Erasmus MC

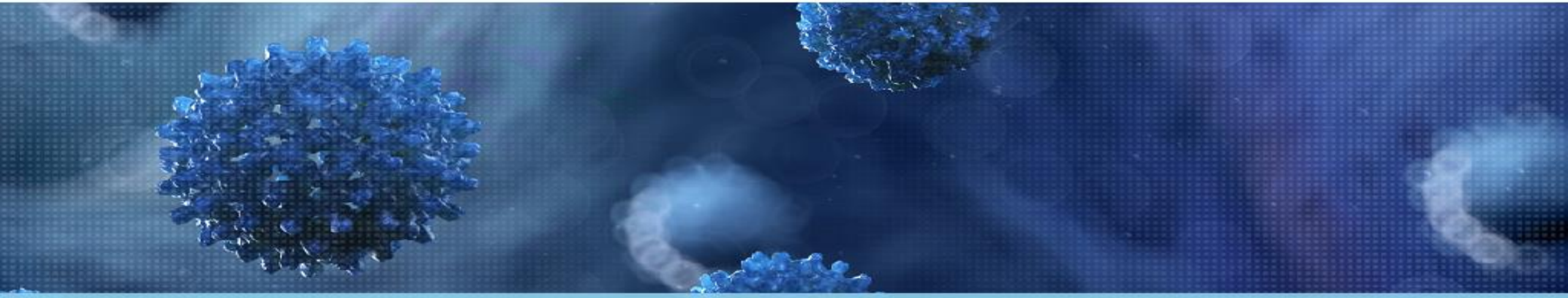
WHO collaborating centre for Arbovirus and Hemorrhagic Fever Reference and Research

one health pact

VEO

Viroscience lab

WHERE SKILLS MEET TO STUDY & PROTECT



Emerging viruses in a changing world
Rotterdam, October 2026

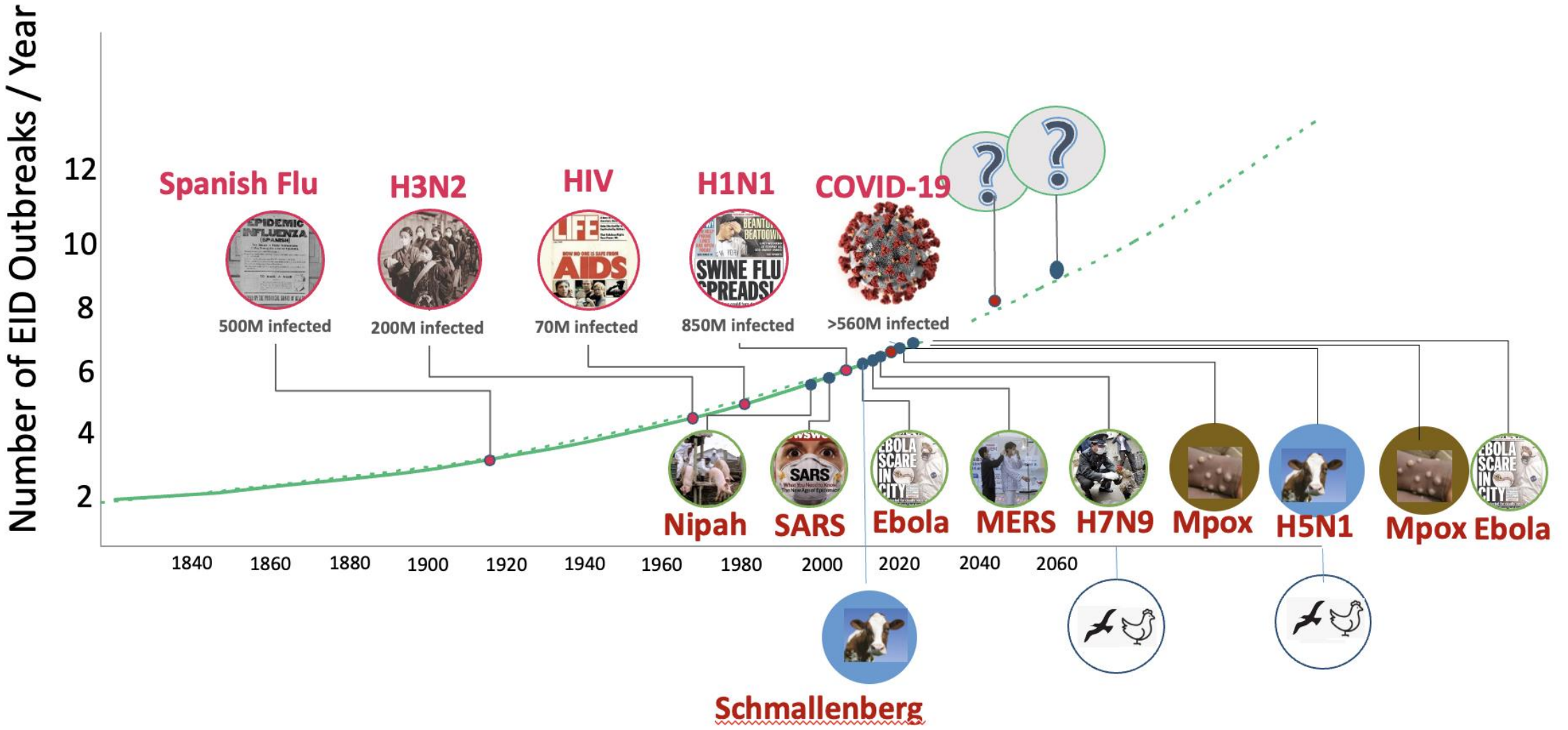
www.pdpcenter.nl

m.koopmans@erasmusmc.nl; @MarionKoopmans

“You better get used to it, the world is entering a phase in which new outbreaks of rapidly spreading diseases is the new normal”

Mike Ryan, Former head
WHO emergency program





Sun et al, 2023; https://link.springer.com/article/10.1186/s12992-023-00959-0

The common underlying theme: the Anthropocene

"an era in which health increasingly is affected by human impact on the planet"

- CHANGE in demographics (humans and animals)
- CHANGE in political landscape
- CHANGE in behavior
- CHANGE in technology
- CHANGE in climate
- CHANGE in land use

Changing balance between humans, animals, ecosystems, viruses and microbes

- Re-introduction of eradicated diseases
- New diseases
- Tipping points for known diseases

Sikkema and Koopmans;
https://pubmed.ncbi.nlm.nih.gov/41044181/

Categories of drivers that explain why we see more frequent, bigger and more impactfull epidemics

Probability of spillover

- Large scale deforestation
- Biodiversity loss
- Animal farming with low biosecurity
- Increasing density of human and animal populations ….
- Increasing food demand

Probability of spread

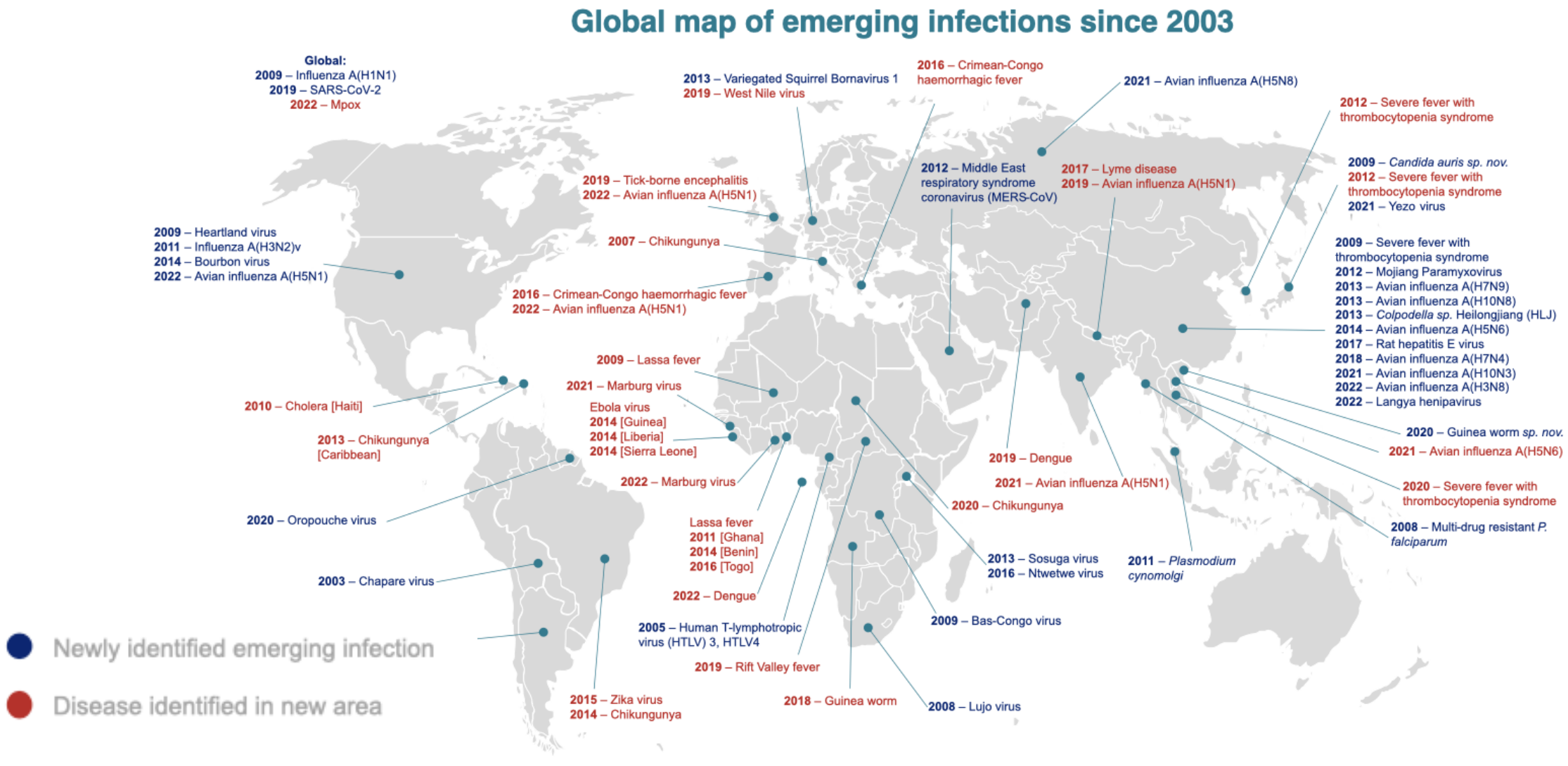
- Global travel and trade
- Megacities with poor infrastructure
- Industrial farming ….

