ultimately leading to the death of over 200 million people.[74] While demonstrating the potentially devastating effects a pandemic could have on the global population, this Plague also represented the first

---

https://www.readcube.com/articles/10.3389/fmicb.2020.631736 (explaining how "plague" is classified as a re-emerging infectious disease by the WHO).

65 *Id.* at 11.

66 *See, e.g.*, NIEHS, *Vector-borne Diseases*, *supra* note 48 (explaining vector-borne diseases and transmissions are influenced with human exposure).

67 LePan, *supra* note 9.

68 *See id.* (displaying historical zoonotic diseases and providing infection rate estimates).

69 *Id.*

70 *Id.*

71 *See Bubonic Plague: The First Pandemic*, SCI. MUSEUM (Apr. 25, 2019), https://www.sciencemuseum.org.uk/objects-and-stories/medicine/bubonic-plague-first-pandemic/ (discussing early colonization and trade as drivers in disease spread).

72 *Id.*

73 *Id.*

74 *The Spread of Disease along the Silk Roads*, UNESCO, https://en.unesco.org/silkroad/content/spread-disease-along-silk-roads (last visited Oct. 3, 2022).

time on record where substantial public health measures were implemented to minimize the spread of disease.[75] Doctors isolated Plague patients and enacted quarantine periods for ships entering local ports, a sophisticated disease prevention method still used today.[76] Lessons from the effects of past pandemics demonstrate the increased rates of infection as people move around the globe, a significant factor in the progression of zoonotic disease.[77] This remains a substantial driver in disease spread today.[78]

Transmission between organisms and humans varies in complexity.[79] Some diseases, such as the Nipah virus, have clear and direct transmission routes from animals while others seem to travel between a variety of species before settling in humans.[80] In one Nipah outbreak, over 80% of patients had handled or interacted with pigs in the time leading up to the illness onset.[81] Rabies too is spread entirely by direct animal contact, a pathway that is exacerbated by today's globalization – illegal wildlife trade being one of the greatest factors.[82] Other diseases, like the Ebola and Marburg viruses, have a more complicated method of transmission, with humans becoming infected through interaction with infected habitats or hosts, which first became infected through some sort of interaction with a host or vector.[83] The Ebola virus likely originated in African primates and quickly spread throughout the globe.[84] The Marburg virus has also been linked to Kitum Cave in Kenya, a remote natural attraction for tourists and hikers that houses

---

75 *Id.*

76 *Id.*

77 *See generally, Bubonic Plague: The First Pandemic*, *supra* note 71 (showing how the transmission of diseases via fleas transferred bacteria through their bites).

78 *Id.*

79 B.B. Chomel, *Zoonoses*, ENCYCLOPEDIA MICROBIOLOGY 820, 821 (Feb. 17, 2009), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7149995/.

80 *See* ANDIMAN, *supra* note 59, at 100 (demonstrating that the Nipah virus originates in fruit bats and is transmitted to pigs, who then spread the disease to humans).

81 *Id.* at 196.

82 *See id.* at 144–45 (explaining how exploratory human activities aggravate the spread of rabies).

83 PRESTON, *supra* note 11, at 38–39, 47, 66.

84 *History of Ebola Virus Disease*, CDC [hereinafter *History of Ebola*], https://www.cdc.gov/vhf/ebola/history/summaries.html (May 27, 2021).

thousands of bats.[85] There have been fifteen different outbreaks and 471 cases of Marburg, with at least two outbreaks linked to the cave.[86] One man visited Kitum Cave and returned home with his traveling companion, who was also infected, and spread the virus to a doctor upon seeking treatment at home.[87] Another man visited the cave and went to a hospital upon returning home, where he later died.[88] The nurse that attempted resuscitation on the man later fell ill with the virus.[89] The spread of these viruses was complicated and proved that zoonotic disease transmission is not as straightforward as it may seem; the increased ease of global travel enables diseases like Marburg to easily spread between towns, cities, countries, and continents - infecting household members, friends, medical professionals, and more.[90] Whether an illegally traded animal or recently traveled human is the vector responsible for disease transmission, global movement is a significant driver in zoonotic disease transmission.[91]

One Ebola virus-infected individual on a plane may infect every other passenger through the aerosolization of fluids from coughing, vomiting, and bleeding.[92] The recent 2014–2015 outbreak in Guinea, Liberia, and Sierra Leone had 28,616 cases, resulting in 11,310 deaths.[93] Easy worldwide travel facilitated this rapid transmission, but "[the e]bola outbreak in West Africa…was the

---

85 *History of Marburg Virus Disease (MVD) Outbreaks*, CDC [hereinafter *History of Marburg*], https://www.cdc.gov/vhf/marburg/outbreaks/chronology.html (Aug. 5, 2022); PRESTON, *supra* note 11, at 305.

86 *History of Marburg*, *supra* note 85.

87 *Id.*

88 *Id.*

89 *Id.*

90 *See id.* (showing how many factors contribute to the global spread of infectious disease).

91 SUSTAINING GLOBAL SURVEILLANCE AND RESPONDING TO EMERGING ZOONOTIC DISEASES 3 (Gerald T. Keusch et al. eds., National Academies Press 2009).

92 *See, e.g.*, *History of Ebola*, *supra* note 84 (explaining instances where the Ebola virus spread through aerosolization via aircraft travel).

93 *2014-2016 Ebola Outbreak in West Africa*, CDC, https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/index.html#:~:text=The%20impact%20this%20epidemic%20had,outside%20of%20these%20three%20countries (Mar. 8, 2019).

result of forest losses leading to closer contacts between wildlife and humans…."[94]

Globalization may be a significant driver of zoonotic disease *spread*, but habitat fragmentation is the main cause of a disease jumping from an *animal* to *human* host.[95] Lyme disease, for example, is rapidly increasing in prevalence throughout North America.[96] Reduction in forest lands is limiting the amount of vertebrate species to prey on the white-footed mouse, a common reservoir for the *Borrelia burgdorferi* bacterium, which causes Lyme disease.[97] Blacklegged ticks, therefore, increasingly feed on this organism, which leads to greater transmission of Lyme to humans as humans interact with the tick's natural habitats and hosts.[98] As humans continue to encroach on natural forests, the rate of Lyme disease infection will increase.[99] Habitat fragmentation will only exacerbate this.[100]

An inequitable distribution of global wealth further worsens these disease trends.[101] The Global South, historically lagging behind the North in economic, social, public health, and other advancements, faces a significant disadvantage when combating these diseases.[102] Many of the zoonotic diseases listed here disproportionately impact the impoverished populations of the world.[103] Ultimately, zoonotic disease transmission finds success in

---

94 *See* Janine Natalya Clark, *The COVID-19 Pandemic and Ecological Connectivity: Implications for International Criminal Law and Transitional Justice*, 18 J. INT'L CRIM. JUST. 1046, 1050 (Dec. 21, 2020) (discussing the significance of the pandemic from an ecological perspective).

95 *See e.g.*, Barbara A. Han et. al., *Global Patterns of Zoonotic Disease in Mammals*, 32 TRENDS PARASITOLOGY 565, 568, 572 (July 2016) (discussing how human travel is a factor in the spread of infectious diseases and how zoonotic infection is facilitated through parasite shedding in encroaching habitats).

96 *Zoonoses*, *supra* note 45, at 23.

