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COVID-19: Its Effect on Nomadic Pastoralism and Nature Conservation Issues in Mongolia

Uudus Bayarsaikhan,
National University of Mongolia

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Impacts of the coronavirus pandemic on biodiversity conservation

The COVID-19 pandemic is a reminder of the close relationship between human and planetary health. It is estimated that 75 percent of all emerging infectious diseases in humans are zoonotic (those transferred from animals to humans). – World Bank, 2020

The main question is how these viruses are transmitted to us from either bat or pangolin or other wildlife species.
Disease transfer works both ways and even wildlife receive diseases from people and livestock.

How Many Species Are There on Earth and in the Ocean?

Table 2. Currently catalogued and predicted total number of species on Earth and in the ocean.

Species	Earth			Ocean		
	Catalogued	**Predicted**	**±SE**	**Catalogued**	**Predicted**	**±SE**
Eukaryotes						
Animalia	953,434	7,770,000	958,000	171,082	2,150,000	145,000
Chromista	13,033	27,500	30,500	4,859	7,400	9,640
Fungi	43,271	611,000	297,000	1,097	5,320	11,100
Plantae	215,644	298,000	8,200	8,600	16,600	9,130
Protozoa	8,118	36,400	6,690	8,118	36,400	6,690
Total	1,233,500	8,740,000	1,300,000	193,756	2,210,000	182,000
Prokaryotes						
Archaea	502	455	160	1	1	0
Bacteria	10,358	9,680	3,470	652	1,320	436
Total	10,860	10,100	3,630	653	1,320	436
Grand Total	**1,244,360**	**8,750,000**	**1,300,000**	**194,409**	**2,210,000**	**182,000**

Predictions for prokaryotes represent a lower bound because they do not consider undescribed higher taxa. For protozoa, the ocean database was substantially more complete than the database for the entire Earth so we only used the former to estimate the total number of species in this taxon. All predictions were rounded to three significant digits.

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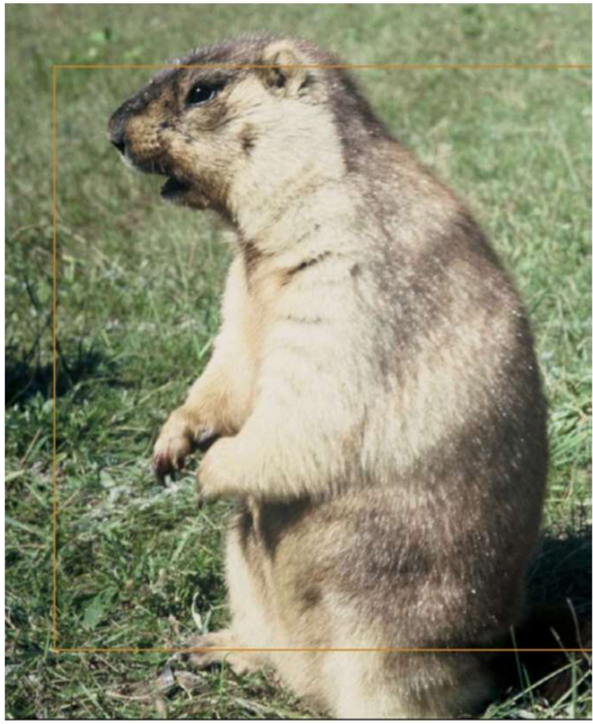
Assessment of this pattern for all kingdoms of life on Earth predicts 8.7 million (±1.3 million SE) species globally, of which ,2.2 million (±0.18 million SE) are marine. Research results suggest that some 86% of the species on Earth, and 91% in the ocean, still await description.

