Fighting Zoonoses Under the One Health Approach – Respect for all and harm to none?

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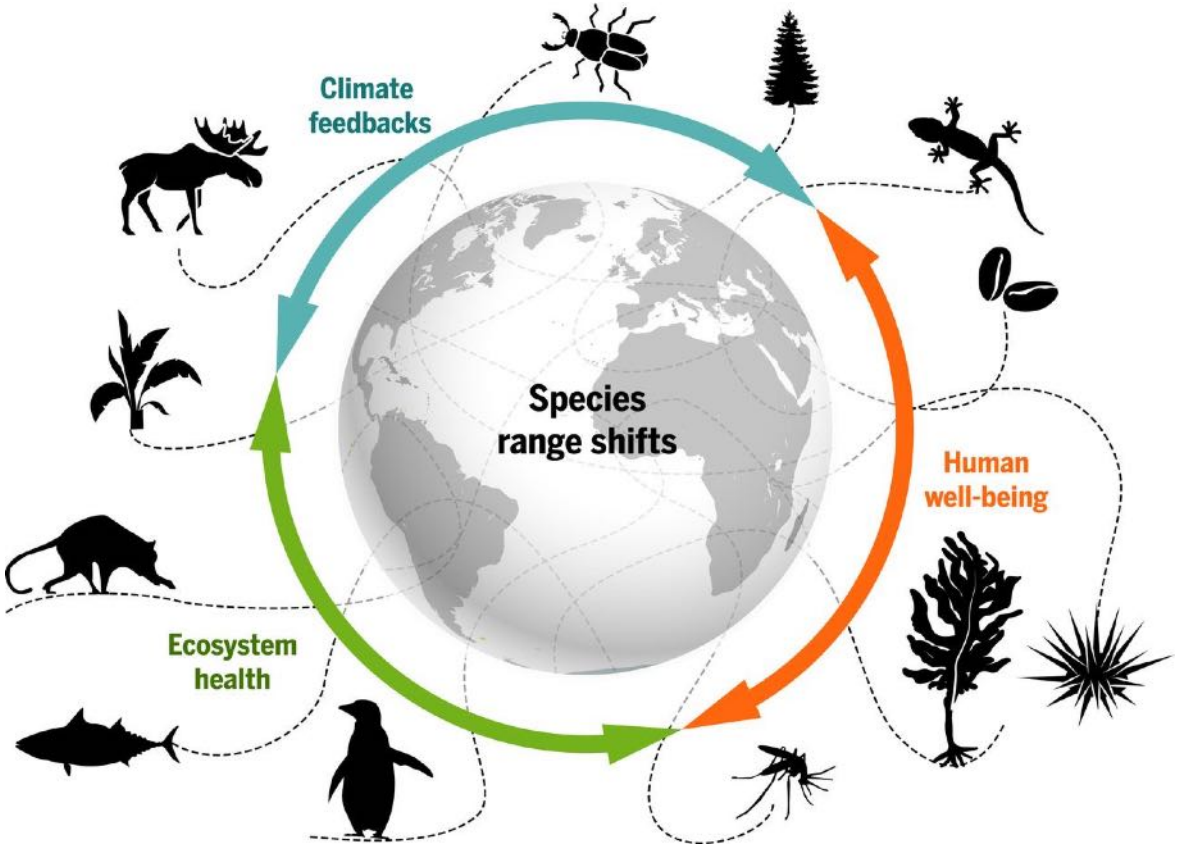