Probability of increased impact

- Ageing
- Increase in population with comorbidities
- Social disparities
- Demographics …….

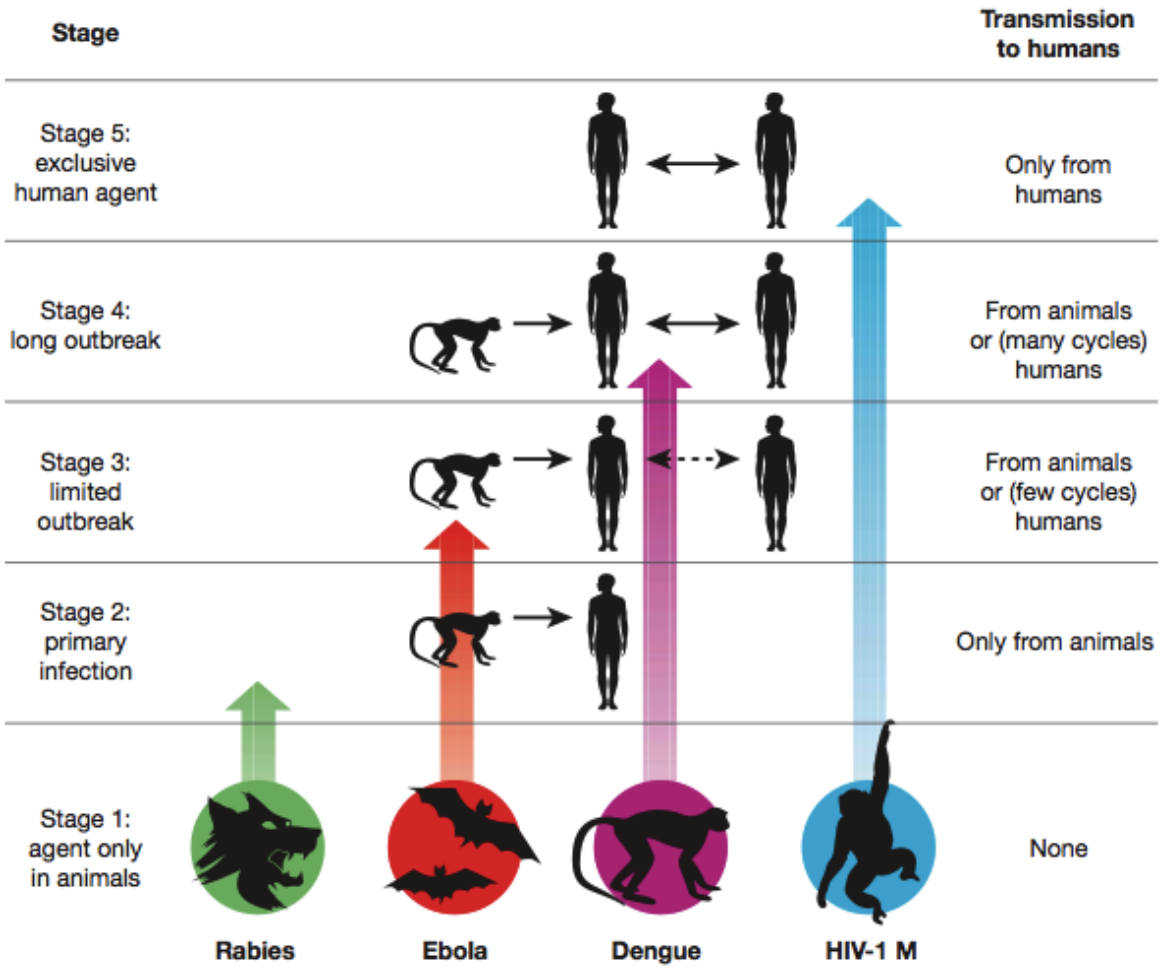
Climate change can affect many of these drivers, although it is difficult to define effects precisely

Outbreaks of emerging infections happen everywhere



https://www.gov.uk/government/publications/emerging-infections-characteristics-epidemiology-and-global-distribution/emerging-infections-how-and-why-they-arise

Spillover > epidemic? > pandemic?



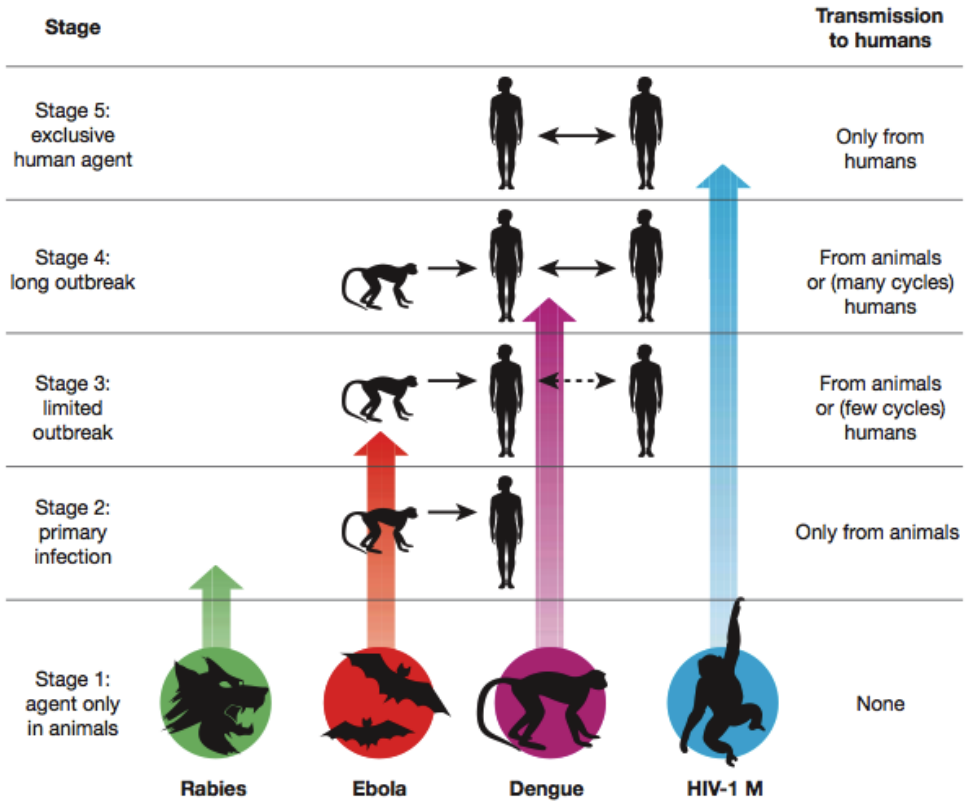
Public health threat

Biggest window of opportunity for early containment

Individual health threat

Wolfe et al, 2007

Questions with a(ny) spillover



1. What is it?
2. How can I detect it?
3. What is the reservoir?
4. Who can be infected?
5. What is the mode of transmission?
6. How widespread is it?
7. How contagious is it?
8. How severe is the disease?
9. Who is most at risk?
10. (How) can it be stopped, prevented?