97 Farnese, *supra* note 5, at 477.

98 *Id.*

99 *See id.* at 478 (drawing the connection between deforestation, mining, excavating, and irrigation to the increased risk of disease).

100 *Id.* at 477.

101 *See, e.g.*, Priest & Williams, *supra* note 40, at 286 (demonstrating how the COVID-19 pandemic has highlighted global disparities in race).

102 *See id.* at 285 (explaining the ways in which racism continues to impact and structure society to produce health disparities such as higher rates of preterm birth primarily in the Southeast).

103 *Id.*

globalized societies with economic inequalities, environmental degradation, and common incidences of human-wildlife interaction.[104]

The COVID-19 pandemic is the most significant public health threat of the last century and acts as a case study to describe the manner in which land use impacts disease spread.[105] Beginning in the end of 2019, the COVID-19 pandemic has rapidly spread around the world and impacted the lives of billions.[106] The outbreak is largely believed to have begun in the Hunan Food Market in Wuhan, China, which frequently sells bats, frogs, snakes, birds, marmots, and rabbits for human consumption.[107] In the classic form of spillover, a seller at the market is presumed to have sold an infected animal to a consumer, who ate the animal and became infected with the virus, eventually infecting others and leading to its spread.[108]

As of January 5, 2023, there have been 657,430,133 confirmed cases and 6,676,645 deaths globally from COVID-19.[109] The pandemic has also brought to light many humanitarian problems, including a disproportionate effect on communities of color due to long-term racial inequity.[110] In the United States, historically redlined communities are at higher risk of pulmonary and coronary problems, a risk factor that greatly increases susceptibility to severe COVID-19 infection.[111] Overcrowding in impoverished

---

104 Ioannis Magouras et al., Opinion, *Emerging Zoonotic Diseases: Should We Rethink the Animal–Human Interface?*, 7 FRONTIERS VETERINARY SCI. 1, 1 (Oct. 22, 2020), https://www.frontiersin.org/articles/10.3389/fvets.2020.582743/full.

105 *Global Health Security*, USAID, https://www.usaid.gov/global-health/health-areas/global-health-security (last visited Oct. 3, 2022).

106 Muhammad Adnan Shereen et al., *COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses*, 24 J. ADV. RES. 91, 92 (Mar. 16, 2020).

107 *Id.*; Dina Fine Maron, *'Wet Markets' likely launched the coronavirus. Here's what you need to know*, NAT'L GEOGRAPHIC (Apr. 16, 2020, 10:14), https://www.nationalgeographic.co.uk/science-and-technology/2020/04/wet-markets-likely-launched-coronavirus-heres-what-you-need-know.

108 Maron, *supra* note 107.

109 *WHO Coronavirus (COVID-19) Dashboard*, *supra* note 2.

110 Min Li & Faxi Yuan, *Historical Redlining and Resident Exposure to COVID-19: A Study of New York City*, 14 RACE & SOC. PROBS. 85, 98 (June 18, 2021).

111 *Id.* at 86; *Neighborhood 'Redlining' Associated With Increased CVD Risk*, AM. COLL. CARDIOLOGY (July 7, 2022), https://www.acc.org/latest-in-

communities facilitates the rapid spread of the virus.[112] Similarly, overcrowded prisons have infection rates four times higher and death rates double that of the general public.[113] Issues like this will only expand as the pandemic progresses, and in the long term, more zoonotic diseases will be spread to humans.[114]

The gravity of the COVID-19 pandemic emphasizes the significant need for action to combat disease transmission. If no changes are made, the world will continue to be at risk for similar threats in the future.[115] It is imperative that action is taken now while the public has a vested interest in counteracting infectious disease transmission.

III. LAND USE AND ZOONOTIC DISEASE

The consequences of habitat fragmentation extend far beyond the anthropocentric values associated with preventing zoonotic disease spread: it threatens wildlife well-being, diminishes genetic variability, and altogether reduces the likelihood that an organism will reach a mature age and reproduce.[116] Land use plays a significant role in the interaction between man and nature and can be a tool to challenge the status quo in which global development is entrenched. Local governments can enact zoning regulations to separate certain uses from others, protect natural spaces, restrict development, create parks, and provide for more or less dense

---

cardiology/articles/2022/07/07/13/42/neighborhood-redlining-associated-with-increased-cvd-risk.

112 Khansa Ahmad et al., *Association of poor housing conditions with COVID-19 incidence and mortality across US counties*, 15 PLOS ONE 1, 7 (Nov. 2, 2020), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7605696/pdf/pone.0241327.pdf.

113 Emily Widra, *Since you asked: Just how overcrowded were prisons before the pandemic, and at this time of social distancing, how overcrowded are they now?*, PRISON POL'Y INITIATIVE (Dec. 21, 2020), https://www.prisonpolicy.org/blog/2020/12/21/overcrowding/.

114 Gregory Hooks & Wendy Sawyer, *Mass Incarceration, COVID-19, and Community Spread*, PRISON POL'Y INITIATIVE (Dec. 2020), https://www.prisonpolicy.org/reports/covidspread.html.

115 Edward C. Holmes, *COVID-19—lessons for zoonotic disease*, 375 SCI. 1114 (Mar. 10, 2022), https://www.science.org/doi/10.1126/science.abn2222.

116 Matthew Allcock & Luke Hecht, *Potential effects of habitat fragmentation on wild animal welfare*, ECOEVORXIV PREPRINTS 1, 7 (Aug. 10, 2020), https://ecoevorxiv.org/hb7nm/.

development.[117] They shape the modern landscape through these powers and dictate the opportunities through which humans may interact with nature.

Land uses are largely established at the local level as States delegate the authority to regulate development to the local government.[118] In the United States, for example, the Standard State Zoning Enabling and Standard City Planning Enabling Acts delegate zoning authority to states, who can thereafter delegate the authority to local governments as they see fit.[119] Local authority manifests through a number of different land use powers, and can create or prevent the manner through which people are interacting with the natural world.

Spillover is more likely to occur as these interactions grow with increased infringement on natural habitats; among the highest risk factors for zoonotic disease transmission are frequency of interaction between wild animals and humans, often caused by urbanization, deforestation, land use, and agricultural change.[120] Human encroachment on natural spaces brings people and wildlife into close contact, providing a mechanism through which zoonotic disease may spread from animal to human host.[121]

Success of a zoonotic disease is often determined by the habitat from which it emerges.[122] As aforementioned, habitat fragmentation is one of the leading causes of zoonosis, with land use change as the cause of 42% of disease emergence.[123] As more habitats are reduced to make way for human settlements, more

---

117 *See generally* Vill. of Euclid, Ohio, v. Ambler Realty Co. 272 U.S. 365 (1926) (permitting separation of uses through zoning by local governments and providing grounds for all zoning practices in the United States).

118 *Standard State Zoning Enabling Act and Standard City Planning Enabling Act*, AM. PLAN. ASS'N, https://www.planning.org/growingsmart/enablingacts/ (last visited Dec. 4, 2021).

119 *Id.*

120 Zöe L. Grange et al., *Ranking the risk of animal-to-human spillover for newly discovered viruses*, 118 PNAS 1, 4 (Apr. 13, 2021), https://doi.org/10.1073/pnas.2002324118.