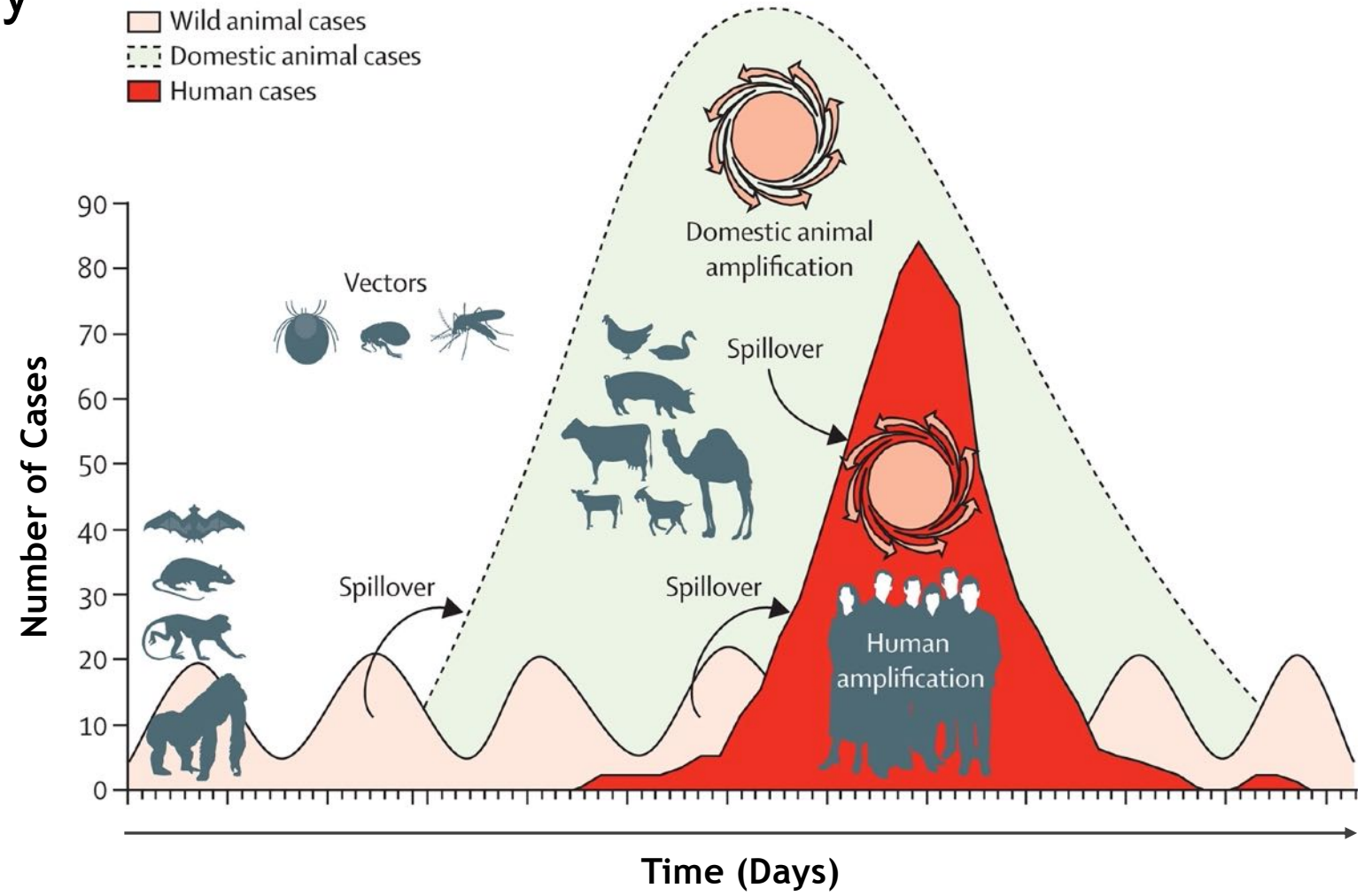
Friedrich-Loeffler-Institut
Federal Research Institute for Animal Health
Greifswald – Insel Riems