Wolfe et al., 2007

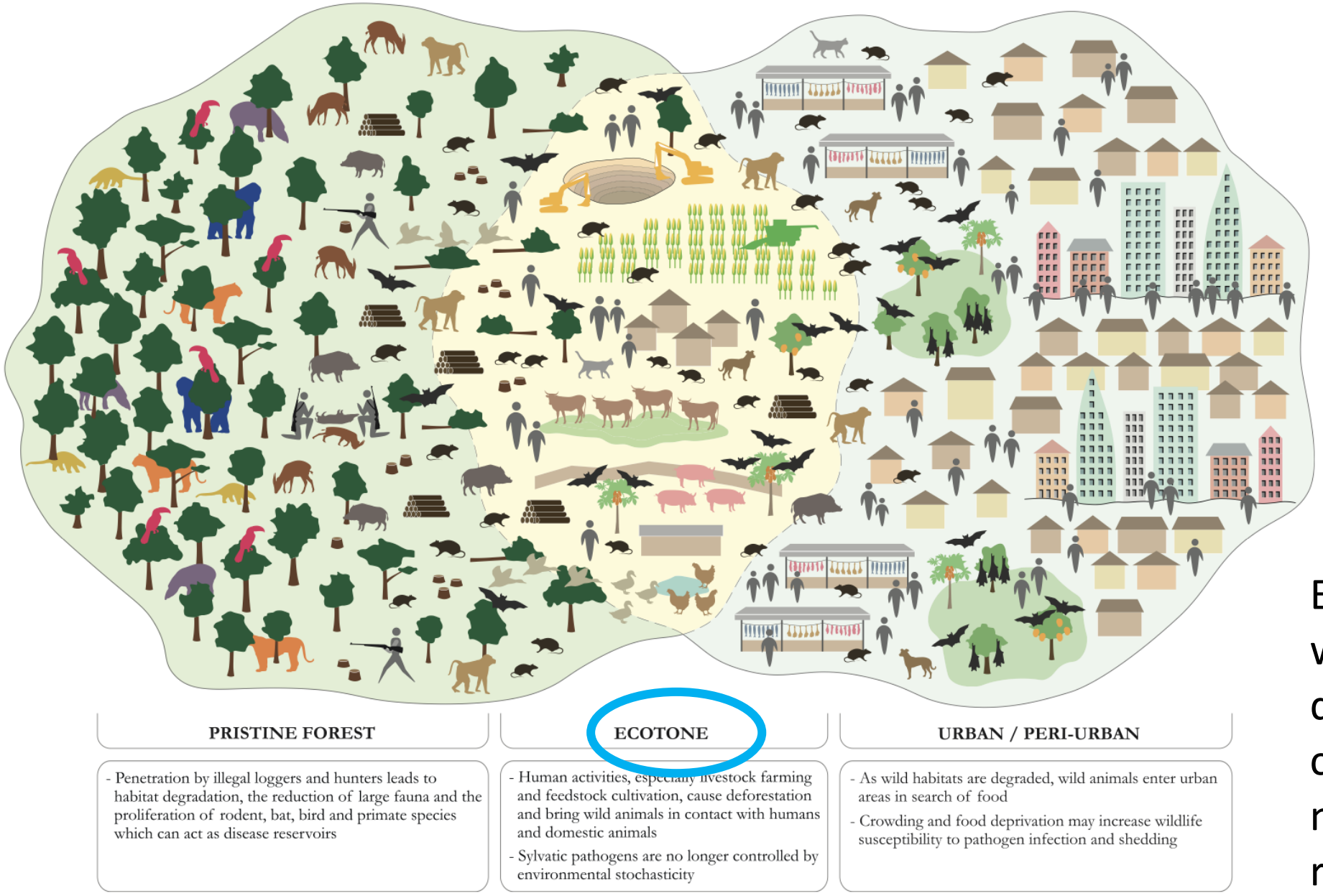
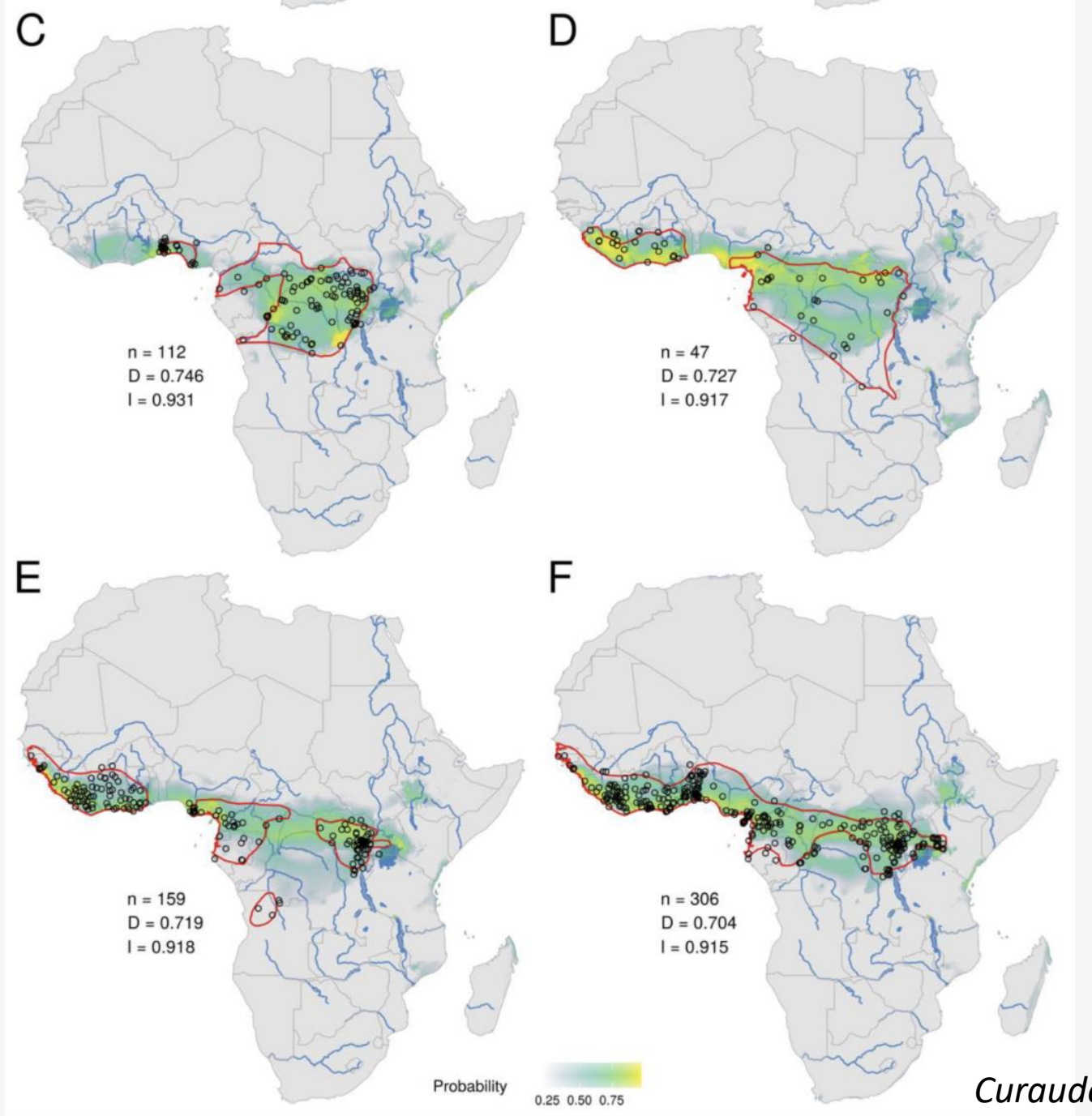


Figure 2. Tropical deforestation and overhunting as drivers of wildlife-origin zoonotic disease transmission

https://www.thelancet.com/action/showPdf?pii=S2589-5370%2822%2900116-X

Ecotones = Places where normally distinct ecosystems converge, leading to novel interactions and risks