121 Clark, *supra* note 94.

122 *Id.*

123 *See Zoonoses*, *supra* note 45, at 18 (drawing the connection between the reduction in natural ecosystems and ecological change typically associated with habitat fragmentation and zoonosis); Loh et al., *supra* note 3, at 434.

"edge" habitats come into being, leading to increased human-wildlife interaction.[124]

The anthropocentric practices of resource consumption tie the natural world with the man-made, allowing human exploitation of the natural environment to create unnatural pathways through which disease may travel.[125] Where Indigenous peoples thousands of years ago protected and acted as stewards of the natural world, mankind today has taken the approach of domination.[126] This forceful method of resource consumption opens the door to the many problems associated with habitat reduction and encroachment, including zoonotic disease spread.

Additionally, habitat fragmentation reduces the genetic variability in a population.[127] The problems associated with habitat fragmentation and zoonotic disease extend to both sides of the treeline – animals may be harming humans, but so too are humans harming animals.[128] Due to the reduction in habitat size and increase in edge habitats, different species may thrive while others fail.[129] Edge habitats are typically inhabited by species that can adapt to both human and natural environments.[130] These species in edge habitats are denoted as *generalists*.[131] The species further into the natural space are *specialists*, with their food sources and habitat

---

124 *See* Farnese, *supra* note 5, at 477 (explaining "edge" effects and linking them to habitat reduction).

125 *See id.* (demonstrating how these practices create unnatural pathways).

126 *Recognizing and Honoring the Original Stewards of the Land*, HUDSON HIGHLANDS LAND TR., https://www.hhlt.org/indigenous-land-acknowledgements/ (last visited Oct. 4, 2022).

127 *Zoonoses*, *supra* note 45, at 23.

128 *See generally* Simon Deakin & Gaofeng Meng, *The Governance of Covid-19: Anthropogenic Risk, Evolutionary Learning, and the Future of the Social State*, 49 INDUS. L.J. 539 (Dec. 2020) (explaining how organized human activity toward the natural environment triggers feedback).

129 David Vallejo, *Edge effects and habitat fragmentation: the main causes of species extinction*, ZOO PORTRAITS (Aug. 7, 2018), https://www.zooportraits.com/edge-effects-habitat-fragmentation-extinction/ (explaining how opportunistic, often invasive, species may benefit from the fragmentation that weakens endemic populations).

130 *Id.*

131 *Generalist and Specialist Species*, NAT'L GEOGRAPHIC, https://education.nationalgeographic.org/resource/generalist-and-specialist-species (last visited Oct. 4, 2022).

often restricted to specific interior areas of the habitat.[132] These are called *interior species*.[133]

By reducing natural space, the habitat for interior species decreases, reducing species richness and diversity.[134] Reduction in habitat can be so severe as to completely push out the interior species, leaving only the more resilient generalist species to remain.[135] Because of the nature of generalist species, they can more frequently venture into the built environment away from their natural habitat, subsequently infecting humans with disease.[136] As a common example, deer are often seen on the edges of forests, venturing into backyards and roads to eat.[137] Increased development on the edge of forests and other natural spaces provides more opportunities for deer to venture, exposing them to human threats beyond the scope of their natural habitat while also contributing to the reduction in interior species diversity.[138] Continuing habitat fragmentation patterns will only exacerbate and further the trend of interior species loss.[139]

There is also a positive correlation between habitat heterogeneity and species diversity.[140] In other words, a habitat remaining wholly unchanged will provide for a wider variety of

---

132 *Id.*

133 Louis Imbeau et al., *Are Forest Birds Categorised as "Edge Species" Strictly Associated with Edges?*, 26 ECOGRAPHY 514, 515 (Aug. 2003).

134 Vallejo, *supra* note 129.

135 *See id.* (explaining that certain species cannot live in small habitats and require larger areas, and are often affected by edge effects).

136 *Generalist and Specialist Species*, *supra* note 131.

137 *See* Miranda Reinson et al., *Impacts of Habitat Fragmentation on White-tailed Deer (Odocoileus virginianus) in South Central Nebraska*, INT'L. DEER BIOLOGY CONG. (Aug. 2018), https://www.researchgate.net/publication/327041445_Impacts_of_Habitat_Fragmentation_on_White-tailed_Deer_Odocoileus_virginianus_in_South_Central_Nebraska (explaining that fragmentation could be impacting their use of the landscape but deer, as generalists, have adapted to intensively cultivated areas).

138 *See id.* (explaining that land use changes severely impact deer in several ways, such as higher mortalities, disease risk, resource availability shortage, and more).

139 *Id.*

140 Annie Frey-Ehrenbold et al., *Landscape connectivity, habitat structure and activity of bat guilds in farmland-dominated matrices*, 50 J. APPLIED ECOLOGY 252, 253 (2013).

species compared to a habitat that is fragmented or reduced.[141] This, while important with regard to human disease transmission, is of particular concern in animal populations. It is imperative to acknowledge the damage that habitat fragmentation causes for both humans and wildlife, rather than viewing the problem from a human lens only.

To mitigate the effects of zoonotic disease emergence, governments must take into account the impacts of the human environment on natural systems. This is where land use law comes into play. The variety of powers granted to local governments both domestically and abroad can act as the means by which humans may reduce their impact on the natural world, thus halting the effects of zoonotic disease transmission before the disease ever leaves the green environment.

A. Common Land Use Controls for Habitat Preservation

The individualized concerns associated with an area's habitat must be addressed at the local level. While States can incentivize and even require certain mechanisms to combat zoonotic disease transmission, local control is the most effective means of doing so. According to Edward B. Barbier, "[a]ny policy to control habitat loss, such as a tax imposed on the rents from converted land, should also vary with habitat area."[142] Before evaluating the international treaty regime, it is important to have a basic understanding of commonly employed land use techniques that may be used to encourage habitat preservation.

i. Conservation Laws

Many States grant local governments the authority to enact laws that are specific to the locale.[143] This is a simple method of

---

[141] *See id.* (showing how undisturbed habitats influence bird species richness).

[142] Edward B. Barbier, *Habitat loss and the risk of disease outbreak*, 108 J. ENV'T ECONS. & MGMT. 1, 2 (2021).

[143] *See, e.g.*, Permitted action by board of appeals § 267(1)(b) N.Y. TOWN LAW (2014) (providing examples of State delegation of land use powers to local authorities); Paris Agreement to the United Nations Framework Convention on

establishing practices for habitat preservation – among the many mechanisms of local control, conservation and preservation laws are an overarching means to encourage habitat stability.[144] These can include any of the following land use mechanisms, development moratoria, planning requirements, incorporation of disease considerations in decision-making, and more. Additionally, these laws provide an opportunity for creating specific habitat types, such as Ghana's local power to create Forest Reserve designations, establishing a protective mechanism for habitat.[145] The Ghanan Forests Ordinance allows the Governor to appoint a Reserve Settlement Commissioner, who then executes forest management techniques for protected reserves.[146] Conservation laws have the potential to affect entire regions or States and provide a simple and effective method for habitat preservation.

ii. Setback and Buffer Requirements

Setback requirements are generally implemented to prevent buildings from being too close together, but they can also be used to provide buffers between human development and natural space.[147] India requires buffers between waste management facilities and their surrounding environments to promote environmental protection.[148] Entitling these buffers "green belts,"

Climate Change, pmbl., Dec. 12, 2015, T.I.A.S. No. 16-1104 [hereinafter Paris Agreement] (explaining that local knowledge systems are best equipped to respond to local challenges).