Why need to protecting biodiversity

Case studies

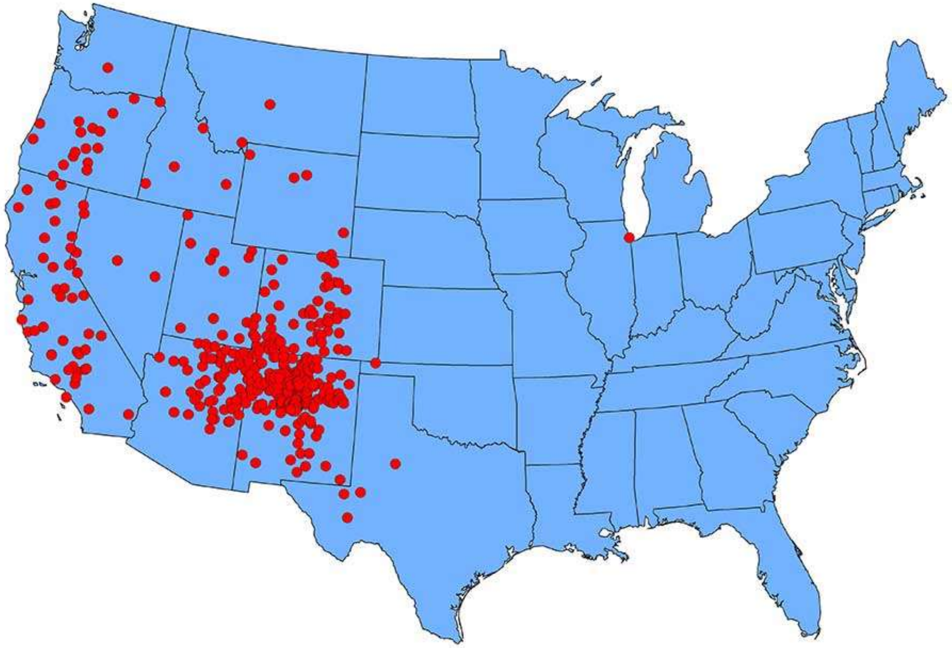
Bubonic plague foci spatio-temporal changes



What should we learn from COVID19

- Human pressure on biodiversity increases the risk of infectious disease.
- First of all we should rethinking about "distance" between other species and human.
- Why its important rethinking about "distance"?
  - Every year WHO registered cases of human bubonic plagues. For example: in 2020 media reported about cases of plague – first in humans in Mongolia, and then in squirrels in Colorado.
  - There have been three great world pandemics of plague recorded, in 541, 1347 and 1894 CE, each time causing devastating mortality of people and animals across nations and continents. On more than one occasion plague irrevocably changed the social and economic fabric of society (*https://jmvh.org/wp-content/uploads/2012/04/JMVH-Vol20_2_print.pdf*).
  - The US Centers for Disease Control and Prevention say that a handful of human plague cases are detected in the US annually, almost always in the rural west. There are rarely any deaths. While there were four in 2015, for instance, there were none recorded in the three subsequent years. Nowadays, the number of cases detected worldwide each year total no more than a few hundred, says Head (*https://www.the-scientist.com/news-opinion/bubonic-plague-cases-are-no-cause-for-panic-67752*).

Reported Cases of Human Plague – United States, 1970–2018

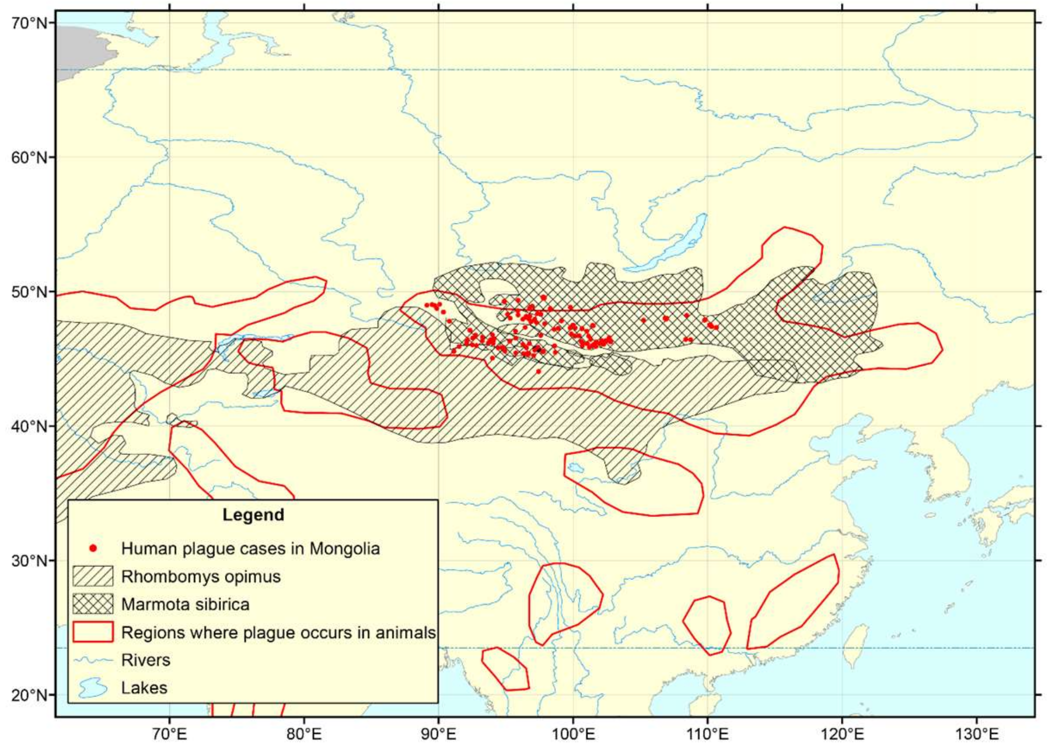


1 dot placed randomly in most likely county of exposure for each confirmed plague case

Source: https://www.cdc.gov/plague/maps/index.html#:~:text=Over%2080%25%20of%20United%20States,in%20people%20ages%2012%E2%80%9345.