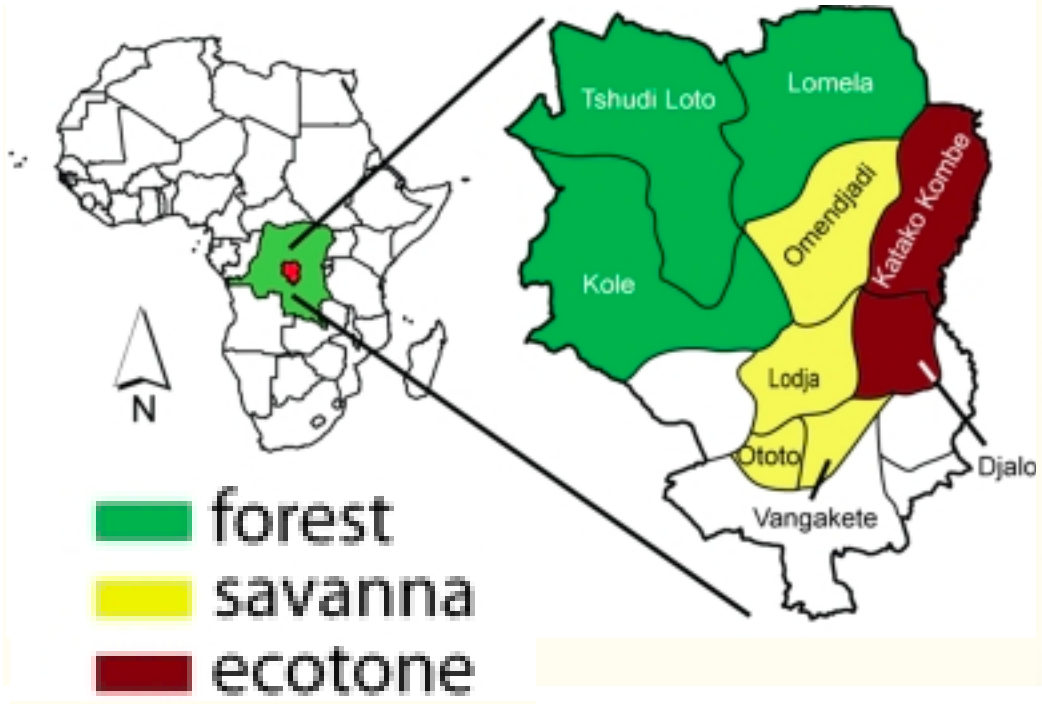




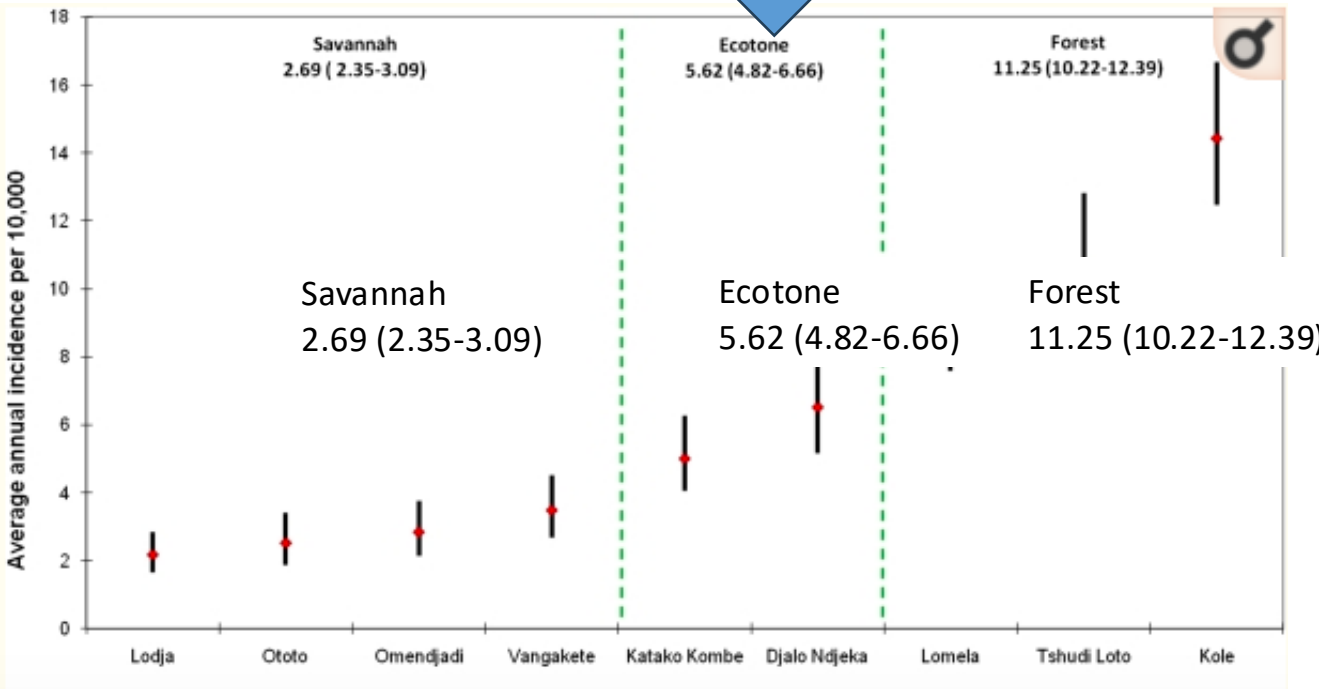


Curaudeau et al https://www.mdpi.com/1999-4915/15/3/727
Doty et al https://www.mdpi.com/1999-4915/9/10/283

Monkeypox spillovers



Infections particularly in children



Probability of spillover

- Large scale deforestation
- Changing susceptibility of humans

Rimoin et al., PNAS 2010

Probability of spread

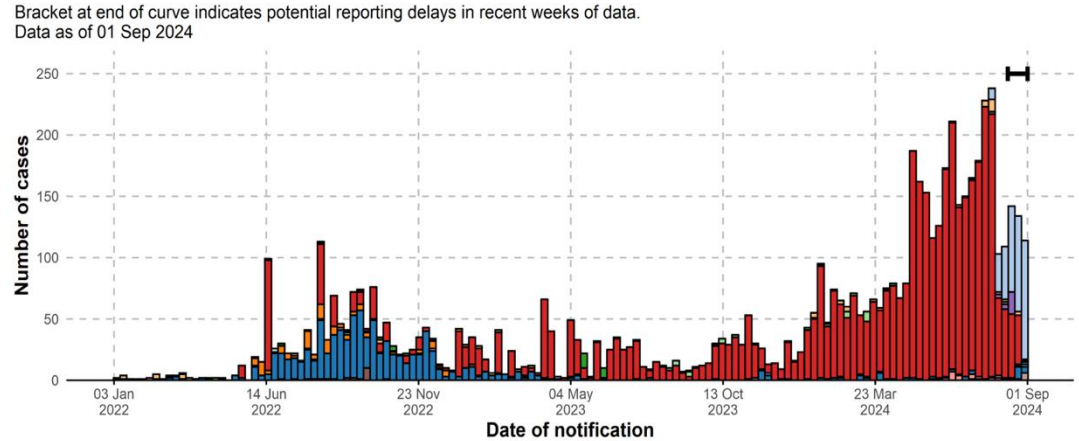
- Urbanization
- Global travel and trade

Probability of increased impact

- Co-morbidities
- Poverty, access to care









WHO Director-General declares mpox outbreak a public health emergency of international concern

Transmission of monkeypox virus clade I: overall risk remains low in the EU/EEA

News

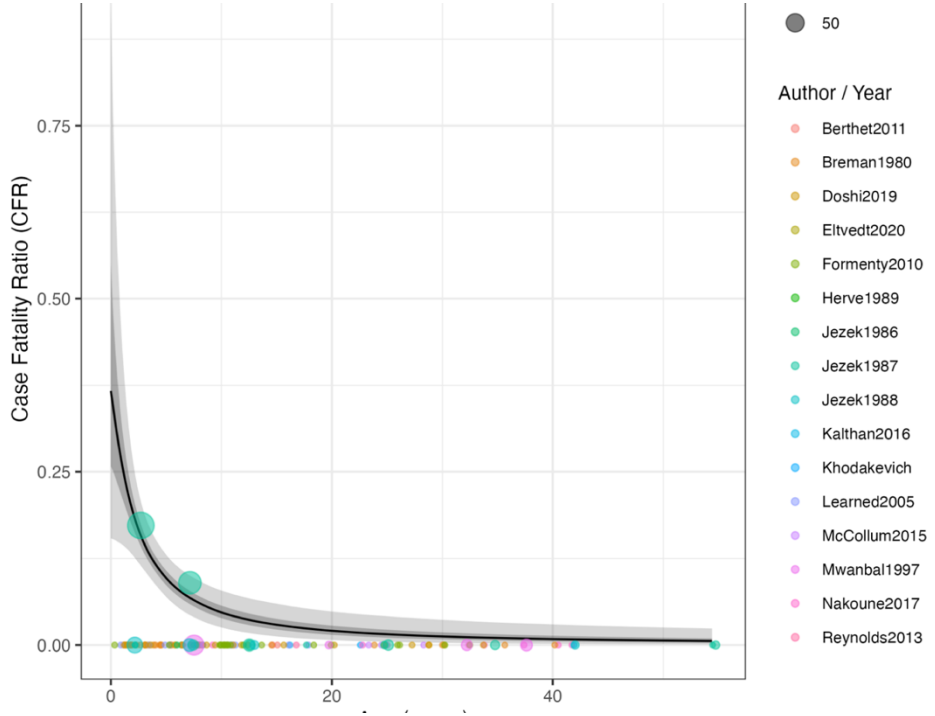
14 Jan 2025

Translate this page

The first instances of confirmed transmission of monkeypox virus (MPXV) clade I among close contacts of imported cases within the EU/EEA have been reported by Germany and Belgium. The European Centre for Disease Prevention and Control (ECDC) is in contact with national public health authorities in these countries regarding this recent development. The overall risk for the EU/EEA population remains low, as assessed in the rapid risk assessment published by ECDC on 16 August 2024.