144 *Conservation*, NAT'L GEOGRAPHIC, https://www.nationalgeographic.org/encyclopedia/conservation/ (explaining the difference between conservation and preservation) (May 20, 2022).

145 IUCN, COMPENDIUM OF LAND USE LAWS FOR SUSTAINABLE DEVELOPMENT, 62 (John R. Nolon ed., 2006) (citing Forests Ordinance ch. 157 §§ 3, 4 (Ghana)) [hereinafter COMPENDIUM]

146 *Id.* at 62, 63.

147 *What Is a Setback Rule for Property?*, SF GATE, https://homeguides.sfgate.com/setback-rule-property-100819.html (Mar. 10, 2021).

148 *Guidelines on the Provision of Buffer Zone Around Waste Processing and Disposal Facilities*, CENT. POLLUTION CONTROL BD. (Apr. 2017), https://smartnet.niua.org/sites/default/files/resources/final_guidelines_on_buffer_zone_29052017.pdf.

they allow surrounding natural resources to remain protected even with polluting practices occurring nearby.[149] As the second most populated country in the world, it is in India's best interest to provide buffers like these in urban areas to protect citizens from the harms which infringing upon wildlife may cause.[150] Buffer zones can also be used to protect natural resources from the general public.

In the state of Georgia in the United States, the Erosion and Sedimentation Control Act requires setbacks from water bodies.[151] The setbacks become more stringent if the water body is a trout fishery, heavily impaired, and more.[152] By enacting setback and buffer requirements, natural resources like forests and water bodies can be protected against human infringement, which suggests that this technique can also be used to encourage separation between humans and wildlife. If an area is known to house specific zoonotic threats, like Kitum Cave in Kenya, government officials can establish setback and buffer zones to protect those in the surrounding areas.[153] By creating more stringent setback requirements in areas near natural spaces, governments can encourage zoonotic disease prevention.

iii. Increased Density

There are a variety of mechanisms to encourage density in urban development, a practice which has many benefits. In Singapore, one of the densest countries in the world, the average per capita carbon dioxide emissions is 7.71 tons, whereas the

---

149 *Id.*

150 *The Ten Most Populated Countries in the World*, WORLD ATLAS, https://www.worldatlas.com/articles/most-populated-countries-in-the-world.html (last visited Sep. 26, 2022).

151 GA. CODE ANN. § 391-3-7 Erosion and Sediment Control (2022).

152 *See id.* § 391-3-7-05(1)(b) (explaining how trout streams require a fifty foot buffer to preserve habitat quality, while other bodies of water typically require a twenty five foot buffer).

153 *See* PRESTON, *supra* note 11, at 47 (discussing how numerous occurrences of the Marburg virus have been traced to Kitum Cave in Mount Elgon National Park in Kenya. Marburg virus is closely related to the Ebola virus and produces violent hemorrhagic symptoms that kill its victims more often than not. The Cave was closed to the public after these breakout cases and similar techniques can be employed in the form of development setbacks).

average person in the United States emits 14.24 tons.[154] Mongolia, one of the least dense countries in the world, faces significantly higher per capita emissions at 26.98 tons.[155] Density-focused development allows a community to be less car- and more pedestrian-oriented, encouraging people to fulfill their basic needs by placing necessary resources within walking distance.[156] There are many mechanisms of increasing density, such as multi-family zoning, smart growth, transit-oriented development, planned unit development, and more. By densifying development, fewer incidences of habitat fragmentation will occur, thus reducing the threat of zoonotic disease transmission.

a. Multi-family Zoning

Encouraging multi-family development is a simple yet effective method of encouraging density. In the global North, the predominant development style is single-family.[157] Largely originating in industrial-era wealth, the single-family style has historically denoted wealthy households, a belief so entrenched that some towns in the United States have outright banned multi-family and affordable accessory dwelling units in single-family

---

[154] *See* Hannah Ritchie & Max Roser, *Singapore: CO_2 Country Profile*, OUR WORLD DATA, https://ourworldindata.org/co2/country/singapore?country=USA~SGP (pointing to the graph indicating per capita CO_2 emissions) (last visited Oct. 5, 2022).

[155] *The Least Densely Populated Countries*, WORLD ATLAS, https://www.worldatlas.com/articles/the-least-densely-populated-countries.html (last visited Oct. 5, 2022); Hannah Ritchie & Max Roser, *Mongolia: CO_2 Country Profile*, OUR WORLD DATA, https://ourworldindata.org/co2/country/mongolia (pointing to the graph indicating per capita CO_2 emissions) (last visited Oct. 5, 2022).

[156] Joe Cortright, *Understanding Walkable Density*, CITY COMMENTARY (Feb. 19, 2020), https://cityobservatory.org/understanding-walkable-density/ (explaining that people are more inclined to walk to and from places in cities where their basic needs may be met within a half mile).

[157] *See, e.g.*, Stephanie Kramer, *U.S. has world's highest rate of children living in single-parent households*, PEW RSCH. CTR. (Dec. 12, 2019), https://www.pewresearch.org/fact-tank/2019/12/12/u-s-children-more-likely-than-children-in-other-countries-to-live-with-just-one-parent/ (discussing the United States' high prevalence of single-family housing).

zones.[158] By allowing multi-family development, States can reduce sprawl and move away from the traditional single-family model.

One scholar argues that, in order for densification to be successful, there must be intersectional analysis and cooperation.[159] They cite the need to analyze the historic fabric of zoning practices, using Bogotá, Colombia as an example.[160] The city's long and rich history plays an important role in the future of its development, according to the author.[161] The political, equitable, financial, and public health concerns at play must all be considered when zoning for multi-family development or implementing any other strategies outlined here.[162] By ignoring these intersectional considerations and focusing only on the primary goal, planners do a disservice to those that may be impacted in other areas; combating habitat fragmentation cannot be solved through the lens of *only* combating habitat fragmentation.

b. Smart Growth and Planned Unit Development

The principle that land use should be planned in a meaningful manner is best demonstrated through the concept of smart growth, which incorporates a variety of land use techniques to push development towards a more sustainable, resilient, equitable, and accessible future.[163] Any State that provides its states, cities, or

---

158 Erin Baldassari & Molly Solomon, *The Racist History of Single-Family Home Zoning*, KQED (Oct. 5, 2020), https://www.kqed.org/news/11840548/the-racist-history-of-single-family-home-zoning; Colt Watkiss, *ADU Introduction*, GREENLAW (Aug. 12, 2021), https://greenlaw.blogs.pace.edu/2021/08/12/2609/.

159 *See* Juan G. Yunda & Bjørn Sletto, *Densification, private sector-led development, and social polarization in the global south: Lessons from a century of zoning in Bogotá*, 97 CITIES 1, 1–2 (Feb. 2020), https://www.sciencedirect.com/science/article/abs/pii/S0264275118318985 (advocating for studies that highlight the impact between public zoning practices and private sector interests).

160 *Id*. at 1.

161 *See id*. at 2 (outlining the author's contention that past policies and social factors contribute to present and future zoning developments).

162 *Id*. at 1.