Reported Cases of Human Plague – Mongolia, 1982–2013

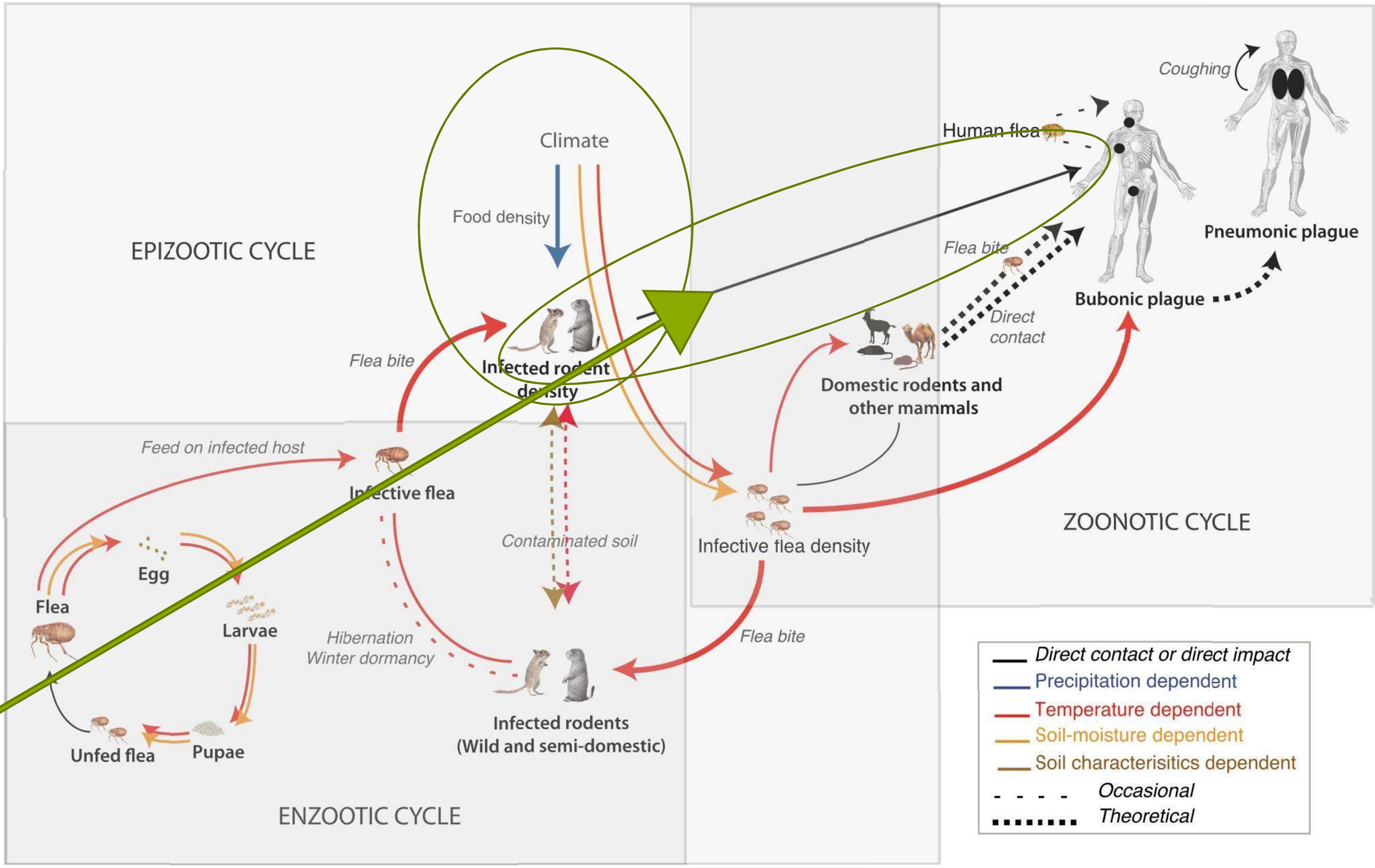
Plague foci are present over an expanded geographical range that includes the Western US, portions of South America, East and South Africa, and Southeast Asia.