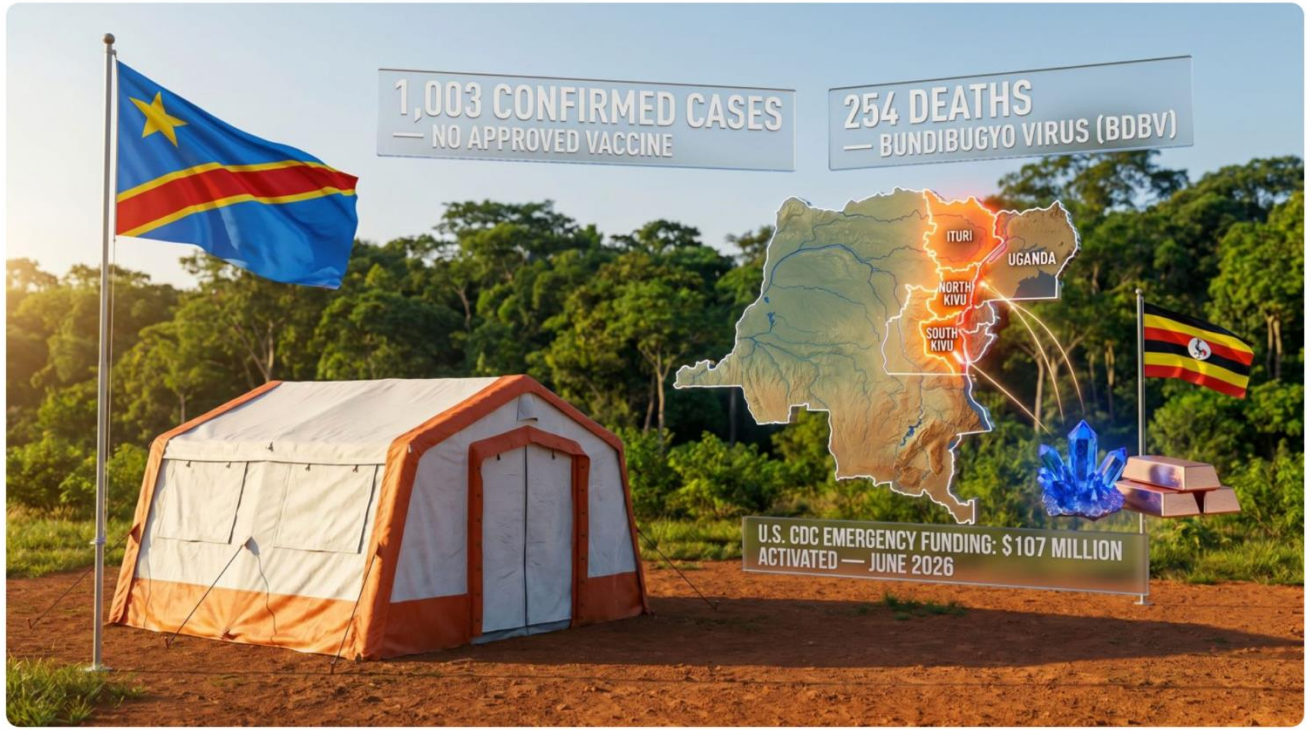
"Although significant uncertainties exist about the severity of mpox caused by MPXV clade I, most people experience mild to moderate symptoms, followed by a full recovery"





Photo's by Leandre Murhula Masariki, Kamituga hospital, DRC

75% of the world's Co and Cu



A Biomedical Blind Spot Collides With a Global Resource Crisis

United Nations | UN News
Global perspective Human stories

EN SEARCH

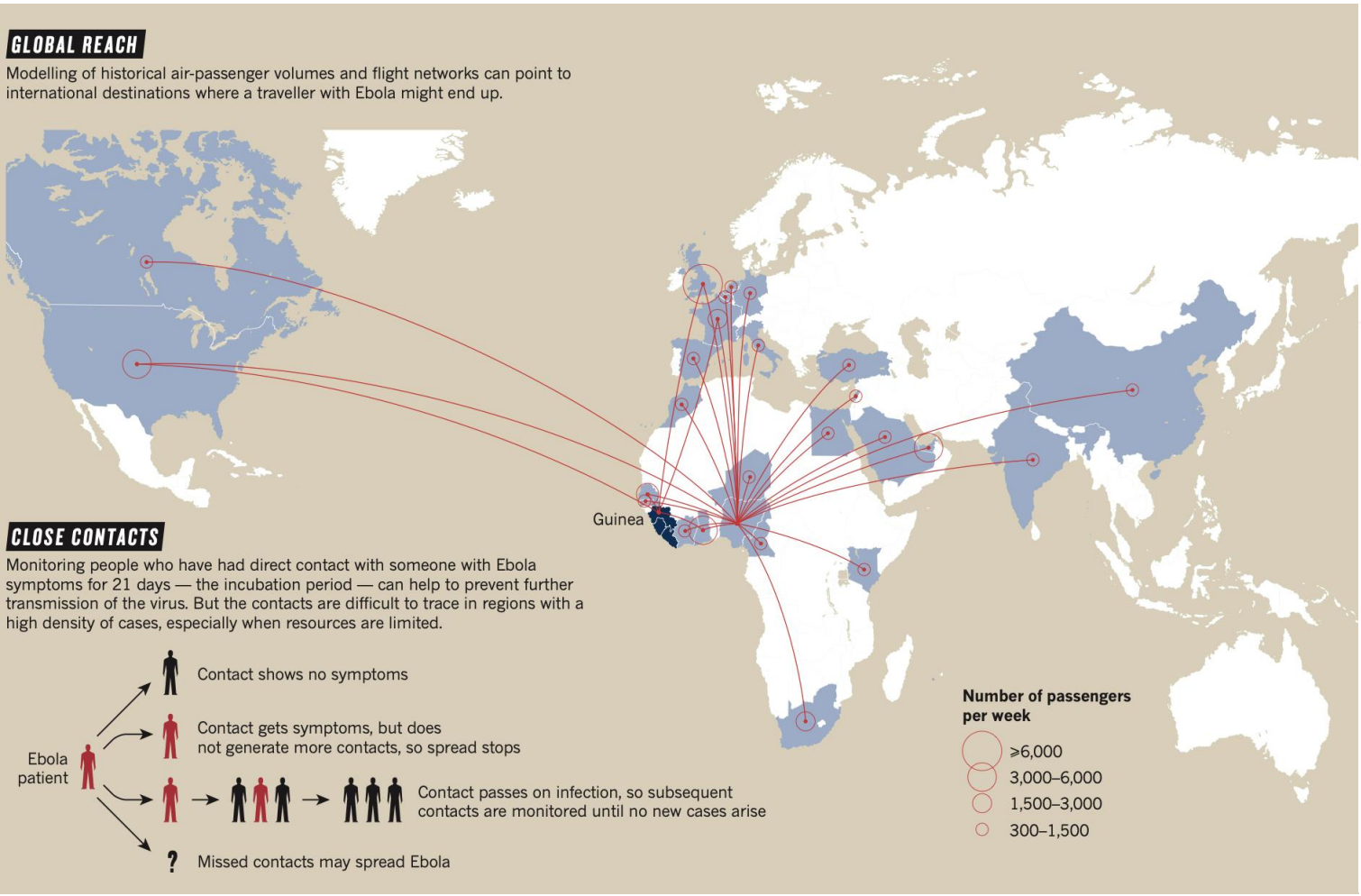
AUDIO HUB SUBSCRIBE

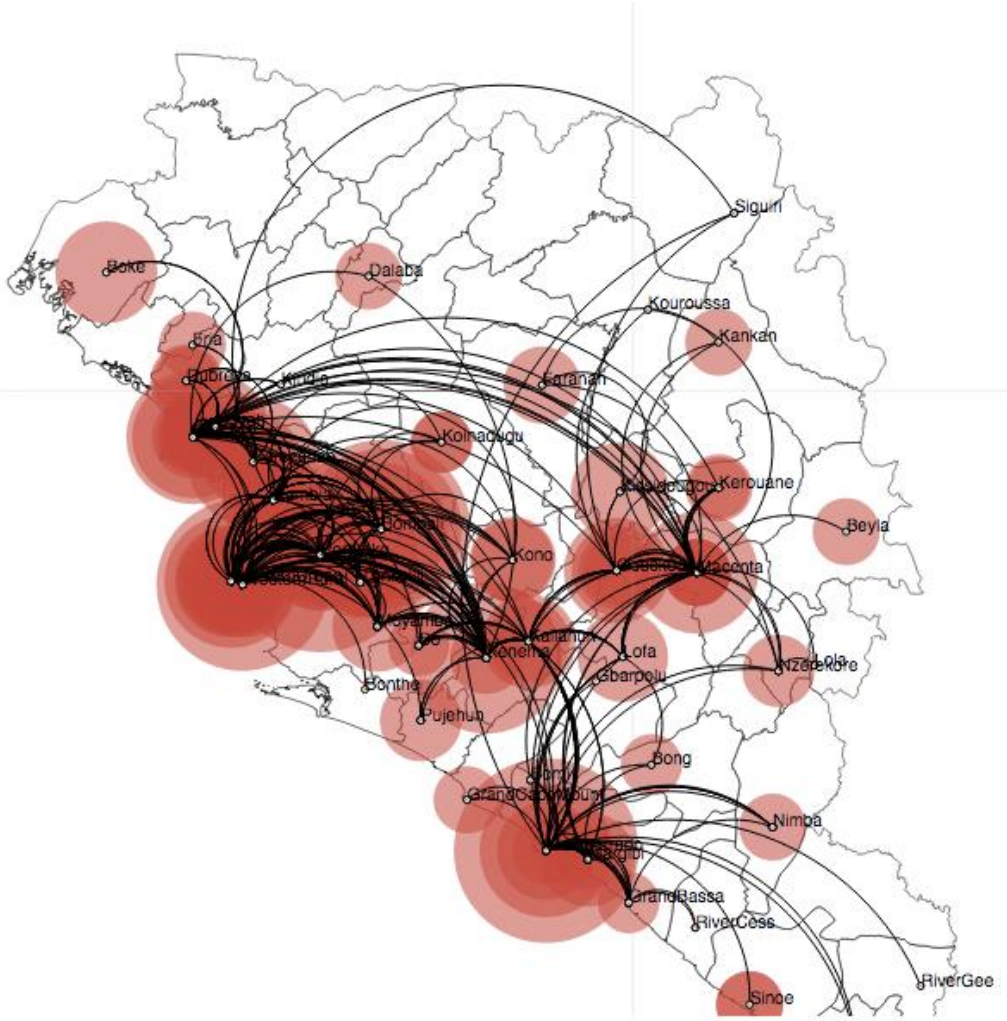
Hospitals overwhelmed in DR Congo, food running out: Goma faces 'devastation'