163 *See What is smart growth?*, SMART GROWTH AM., https://smartgrowthamerica.org/what-is-smart-growth/ (last visited Oct. 5, 2022).

municipalities the power to conduct planning processes can also enable them to plan in a manner compatible with these goals.[164]

Planned unit development, or PUD, is a flexible zoning technique that fits into smart growth by allowing compact mixed use development.[165] Compact mixed uses includes streets with stores and apartments above them, pocket parks, walkability, and more.[166] Because preservation of natural space is a recognized public interest, PUD development is a viable option for international land use control models.[167] By enabling a State's constituent localities to undergo planning activities, the State has the power to vastly improve land use within its borders.

The International Zoning Code ("IZC") provides that PUD *shall* be permitted to establish a "well-balanced" community and achieve a variety of goals, including open space preservation.[168] The IZC is intended to be used as a model for international communities to adopt.[169] States may formulate their own version of these provisions to encourage dense development and limit the impacts of habitat fragmentation and disease transmission.

i. Variances

Land use variances are used to create flexibility in local zoning practices by providing relief for individual parcel owners while also acting for the public good.[170] The IZC defines a variance as "a deviation from the height, bulk, setback, parking or other dimensional requirements established by this code" and permits

---

164 *Id.*

165 Melissa Brock, *PUD (Planned Unit Development): What It Is And How It Differs From Other Types Of Housing*, ROCKET MORTG. (July 13, 2022), https://www.rocketmortgage.com/learn/what-is-a-pud.

166 Meg Byerly Williams, *Low Carbon and Resilient Land Use: Part 2*, GREENLAW (Feb. 8, 2022), https://greenlaw.blogs.pace.edu/2022/02/08/low-carbon-and-resilient-land-use-part-2/.

167 Terry Anderson, *Private Conservation in the Public Interest*, 34 PERC (Dec. 2, 2015), https://www.perc.org/2015/12/02/private-conservation-in-the-public-interest/.

168 INT'L ZONING CODE § 1301.2 (INT'L CODE COUNCIL 2022).

169 *Id.* § 101.3.

170 Jed Burkett, *Land Use Variances*, LEAGUE MINN. CITIES (May 21, 2021), https://www.lmc.org/resources/land-use-variances/.

variances in certain instances.[171] International actors can implement techniques using variances as a base to establish a mechanism of leniency in local land use. For example, the IZC outlines policies that governments can adopt to promote these goals, including conditional use permits and variances.[172]

There are two types of variances employed in the United States which may be used for international promotion of land preservation: use variances and area variances.[173] A use variance permits a use of the land for a purpose which is otherwise not allowed or is prohibited by the applicable zoning regulations.[174] This could be particularly useful in situations where one seeks to establish a land conservation use within an area where it would otherwise be prohibited.

An area variance, in contrast, allows for a "use of land in a manner which is not allowed by the dimensional or physical requirements of the applicable zoning regulations."[175] Less relevant in a land preservation context, this variance could still prove useful in areas where one seeks to build an environmentally conscious structure, education center, research site, or similar structure. Variances can also provide for increased density by being oriented towards multi-family development.

ii. Special Uses

Unlike variances, special use permits govern land uses permissible in an area under applicable zoning code.[176] By allowing special uses, the locality has flexibility in zoning while also

---

171 INT'L ZONING CODE § 1002.1.

172 *See generally id.* § 101.2 (establishing minimal requirements for jurisdictions to adopt through the regulated and orderly development of land use).

173 Jason Somers, *Demystifying the Zoning Variance: Use-variance vs. Area-variance*, CREST REAL EST. (Feb. 21, 2022), https://www.crestrealestate.com/zoning-variance-use-variance-vs-area-variance/.

174 N.Y. TOWN LAW § 267(1)(a) (2014).

175 *Id.* § 267(1)(b).

176 *See The Unique Attributes of a Special Use Permit*, BETENSKY L., https://betenskylaw.com/the-unique-attributes-of-a-special-use-permit/ (last visited Oct. 5, 2022) (explaining the difference between special use permits and variances in zoning regulations); Franklin Square Donut Sys., LLC v. Wright, 881 N.Y.S.2d 163 (N.Y. App. Div. 2009).

ensuring certain characteristics are met or prevented.[177] If employed on the international scale, special use permits can allow governments to plan for conservation techniques by incorporating them as permitted land uses in their planning districts. Additionally, special use permits can be used to allow housing development that meets certain characteristics, such as higher density or affordable units provisions.

iii. Environmental Impact Assessments

Environmental Impact Assessments are common where a developer or government must determine the extent of environmental harms occurring as a result of a planned development.[178] They can be used to ensure that no development will substantially impact natural spaces or bring human development within close proximity of areas with high disease transmission. Chile has a governmental department dedicated to its environmental impact assessments.[179] The Servicio de Evaluación Ambiental, or the Environmental Evaluation Service, is dedicated to conducting Environmental Impact Assessments.[180] By assigning entire departments (the Chilean equivalent of agencies) to environmental impact assessments, Chile can ensure its environment will not be significantly harmed by government action.[181]

Japan has similarly enacted the Environmental Impact Assessment Act and issued an Enforcement Order to ensure the government properly protects the environment when undertaking

---

177 Jose Rivera, *What Is a Special Use Permit?*, LEGALMATCH (July 5, 2018) https://www.legalmatch.com/law-library/article/what-is-a-special-use-permit.html.

178 *See Environmental Impact Assessment*, USAID, https://www.usaid.gov/environmental-policy-roadmap/environmental-impact-assessment (Mar. 31, 2020).

179 *¿Cuál es el Proceso de Evaluación de Impacto Ambiental?* [*What is the Process for Environmental Impact Assessment?*], SERVICIO DE EVALUACIÓN AMBIENTAL, https://www.sea.gob.cl/evaluacion-de-impacto-ambiental/cual-es-el-proceso-de-evaluacion-de-impacto-ambiental (last visited Oct. 5, 2022).

180 *Id.*

181 *Id.*

projects with potentially negative impacts.[182] Greece also has an order dedicated to environmental impact assessments, but bases its law on a United Nations Directive.[183] All of these methods employed internationally – dedicating entire government agencies to environmental impact assessments, establishing a country's own law, or modeling law on United Nations and other laws – should be used to promote environmental preservation for the purposes of zoonotic disease prevention.

iv. Land-Based Financing

Land-based financing tools, such as exactions and impact fees, are commonly used as conditions for plan and permit approval.[184] In order to receive approval, the project must agree to make changes to its proposal based on the public benefit or pay fees to the locality in lieu of doing so.[185] The fees can then be used for local development and, like environmental impact assessments, ensure that development does not infringe upon natural spaces to an extent that would contribute to zoonotic disease transmission.

For example, in 2021 the United Nations Habitat for a Better Future, Global Land Tool Network, and The World Bank offered a Masterclass to the Second Arab Land Conference entitled "Land-Based Financing in the Arab World."[186] The class taught that land development can be incorporated into a larger effort to improve the land, including the use of exactions to invest in infrastructure, land "betterment," dedication or purchase of land for public use, and more.[187] These techniques can be used to encourage sustainability,

---

[182] *環境影響評価法施行令* [*Enforcement Order of the Environmental Impact Assessment Act*] [Act. No. 51] 2014, art. 1 (Japan), https://www.japaneselawtranslation.go.jp/en/laws/view/3376/je.