Source: authors original (unpublished)

- Contact its vector hosts and those contacts develops various ways.
  - Historically black rat is one of vector hosts where living human settlement area. The “Black deaths” of 1347 originated in Asia and spread to the Crimea then Europe and Russia. The vector host in the Black Death pandemic was species *Rattus rattus* or black rat.
  - Black rat had probably acquired the disease from contact with infected wild rodents.
  - **in Mongolia, most of cases from eating marmot meat. In US cases, its mostly from domestic cats.**

“DISTANCE”

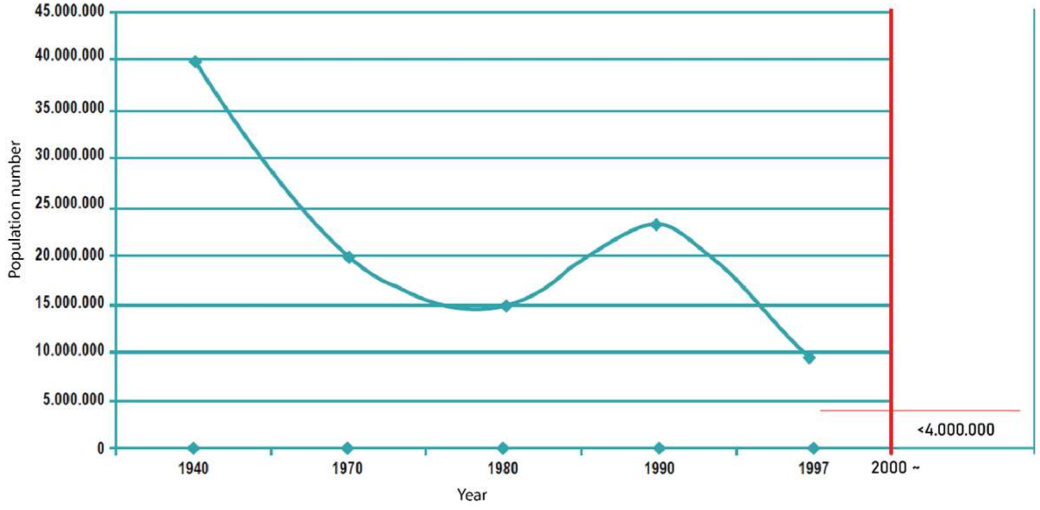


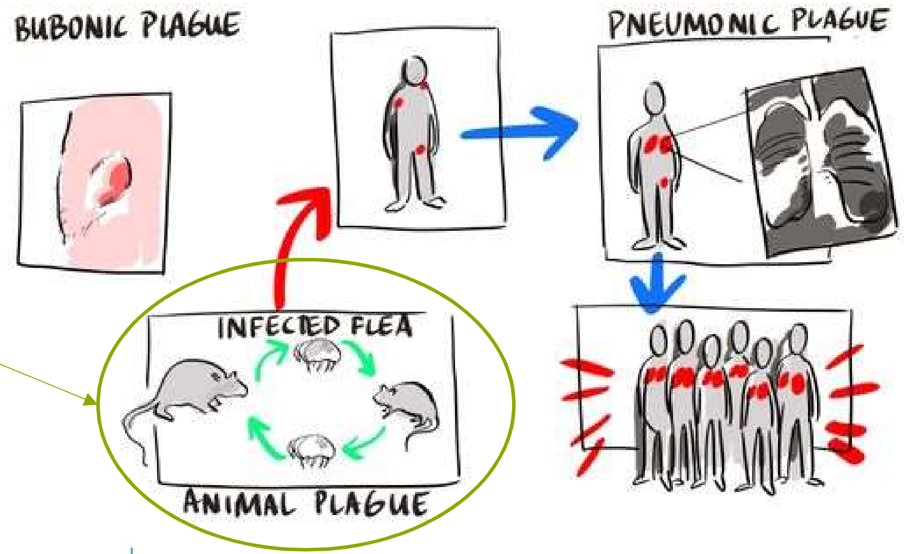
Schematic of the plague cycle with small mammals as hosts and fleas as vectors. Arrows represent connections affected by climate with a color-coding depending on the most influential climate variable on this link (i.e., precipitation, temperatures, and other variables indirectly depending on them such as soil characteristics and soil moisture). Grey rectangles somewhat arbitrarily delimit epizootic, enzootic, and zoonotic cycles. Note that despite their location at the far end of the cycle, humans often provide the only available information on plague dynamics.