Shifting Geography of Life



Pecl, G. T. et al. 2017. Science

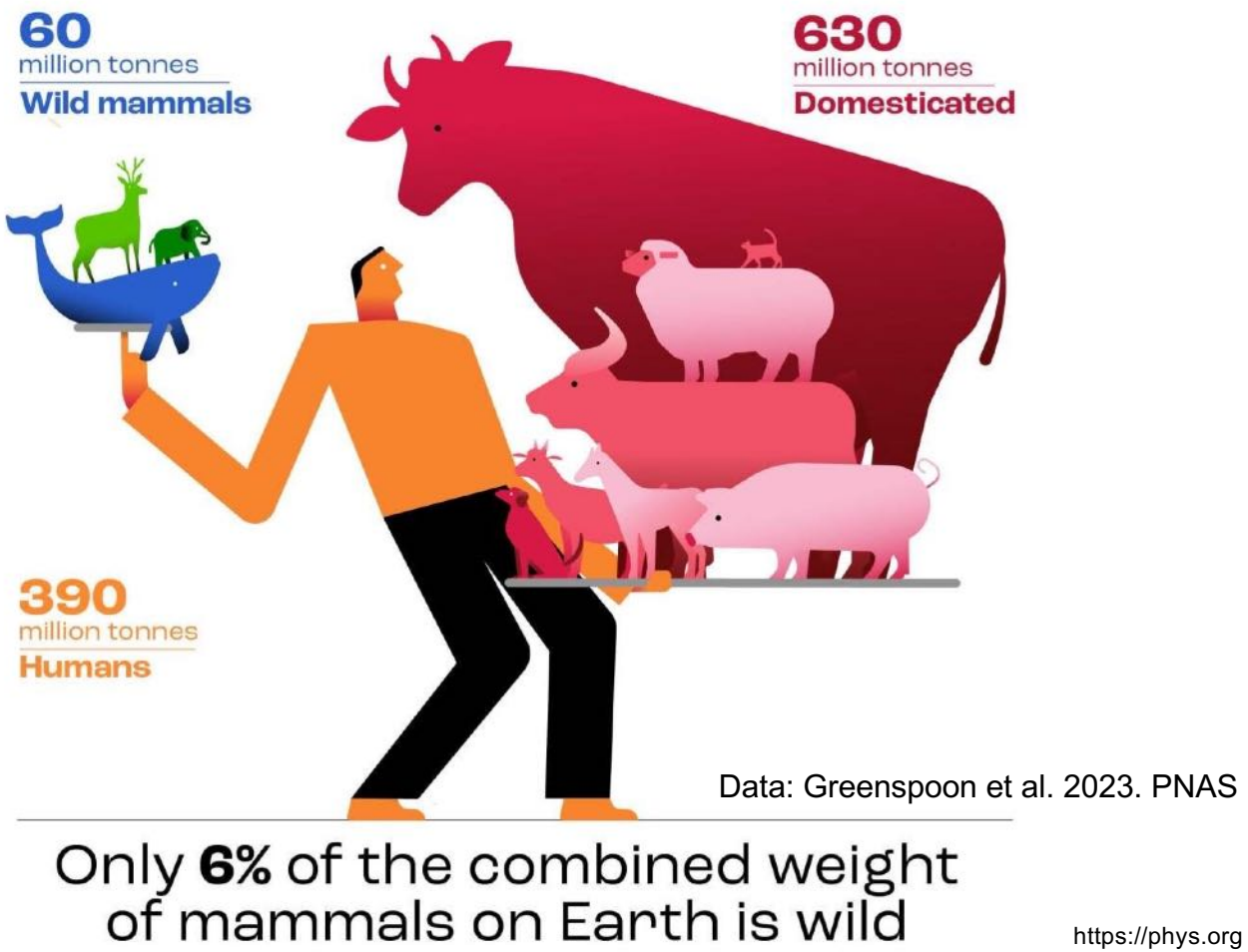
Disease Ecology



Karesh et al. 2012. Lancet

Disease Ecology

- Wildlife is a source for pathogens with epidemic potential
- Livestock is contributing relatively more to zoonotic spillovers than wildlife
- Spillovers can also have positive effects