[183] *Στρατηγική Περιβαλλοντική Εκτίμηση* [*Strategic Environmental Assessment*], Τομέας Περιβάλλοντος [EN MINISTRY ENV'T], https://ypen.gov.gr/perivallon/perivallontiki-adeiodotisi/stratigiki-perivallontiki-ektimisi/ (last visited Oct. 5, 2022) (Greece).

[184] Richard Ducker, *Development Exactions: What are They?*, UNIV. N.C. LRC STUDY COMM. 1 (Mar. 3, 2014).

[185] *Id.*

[186] *Masterclass No (6): Land-Based Financing in the Arab World*, WORLD BANK (Feb. 2021), https://arabstates.gltn.net/wp-content/uploads/2021/03/Masterclass6_LBF_WB-UN-Habitat.pdf.

[187] *Id.*

habitat preservation, green space, and equity considerations while allowing for development. Many critics of environmentally conscious development complain that these concerns can lead to decreased development and thus hinder economic growth of an area; this overlooks the fact that environmentally minded homeowners, renters, and businesspeople are more likely to bring their business to a place that meets higher environmental standards.[188] By implementing exactions or impact fees, the development can still occur while making either necessary changes to the development or providing the funds to make them elsewhere instead.[189]

IV. INTERNATIONAL CONTROLS

A. Introduction to Land Use Solutions at the International Level

Land use law, though practiced differently in each State, is a worldwide system of governance for the way we treat our land.[190] Zoning began two centuries ago and has evolved into an ever-growing process of land use change that appears in a variety of mechanisms globally.[191] The international treaty regime has established many globally-recognized principles, referred to as customary international law, by which all member States are expected to abide.[192] These include:

---

188 *See generally* Federico Demaria, *Why economic growth is not compatible with environmental sustainability*, ECOLOGIST (Feb. 22, 2018), https://theecologist.org/2018/feb/22/why-economic-growth-not-compatible-environmental-sustainability (stating, "economic growth is not compatible with environmental sustainability").

189 Ducker, *supra* note 185, at 3.

190 *The Governance of Land Use*, OECD 8 (2017), https://www.google.com/url?q=https://www.oecd.org/cfe/regionaldevelopment/governance-of-land-use-policy-highlights.pdf&sa=D&source=docs&ust=1665170016959739&usg=AOvVaw0wcyB4UWUiQvrt1uP38yA0.

191 *See, e.g.*, Spencer Gardner, *A History of Zoning in Three Acts – Part I*, STRONG TOWNS (June 28, 2017), https://www.strongtowns.org/journal/2017/6/28/a-history-of-zoning-in-three-acts-part-i (pointing out zoning issues that occurred centuries ago).

192 *Customary International Law*, CORNELL L. SCH. LEGAL INFO. INST. [hereinafter *Customary Int'l Law*],

Human and indigenous rights. The U.N. Universal Declaration on Human Rights and the U.N Declaration on the Rights of Indigenous Peoples largely govern human rights and outlines the fundamental rights that must be protected by all States.[193]

Right to a healthy environment. This was officially declared a human right by the United Nations Human Rights Council in October 2021, providing for the first time that States must protect the environment as a human right.[194] Recent litigation has proven successful in finding that a State government must act to prevent environmental harms due to citizens' right to a healthy environment.[195]

Right to development. The 2015 Paris Climate Agreement emphasized States' right to development, or that States have a right to pursue economic development within their borders.[196] This right was first established in the Declaration on Right to Development.[197]

Common concern of humankind. Less a human right, the common concern of humankind principle is used to highlight areas in which all States have an obligation to, such as climate change or ocean acidification, due to the communal nature of the concern.[198] It encourages states to take action to mitigate these concerns.[199]

Good neighborliness and the duty to cooperate. This duty ties into the duty not to cause transboundary harm, as discussed in the *Trail*

---

https://www.law.cornell.edu/wex/customary_international_law (last visited Sept. 14, 2022).

193 G.A. Res. 217 (III) A, pmbl., Universal Declaration on Human Rights (Dec. 10, 1948); G.A. Res. 61/295, Declaration on the Rights of Indigenous Peoples (Sept. 13, 2007).

194 *Access to a healthy environment, declared a human right by UN rights council*, U.N. NEWS (Oct. 8, 2021) [hereinafter *Access to a healthy environment*], https://news.un.org/en/story/2021/10/1102582.

195 *See, e.g.*, Hof's-Den Haag [Hague Court of Appeals] Oct. 9, 2018, ECLI:NL:GHDHA:2018:2591 DE STAAT DER NEDERLADEN/STITCHNING URGENDA (Neth.) (discussing the duty of the state to take climate change mitigation measures due to the severity of climate change).

196 *See* Paris Agreement, *supra* note 143, pmbl. (establishing the importance of state development while taking action to combat climate change).

197 G.A. Res. 41/128, Declaration on the Right to Development (Dec. 4, 1986).

198 Friedrich Soltau, *Common Concern of Humankind*, OXFORD HANDBOOK INT'L CLIMATE CHANGE L. 202, 205 (Kevin R. Gray et al. eds., 2016).

199 *Id.*

Smelter Arbitration.[200] States have a duty not to harm their neighbors.[201]

Prior informed consent. The duty of prior informed consent governs the actions of States that are anticipated to have impacts beyond the State's borders.[202] This was initially used in the hazardous substance realm, where States were obliged to inform others of a hazardous substance's dangers when shipping it to other States, but it can also be employed in habitat management contexts.[203]

Duty to assess environmental impacts. Tying into environmental impact assessments, States have a duty to evaluate the environmental impacts of actions within their borders that may affect other states or significantly harm the environment.[204]

All governmental practices are expected to abide by these principles.[205] In the scope of reducing habitat fragmentation for zoonotic disease prevention, these principles have excellent potential to be used in pursuit of disease risk reduction goals.[206] The international environmental treaty regime, though establishing

---

[200] *See* Trail Smelter Arbitration (U.S. v. Can.), 3 Reps. Int'l Arb. Awards 1905, 1968 (1938) (establishing that a Canadian plant had no right to cause transboundary harm, and States must not operate in a manner so as to cause harm to others).

[201] *See id.*

[202] *See* Katharina Kummer Peiry, *Prior Informed Consent*, MAX PLANCK ENCYCLOPEDIA INT'L L., https://opil.ouplaw.com/view/10.1093/law:epil/9780199231690/law-9780199231690-e1457 (last visited Sept. 29, 2022) (documenting the concept, origin, and objective of prior informed consent as a way to promote shared responsibility of the States pertaining to the protection of the environment).

[203] *Id.*

[204] *See, e.g.*, Cymie R. Payne, *The International Court of Justice Recognizes Environmental Impact Assessment as a Duty under International Law*, BERKELEY L. (Apr. 22, 2010), https://www.law.berkeley.edu/article/the-international-court-of-justice-recognizes-environmental-impact-assessment-as-a-duty-under-international-law/ (discussing the International Court of Justice judgment that recognizes the environmental impact assessment doctrine under international law).

[205] *See Customary Int'l Law*, *supra* note 192 (explaining how customary international law results from states which follow an agreed sense of legal obligation to each other).

[206] S.S. Myers & J. Patz, *Land Use Change and Human Health*, ENCYCLOPEDIA ENV'T HEALTH 396, 404 (Mar. 3, 2011), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7152004/ (explaining how the understanding of land use changes can help prevent the transmission of infectious diseases).

and exemplifying these principles, is lacking in terms of utilizing them to combat habitat fragmentation.[207] The discussion below evaluates the regime through this lens.