Lactic Acid Bacteria Vector Vaccines - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Schematic-of-the-plague-cycle-with-small-mammals-as-hosts-and-fleas-as-vectors-Arrows_fig1_295259898 [accessed 11 Jan, 2021]

Ecosystems consists from subsystems.
Each system has its own characteristics such as members of system, functional connections between members.

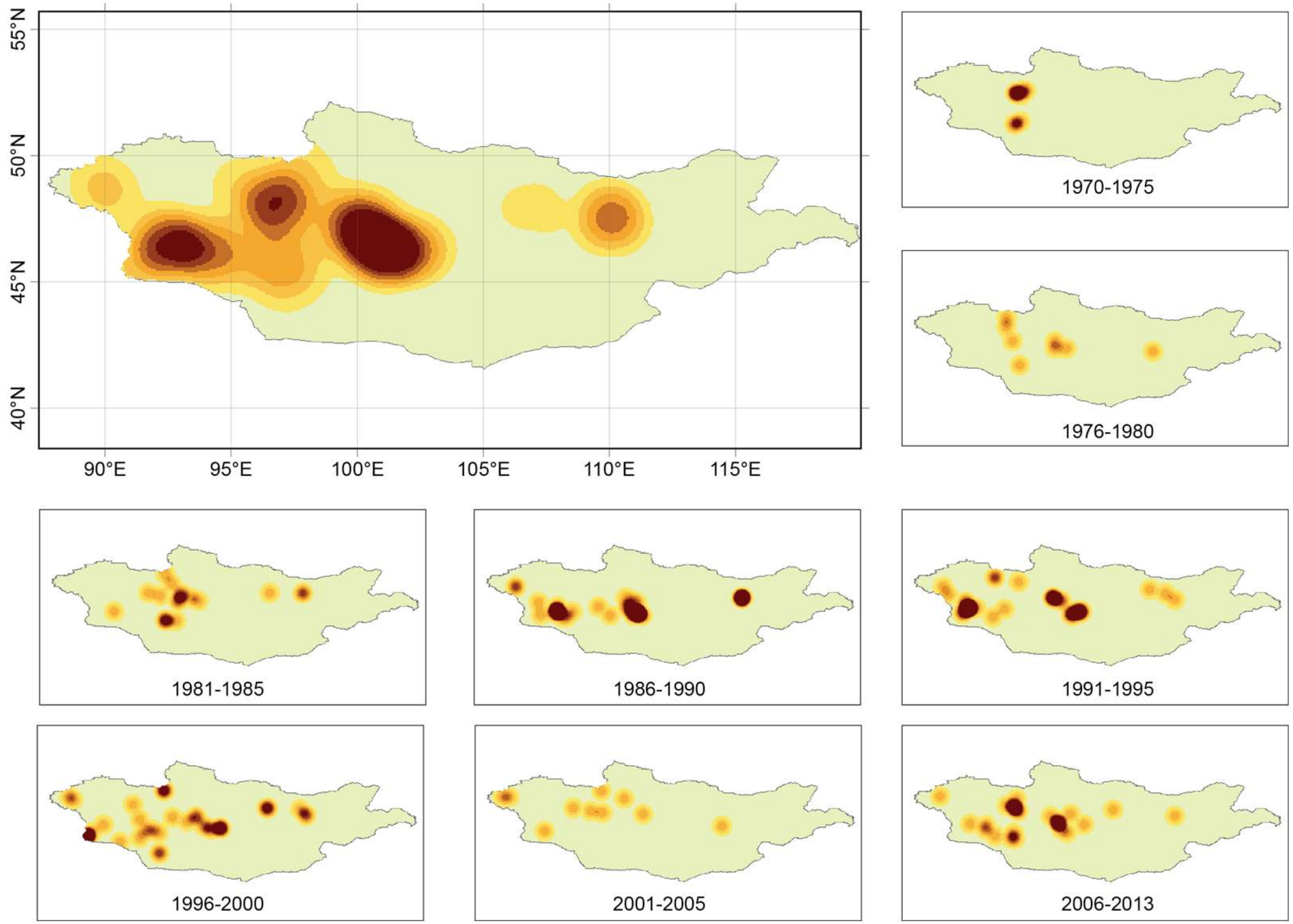
Animal plague defends from population density, environmental condition and other biotic and abiotic factors.