Data: Greenspoon et al. 2023. PNAS

https://phys.org

Disease Ecology

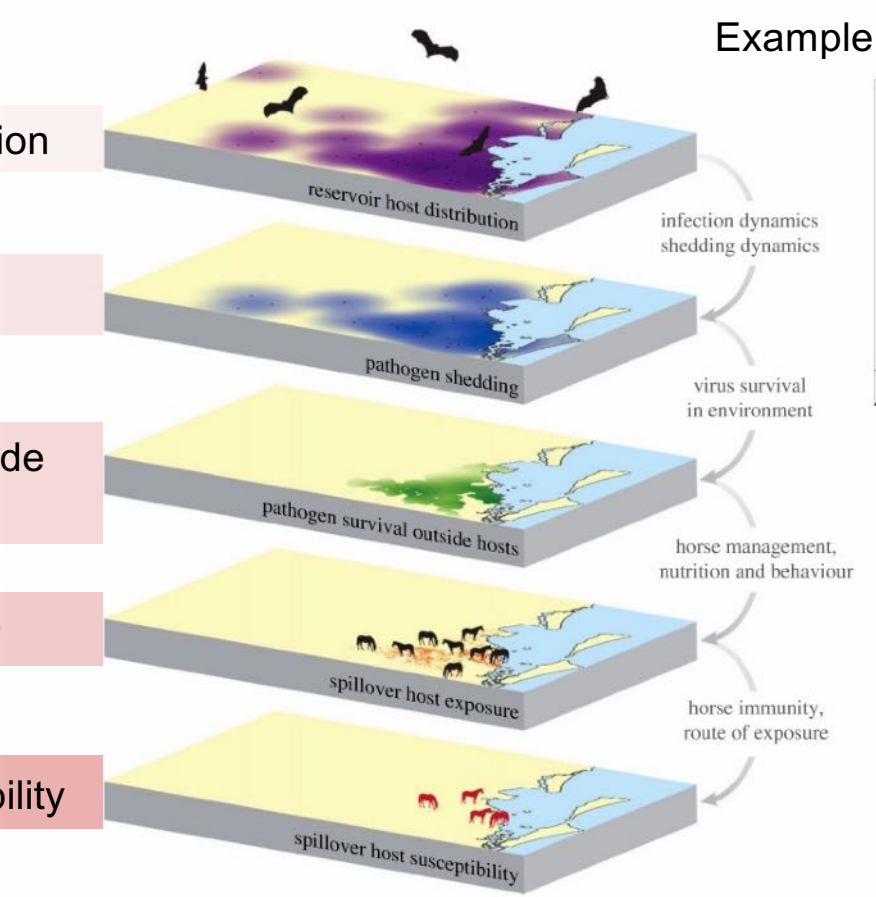
Reservoir host distribution

Pathogen shedding

Pathogen survival outside hosts