B. Intergovernmental Controls

While the United Nations regime is the main international system of environmental governance, other examples do exist as smaller agreements.[208] For example, the Global Health Security Agenda helps countries meet the World Health Organization's ("WHO") International Health Regulations, which created a framework for detecting, responding to, and controlling zoonotic disease.[209] Over fifty countries have joined these efforts, and some of the agreement's goals include preventing zoonotic disease spread.[210] In addition to the WHO, the World Organization for Animal Health and United Nations Food and Agriculture Organization both have mandates addressing zoonotic disease.[211]

Certain non-governmental organizations ("NGOs") and environmental interest groups are also involved in encouraging

---

[207] Vanda Felbab-Brown, *Preventing pandemics through biodiversity conservation and smart wildlife trade regulation*, BROOKINGS (Jan. 25, 2021), https://www.brookings.edu/research/preventing-pandemics-through-biodiversity-conservation-and-smart-wildlife-trade-regulation/ (explaining that environmental policies in the United States, Indonesia, and South America are inadequate).

[208] *See Support Sustainable Development and Climate Action*, U.N., https://www.un.org/en/our-work/support-sustainable-development-and-climate-action (last visited Oct. 7, 2022) (indicating the obligations of Member States in meeting the U.N.'s sustainable development agenda); *see also*, *Informal Leaders' Roundtable on Climate Action*, U.N. (Sept. 21, 2022), https://www.un.org/en/climatechange/informal-climate-leaders-roundtable-climate-action-2022 (reporting on the informal meeting between world leaders on Climate Action during the 77th Session of the U.N. General Assembly, which lead to renewed global commitments by those in attendance).

[209] *Global Health Security Agenda*, CDC (Sept. 21, 2022), https://www.hhs.gov/about/agencies/oga/global-health-security/agenda/index.html.

[210] *Id.*

[211] *See One Health*, FOOD & AG. ORG. U.N., https://www.fao.org/one-health/en (last visited Oct. 7, 2022) (explaining how the FOA works closely with partner organizations to prevent transboundary diseases).

inter-State communication and land use control efforts.[212] For example, One Health is working towards regional and national cooperation with regard to zoonotic disease.[213] While agreements like these are effective to some extent, the international system of environmental governance is lacking and States must take action to encourage habitat protection within their borders.

C. International Environmental Treaties

The international treaty regime is a vast category of non-binding initiatives upon which significant scholarship is based.[214] The United Nations has contributed to the development of over 560 multilateral international treaties, 20 of which are important environmentally focused treaties, according to the United Nations Sustainable Development Goals Knowledge Platform.[215] The main topics within the environmental regime are specific pollutants, sustainable development, and ozone protection.[216] This article discusses a select few treaties as examples of how the regime may be used to promote disease prevention goals.

The Stockholm Declaration, adopted in 1972, established the first global goal of sustainable development.[217] The Declaration created obligations for the global North to sustainably manage the

---

[212] *See, e.g.*, *Call for Proposals: Zoonotic Diseases and One Health in the Asia-Pacific Region*, FUNDS NGOS, https://www2.fundsforngos.org/latest-funds-for-ngos/call-for-proposals-zoonotic-diseases-and-one-health-in-the-asia-pacific-region/ (last visited Oct. 7, 2022) (calling for fundraising for certain NGOs to contribute to combatting zoonotic disease spread).

[213] *See, e.g.*, *id.* (describing how One Health is encouraging applications from various media organizations to report on Zoonotic diseases).

[214] *See, e.g.*, HARI M. OSOFSKY & LESLEY K. MCALLSITER, CLIMATE CHANGE LAW AND POLICY (2012) (noting various types of scholarship on the international treaty regime).

[215] *Depository of Treaties*, U.N. TREATY COLLECTION, https://treaties.un.org/Pages/Home.aspx?clang=_en (last visited Oct. 7, 2022); *Major Agreements*, *supra* note 7.

[216] *See generally* G.A. Res. 66/288, art. 163 (July 27, 2012) (displaying major agreements and conventions which discuss key environmental issues).

[217] *See* U.N. Conference on the Human Environment, *Report of the United Nations Conference on the Human Environment*, Stockholm, 5-16 June 1972, art. 44, U.N. Doc A/CONF.48/14/Rev.1, part III [hereinafter *Stockholm*], https://digitallibrary.un.org/record/523249?ln=en (explaining the aftermath of the Stockholm Conference).

environment and spurred decades of environmental summits and conferences.[218] Additionally, this was the first instance of environmental principles that ultimately became customary international law.[219] Principle one (1) of the Declaration established the right of all people to a healthy environment and Principle twenty-one (21) created the norm that States should not cause transboundary harm.[220] These principles inform modern decision-making and provide relevant bases for land use control.[221]

The right of all to a healthy environment includes the right to be protected from environmental harms.[222] As this article has established, this is deeply entrenched with zoonotic disease spread. The Stockholm Declaration alone provides sufficient basis for the international community to encourage States to enact the techniques outlined here.

The Rio Declaration similarly touched on the obligation not to cause transboundary harm and also introduced two new principles: the Precautionary Principle and common but differentiated responsibilities ("CBDR").[223] The Precautionary Principle is a widely accepted scientific norm that encourages caution in the face of uncertainty – where scientific knowledge is lacking, lawmakers, scientists, and citizens alike are encouraged to be cautious in their handling of the area.[224] This is best exemplified by the Intergovernmental Panel on Climate Change Report, a compendium of climate science updated every few years by global

---

218 Pamela Chasek, *The Legacies of the Stockholm Conference*, INT'L INST. SUSTAINABLE DEV. (June 1, 2022), https://www.iisd.org/articles/deep-dive/stockholm-conference-legacy.

219 *Stockholm*, *supra* note 217, at annex II, app., art. 7.

220 *Id.* at ch. I, § II, princs. 1, 21.

221 *Id.* at ch. II(C).

222 *Access to a healthy environment*, *supra* note 194; *see also* Joshua J. Bruckerhoff, Note, *Giving Nature Constitutional Protection: A Less Anthropocentric Interpretation of Environmental Rights*, 86 TEX. L. REV. 615, 615 (2008) (discussing the extensions of environmental rights).

223 U.N. Conference on Environment and Development, *Rio Declaration on Environment and Development*, princs. 7, 15 U.N. Doc. A/CONF.151/26/Rev.1 vol. I, annex I (Aug. 12, 1992) [hereinafter *Rio*], https://www.cbd.int/doc/ref/rio-declaration.shtml.

224 *See, e.g.*, Didier Bourguignon, *The precautionary principle: Definitions, applications and governance*, EUR. PARLIAMENT 16 (2015) (comparing the cautionary approaches taken by the US with the cautionary approaches taken by the EU).

scientific and policy leaders.[225] Though climate change, or what was then called global warming, was still widely contentious when the first report was released in the 1990's, scientists still published the document, arguing that urgent action was needed.[226]

The Precautionary Principle should be employed in dealing with the threat of zoonotic disease.[227] Because there is no way to know the extent of potential future harm if we do not mitigate the potential for zoonotic disease spread now, those in power have the duty to protect their citizens by employing measures that actively combat the threat. The perils of the COVID-19 pandemic have exemplified the havoc a pandemic can wreak upon an unsuspecting world.[228] The global landscape must utilize the wide variety of existing land use techniques to limit habitat fragmentation and reduce the threat of zoonotic disease spread.