Simplified circle of bubonic plague

(https://openwho.org/courses/knowledge-resources-plague?locale=es)



55°N
50°N
45°N
40°N
90°E
95°E
100°E
105°E
110°E
115°E
1970-1975
1976-1980
1981-1985
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1991-1995
1996-2000
2001-2005
2006-2013

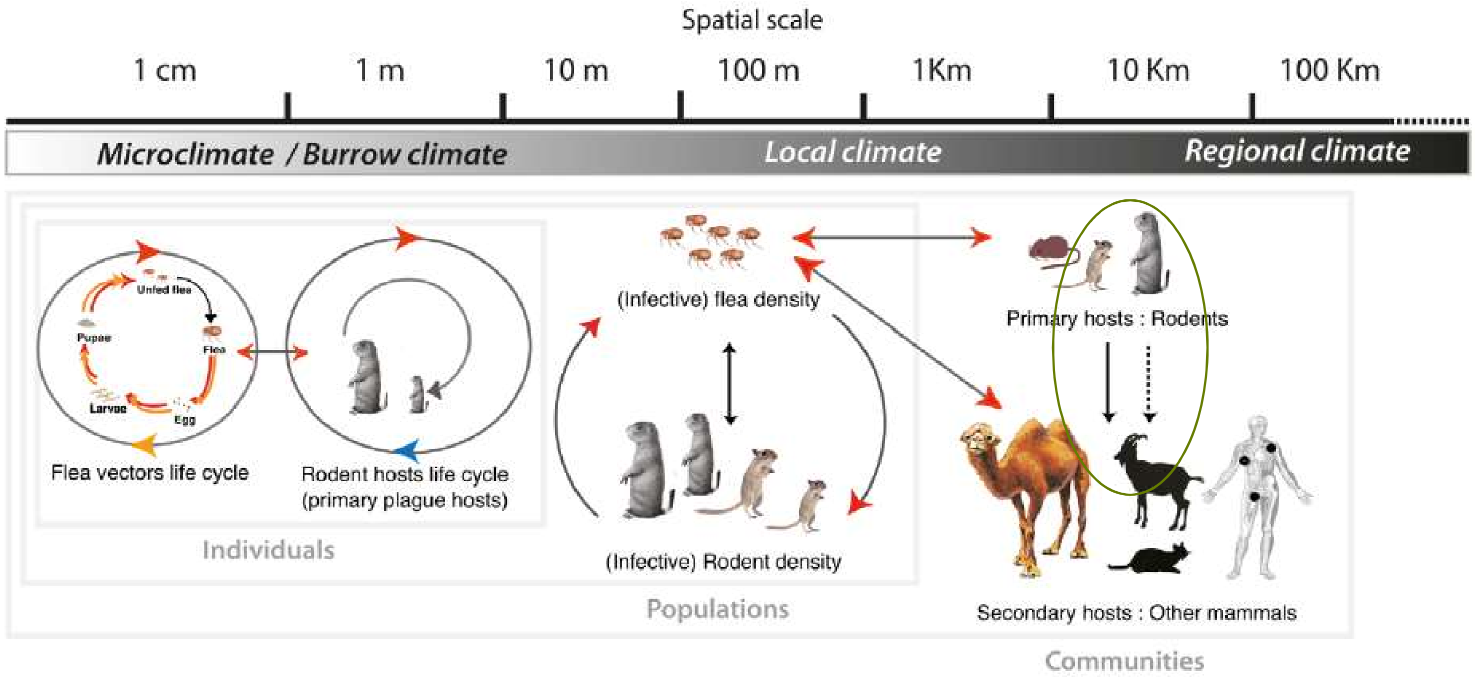


Illustration of the abiotic environment impact on the plague cycle as a function of spatial scale. Arrows represent connections affected by climate (see Figure 1 for the meaning of color coding). Most climate variables act over a wide range of scales and only the effects we deemed most important are represented. At the level of individuals, populations and communities hosts and vectors are influenced by climate variability at the relevant scale (local or regional). At the smaller scale, the burrow acts as a filter on climate variables. Note that secondary hosts are placed at the kilometer and larger scale on the basis of the type of information generally available regarding their infection.