Spillover host exposure

Spillover host susceptibility

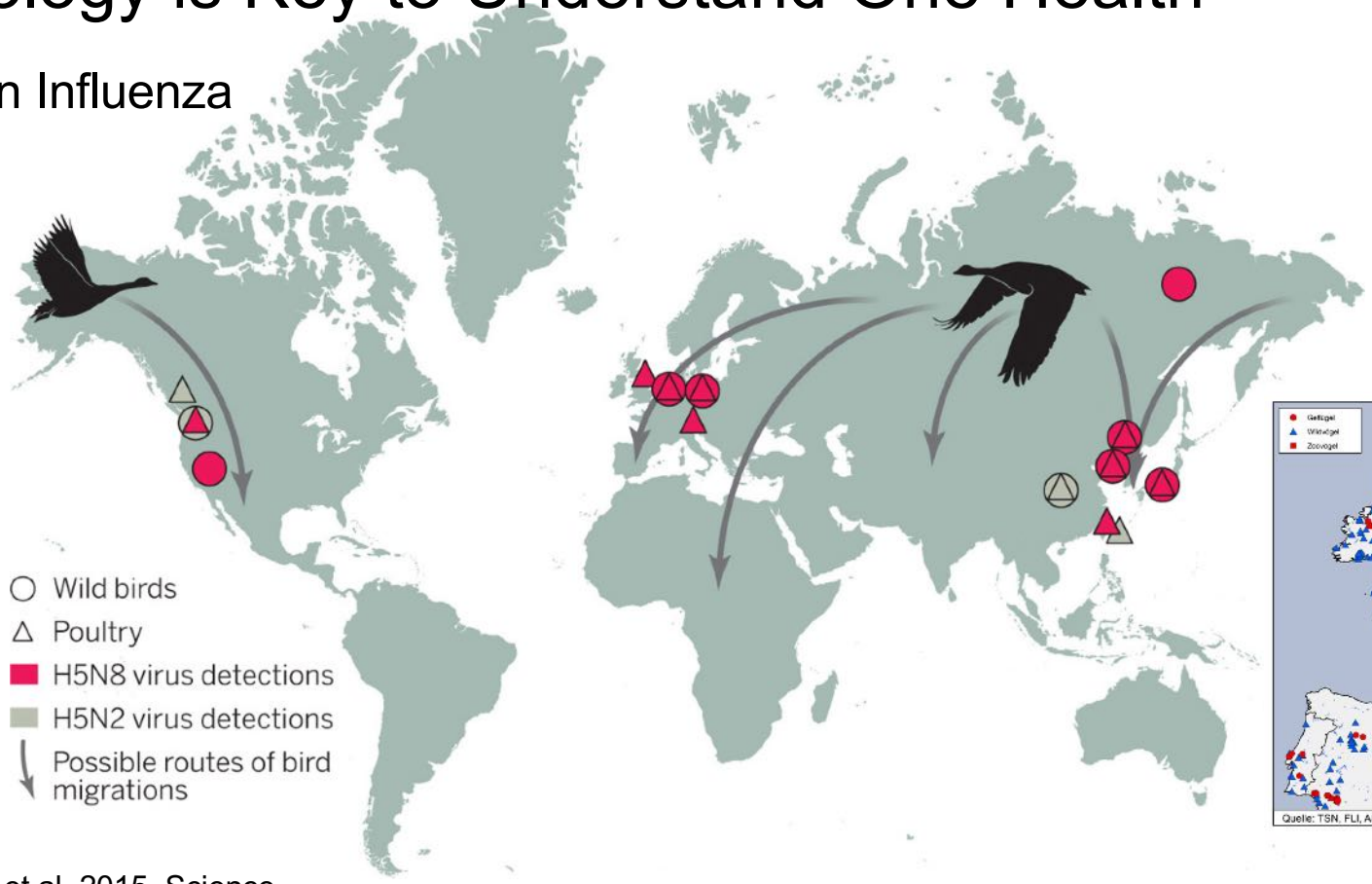


Example hendravirus

Plowright et al. 2015. Proc. Royal Soc B Biological Sci.