The principle of CBDR focuses on the disparity caused by the global effects of development between States.[229] While much of the global North has been reaping the benefits of hundreds of years of development and economic strength, the global South has lagged behind and thus not obtained the same benefits.[230] Any solution to these issues must include consideration of this disparity, and any transboundary efforts must incorporate cooperation between the North and South.

---

225 *See generally The Intergovernmental Panel on Climate Change*, IPCC, https://www.ipcc.ch/ (last visited Oct. 7, 2022) (stating that the IPCC was created in 1988 by the World Meteorological Organization and the United Nations Environment Programme specifically with the goal of providing governments at all levels with scientific information they can use to develop climate policies).

226 *See History of the IPCC*, IPCC, https://www.ipcc.ch/about/history/ (last visited Oct. 7, 2022) (explaining the importance of climate change as a challenge with global consequences which requires urgent international cooperation).

227 *See generally Rio*, *supra* note 223, at princ. 15 (arguing the use of the precautionary approach to protect the environment from such threats of irreversible damage).

228 *See The Social Impact of COVID-19*, U.N. DEPT. ECON. SOC. AFF. (Apr. 6, 2020), https://www.un.org/development/desa/dspd/2020/04/social-impact-of-covid-19/ (signifying the impact of COVID-19 on the sudden and unforeseen consequences on the people and planet).

229 *common but differentiated responsibilities*, UNEP, https://leap.unep.org/knowledge/glossary/common-differentiated-responsibilities (last visited Oct. 7, 2022).

230 Blythe Riggan, *Global North and South: Sustainable Development*, BORGEN MAG. (July 10, 2014), https://www.borgenmagazine.com/global-north-south-sustainable-development/.

The Kyoto Protocol was the first to establish a cap-and-trade-type mechanism between States, aiming to resolve some of the North-South tension.[231] It produced a cooperative model between those that pollute and those that do not, providing an impressive, albeit toothless, example of mechanisms States may employ to encourage collaboration and cooperation.[232] A similar inter-State cooperative control could provide a significant solution to the habitat preservation crisis. The threat of disease need not be handled unilaterally, and the international treaty regime poses the perspective that intergovernmental cooperation is possible.

The Paris Climate Agreement established a system of control based on Nationally Determined Contributions ("NDCs").[233] This format allows States to specifically implement goals based on their particular needs.[234] A control mechanism such as this could be used to establish State or region-specific land use regimes to prevent zoonotic disease spread via habitat fragmentation. By building on the cooperative principles established by the Kyoto Protocol, the Paris Climate Agreement framework has the potential to spur the next generation of environmental treaties to combat zoonotic disease spread. Together, these international environmental controls have the potential to be used for widespread control of land use.

Because the majority of the environmental treaty regime is binding, yet largely unenforced, significant advancements still must occur for any chance of widespread change.[235] The future of land use regulation at the international scale demands an institutional structure that is enforced, such as trade tariffs or punitive fines to noncompliant States. Substantial action is still needed in this realm.

---

231 *What is the Kyoto Protocol?*, U.N. CLIMATE CHANGE, https://unfccc.int/kyoto_protocol (last visited Oct. 7, 2022).

232 *Id.*

233 *What is the Paris Agreement?*, U.N. CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (last visited Oct. 7, 2022).

234 *Id.*

235 *See* Taylor Kilduff, *The Difficulties of Enforcing Global Environmental Law*, GEO. L. (Feb. 1, 2019), https://www.law.georgetown.edu/environmental-law-review/blog/214/ (discussing the issues accompanying lack of enforcement of international environmental laws).

D. State-specific Controls

The rights and international customs addressed in this article can be implemented at the national level to address domestic zoonotic disease spread. There are many things States can do to ensure these come to fruition, and Brazil represents a unique case study in that it has already implemented some of these techniques. Brazil's Federal Constitution requires master plans to be adopted by cities above a certain population threshold, encouraging effective land use planning.[236] This encompasses everything from zoning districts, buffer requirements, and conservation zoning.

Brazil also enacted Decree 3.179, which established monetary fines and confiscation measures for violations of the State's environmental regulations.[237] These fees are a worthwhile method of fundraising for land conservation measures. In combination with Decree 9605, which establishes criminal sanctions for harms against the environment and animals, a comprehensive punitive measure is in place to combat undesirable land uses.[238] States seeking to add penalties to harmful development can follow this framework to encourage habitat preservation.

The framework established by the techniques listed in this article, in addition to Brazil's statutory regime, promotes effective habitat management to combat zoonotic disease spread. The global landscape of environmental governance has created the foundation necessary to build a regime of habitat preservation that effectively combats this threat.

V. CONCLUSION

Zoonotic disease transmission occurs through spillover from natural to human environments.[239] This spillover will only increase as humans encroach on natural areas, raising the frequency of

---

[236] COMPENDIUM, *supra* note 145, at 279 (citing CONSTITUTION OF THE FEDERATIVE REPUBLIC OF BRAZIL, 1988, art. 182(1)).

[237] *Id.* at 289 (citing Decreto No. 3.179, de 21 de Setembro de 1999, Diário Oficial da União [D.O.U.] de 22.9.1999 (Braz.) (repealed)).

[238] *Id.* at 292 (citing Lei No. 9.605, de 12 de Fevereiro de 1998, Diário Oficial da União [D.O.U.] de 13.2.1998 (Braz.)).

[239] Lipman, *supra* note 1, at 154.

interaction between humans and wildlife.[240] As eloquently stated by United Nations scholars,

success requires addressing the root causes of disease emergence – the fact that human activities are imposing extreme stresses on ecosystems and their ability to function. Addressing the problem at the necessary foundational level calls for reconciling human development within the biophysical environment.[241]

As inhabitants of this planet, humans have chosen the path of domination, treating nature like it exists for the sole purpose of serving our needs.[242] The cost of this path has become apparent in recent decades as climate change and its associated problems have come to a head. We have created the perfect conditions necessary for our destruction, and these conditions will only keep growing if we continue on the path we are on. We must make a change.

So apparent in this need for change is the fact that *it's not happening*.

To reduce the likelihood of future pandemics like COVID-19, the root cause must be addressed. Land use controls can reduce the creation of these diseases in humans, stopping the mitigation process before it ever needs to begin. As self-proclaimed dominators of Earth, it is our duty to do so. International law exists at the level necessary to address the change required for this crisis. Through a variety of mechanisms, States can implement land use controls that reduce habitat fragmentation and lower the spread of zoonotic disease. By acting on the mechanisms already in place, States can act on the imperative that they have the power to support a healthy public by limiting habitat fragmentation and its subsequent impact on zoonotic disease transmission. The next great pandemic can be prevented by doing so.

---

240 *See id.* (demonstrating spillover and explaining that the more contact between humans and natural and wildlife, the greater likelihood of spillover).

241 *Zoonoses*, *supra* note 45, at 27.

242 *See generally* Steve Cohen, *The Limits to Human Domination of Nature*, COLUM. CLIMATE SCH. (Aug. 23, 2021), https://news.climate.columbia.edu/2021/08/23/the-limits-to-human-domination-of-nature/ (providing examples of how humanity has pursued the path of domination over nature).