MONUSCO/Aubin Mukoni | UN peacekeepers patrol Goma in the eastern DR Congo after the city is overrun by rebel forces. In the foreground, military uniforms and equipment have been abandoned on the road.

https://discoveryalert.com.au/bundibugyo-ebola-outbreak-drc-cobalt-supply-chains-2026/





Butler et al, 2014; http://rambaut.github.io/EBOV_Visualization/Makona_1561_D3/


OCEANWIDE
HONDIUS


NETHERLANDS
SWITZERLAND
May 9
Ship will arrive at Tenerife. Non-Spanish passengers will fly home
8
May 3
MV Hondius arrives at Cape Verde
6
7
May 6
Three patients flown to hospital in the Netherlands.
Man in Switzerland hospitalised after arriving home
May 2
Another passenger dies on the ship
5
April 26
The woman dies in Johannesburg
April 27
Second patient flown to hospital
April 24
Deceased passenger's wife flown to Johannesburg
3
4
SOUTH AFRICA
ARGENTINA
2
April 11
First passenger dies of Hantavirus
April 1
MV Hondius leaves Ushuaia
1

Vial et al, Lancet 2023

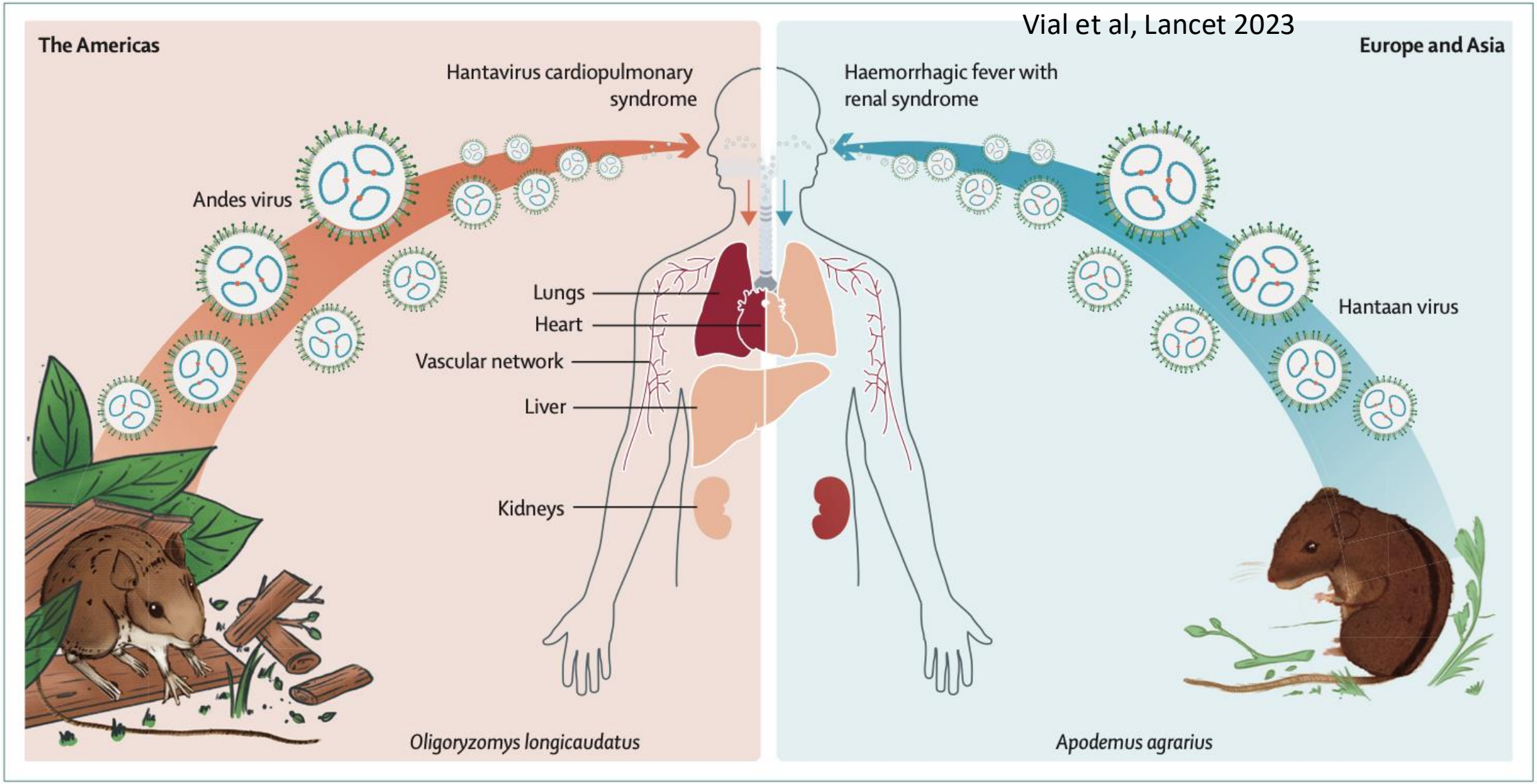
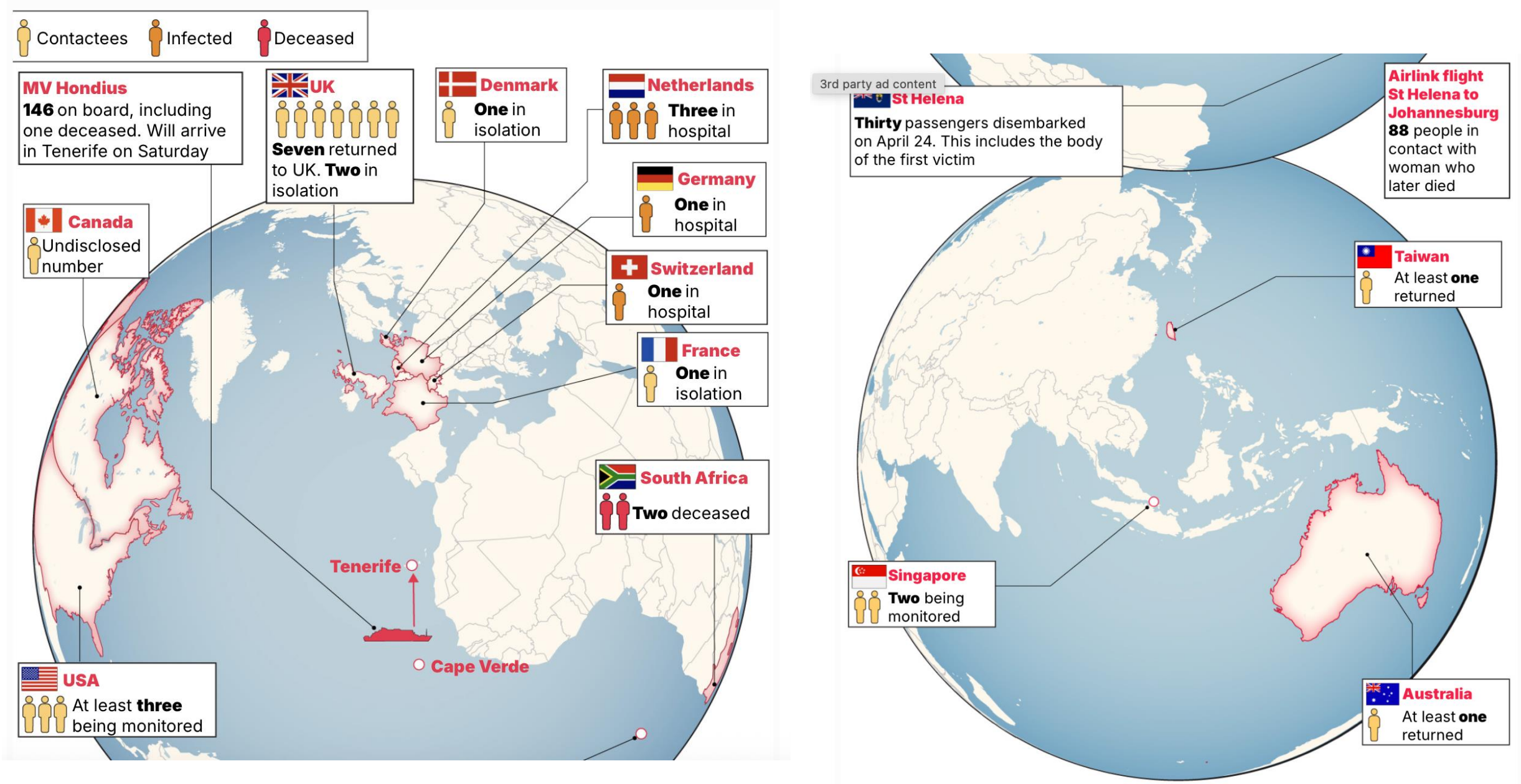
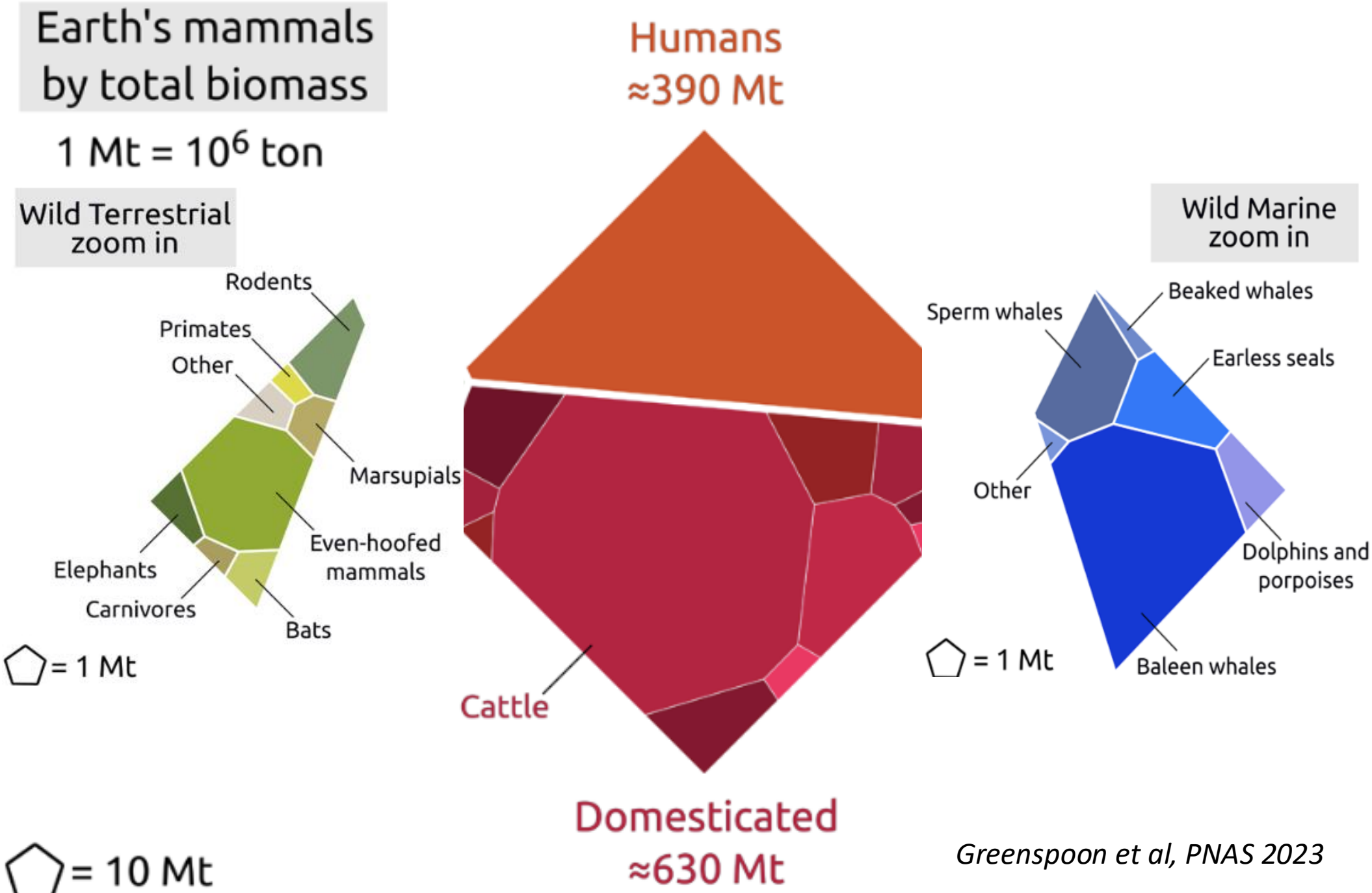