Table 1. Possible mechanisms linking changes in biodiversity to infectious disease in humans

Level of diversity	Aspect of biodiversity undergoing change due to human pressure	Possible mechanism leading to human health effect
Genetic	Gene frequencies within populations of pathogens or hosts	Change in pathogen virulence or host resistance
Microbial	Composition of microbial communities in the external environment or within the host	Change in pathogen virulence in host immune response and allergic sensitization; expansion of range through human transport
Vector Species (living organisms that can transmit infectious pathogens between humans, or from animals to humans)	Abundance, diversity, composition and geographic range of vectors	Change in host-vector contact rates; change in contact between infected vectors and humans; expansion of range
Host Species	Diversity, composition and range of host species	Change in host-pathogen contact rates; change in competent host-vector contact rates; change in pathogen prevalence; expansion of range
Community (interacting species, including predators, prey/food, competitors)	Host density and contact with pathogen, host susceptibility to infection	Change in pathogen prevalence; change in human-pathogen contact rates
Ecosystem	Structure, complexity and diversity of vegetation; physical and chemical properties (e.g. climatic conditions)	Change in vector abundance and composition; change in host composition and distribution; change in host-pathogen contact rates; change in vector-host contact rates; change in infected vector-human contact rates; change in host-human contact rates

Source: Adapted from Pongsiri et al. (2009), Biodiversity Loss Affects Global Disease Ecology, *BioScience*, Vol 59 No. 11, pp 945-954 (2009[19])

Why biodiversity should be factored into the COVID-19 response

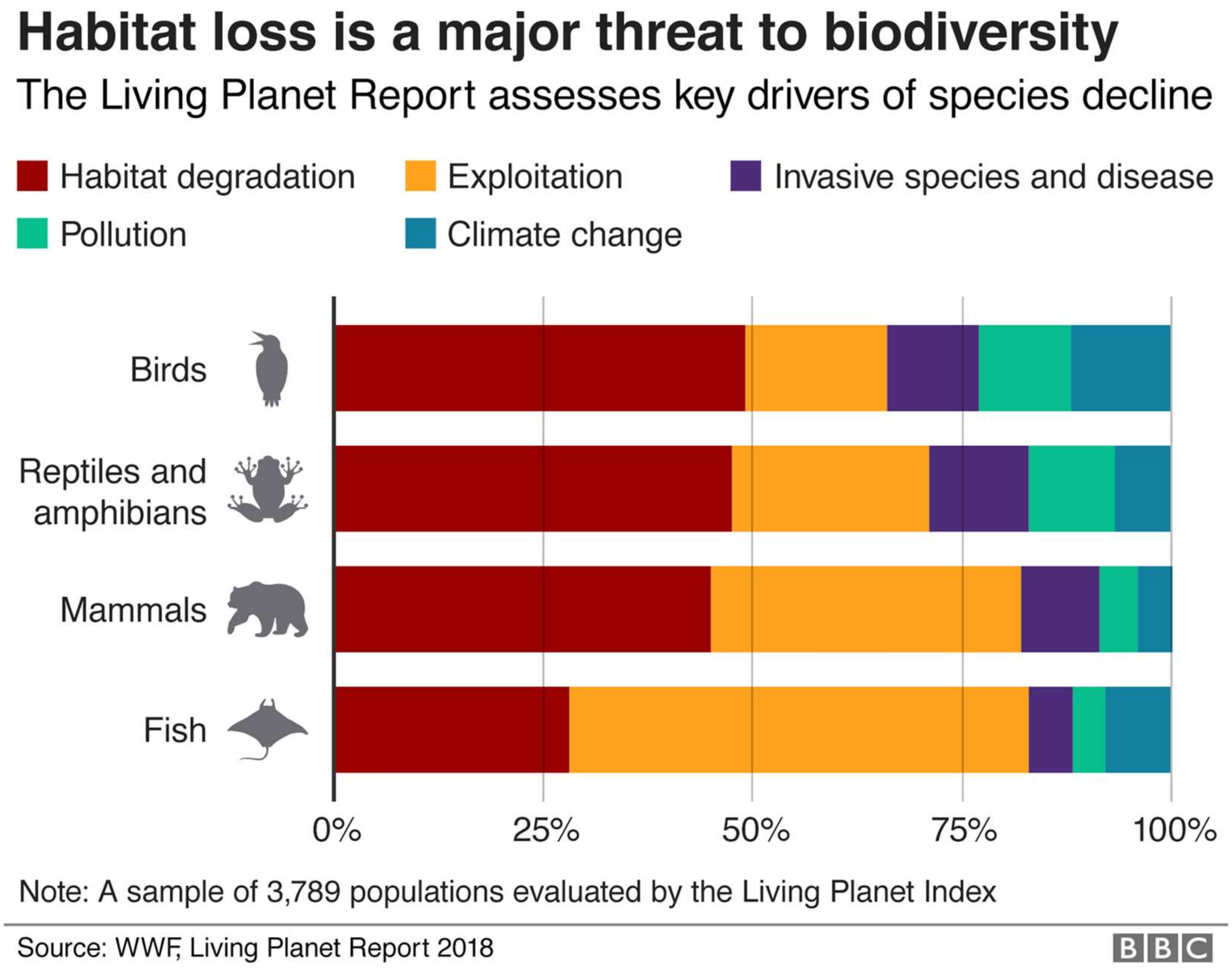
Recent extinction rates are 100 to 1000 times their pre-human levels in well-known, but taxonomically diverse groups from widely different environments.