Figure 1: **Hantavirus transmission from rodents to humans**

Transmission mainly occurs via inhalation of aerosolised viral particles shed in rodent urine, faeces, and saliva. Organ and organ system involvement differs in magnitude according to the infecting virus. Andes virus, Hantaan virus, and their rodent host species shown in the figure are representative of pathogenic

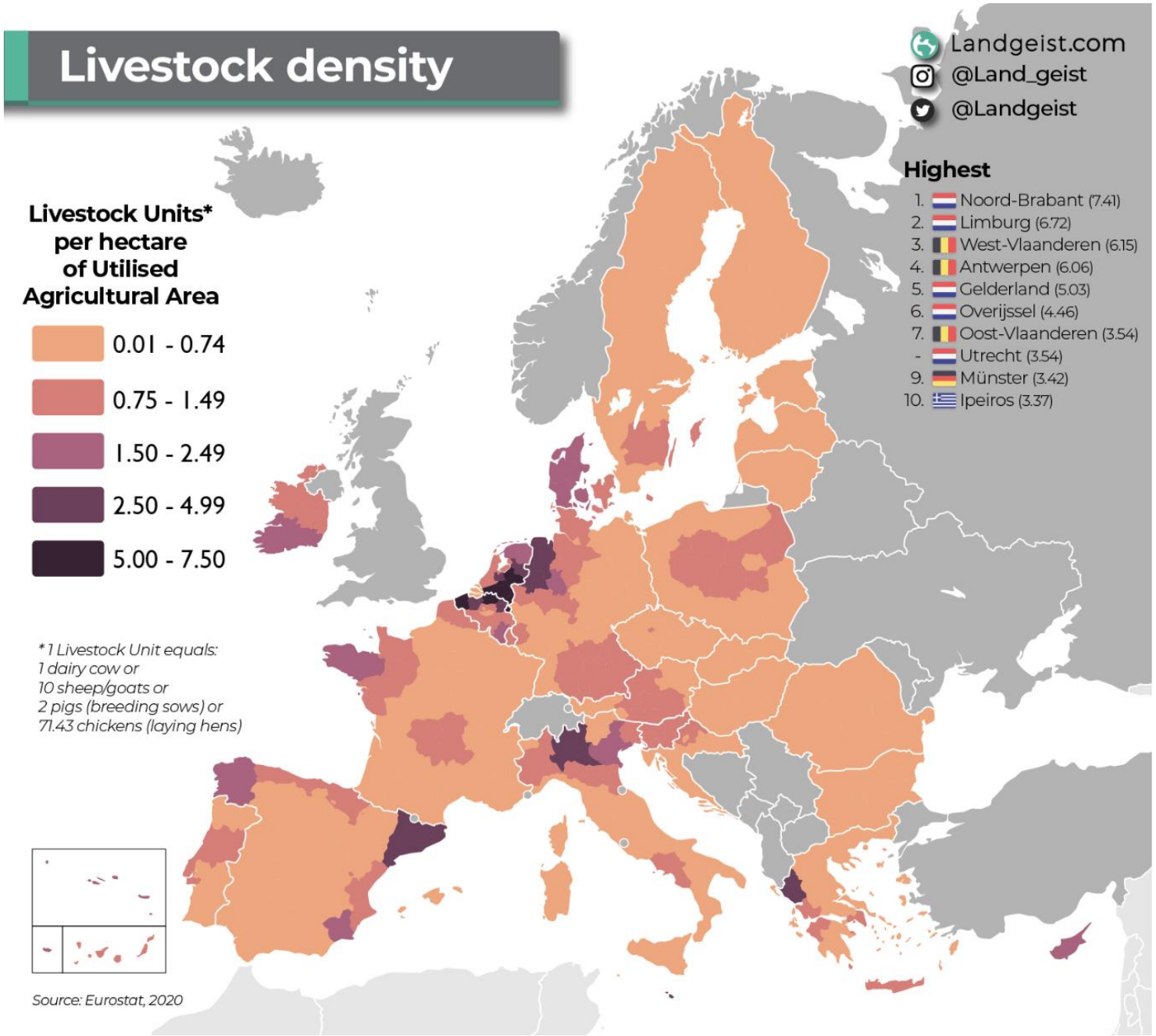


Daily mail, note: not entirely accurate, but shows countries involved

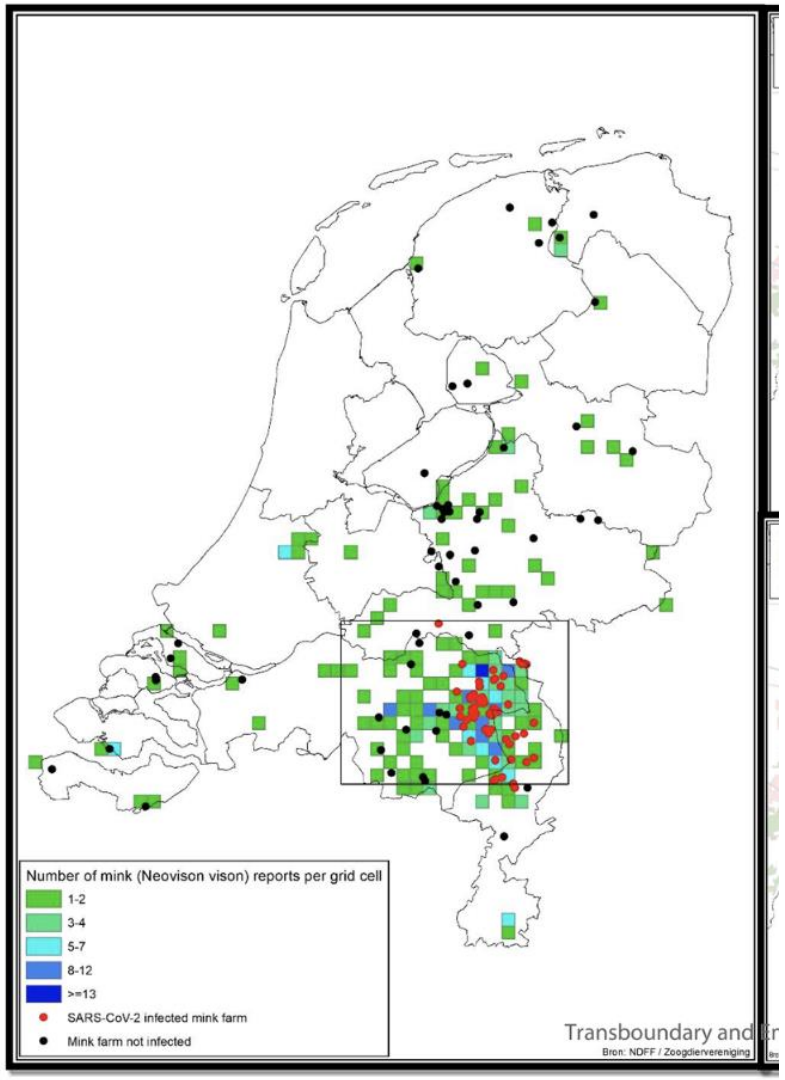


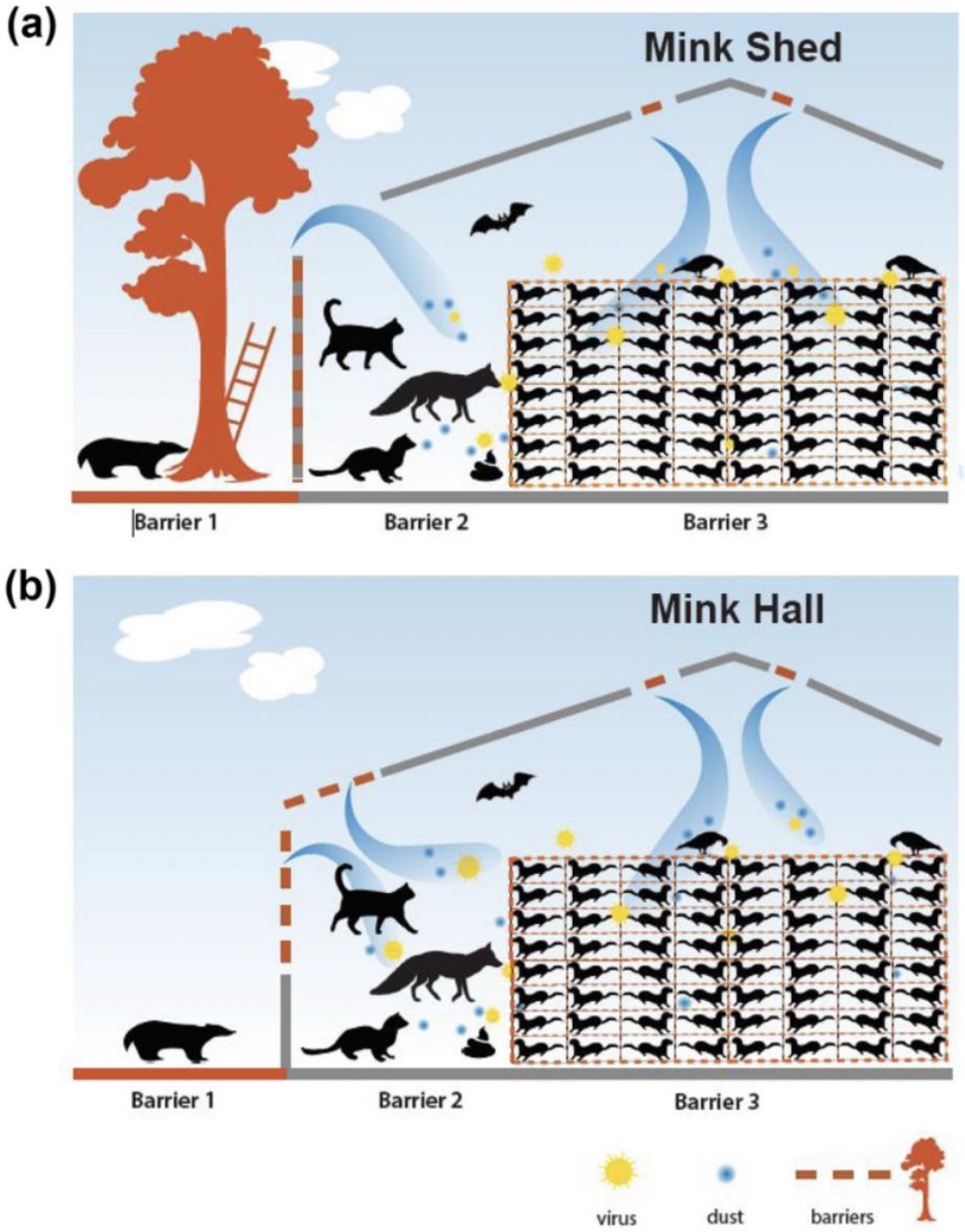
Greenspoon et al, PNAS 2023

Risk areas: high density farming



HIC ecotone

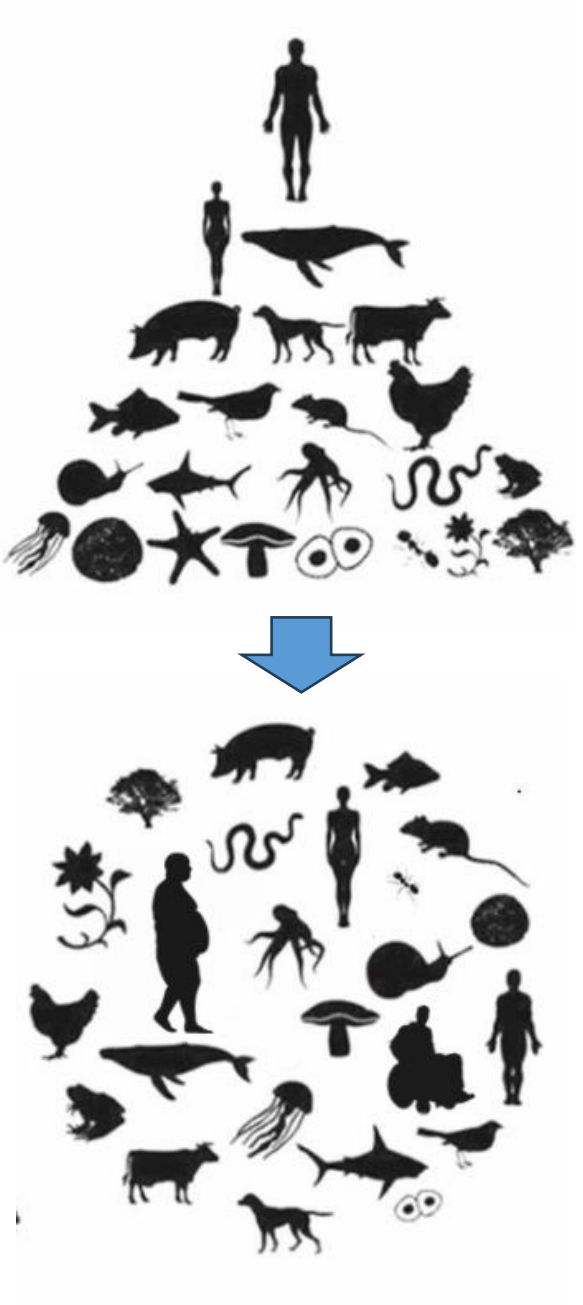




Sikkema et al https://pubmed.ncbi.nlm.nih.gov/35988158/

Take home messages

- One Health and Planetary health focus on understanding the root causes of disease emergence
- Human activities have impact on frequency and size of zoonotic disease outbreaks
- Getting ahead of this curve requires a more integral approach to prevention



https://www.veo-europe.eu
https://www.onehealthpact.org
https://www.globalsurveillance.eu/projects/great-life
https://juakivu.org

PANDEMIC & DISASTER Preparedness Center (PDPC)

DURABLE
Research Network against Epidemics

JUA KIVU
MPOX OUTBREAK RESEARCH

sequencing infectious diseases – African Great Lakes Region
GREAT-LIFE

Global Health
EDCTP3

NIH

NWO

Stevinpremie

ZonMw