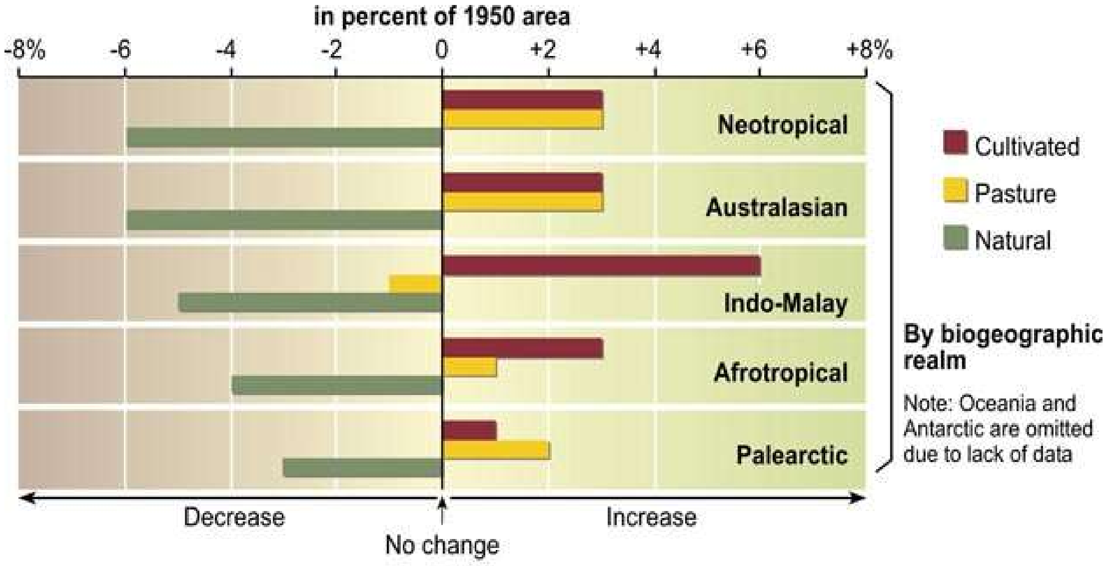
Biodiversity and human infectious diseases are intricately linked. Zoonoses –diseases transmitted from other animal species to humans –account for approximately 60% of all infectious diseases and 75% of emerging infectious diseases in humans(Taylor, Latham and Woolhouse).

Human pressure on biodiversity increases the risk of infectious disease.

Polar bears and baby walruses are icons that represent the loss of biodiversity, according to USC College scholar Jed Fuhrman.

Land-use change resulting from agricultural expansion, logging, infrastructure development and other human activities is the most common driver of infectious disease emergence, accounting for approximately one third of all emerging disease events (Loh etal., 2015).





Source: Millennium Ecosystem Assessment

Land-use change and wildlife exploitation increase disease risk by bringing people and domestic animal populations in close proximity to pathogen-carrying wildlife. Human pressure on ecosystems can also alter infectious disease dynamics by disrupting the species composition, function and structure of ecosystems (Karesh etal., 2012; Keesing etal., 2010; Halliday and Rohr, 2019)

How its impact field research

- Field research has been impacted, with many field sites no longer accessible, because of travel and entry restrictions, and safety concerns.
- This year 2021, International travel has become all but impossible, and post-pandemic recovery may be slow if countries maintain entry restrictions.
- Missed research means missed opportunities, monitor the health of endangered species and ecosystems.
- Conservation research is unlikely to be a government priority during the post-pandemic economic recovery.

- Protecting biodiversity is vital for avoiding the next pandemic. Close to three-quarters of emerging infectious diseases in humans come from other animals. Land-use change and wildlife exploitation increase infectious disease risk by bringing people and domestic animals in close proximity to pathogen-carrying wildlife, and by disrupting the ecological processes that keep diseases in check.
- The economy and human well-being also depend on biodiversity for food, clean water, flood protection, erosion control, inspiration for innovation and much more. Over half the world's global domestic product is moderately or highly dependent on biodiversity. The ongoing decline of biodiversity therefore poses important risks to society. Investing in biodiversity as part of the COVID-19 policy response can help to minimize these risks, while providing immediate jobs and economic stimulus (*Biodiversity and the economic response to COVID-19: Ensuring a green and resilient recovery*).