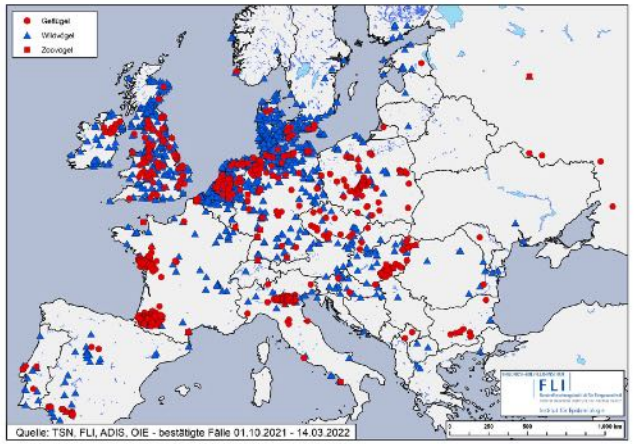
Ecology is Key to Understand One Health

Avian Influenza



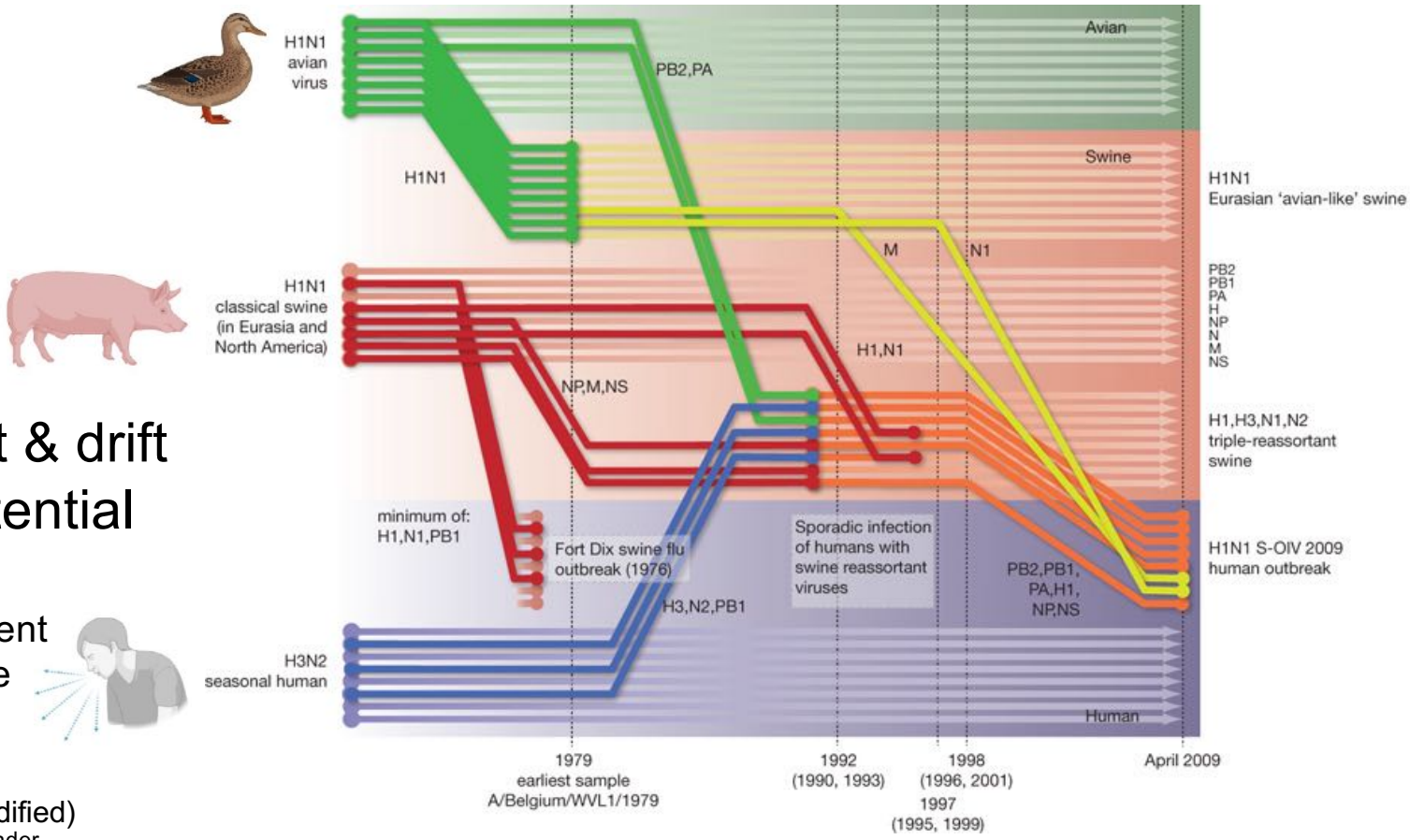
Verhagen et al. 2015. Science

FLI Risk Assessment



The Human Health Context

Avian Influenza



- Antigenic shift & drift
- Pandemic potential

Reconstruction of the sequence of reassortment events leading up to the emergence of S-OIV.

Smith et al. 2009. Nature (modified)
Animal and human pictograms: Biorender

The Socio-ecological and Economical Context

- Farmers are globally aware of avian influenza
- After reporting an outbreak and subsequent depopulation
  - Only global North gets financial compensation for depopulation
- Consequences
  - Lack of reporting
  - Market sale of sick animals and products (further spread of disease)
  - Increases risk behaviour (e.g., bushmeat consumption)
  - No access to health care

The Animal Welfare Context

LAND&FORST
Die Stimme der Landwirtschaft. Seit Generationen.

Christina Schulte, Dr. Peter Hiller, LWK Niedersachsen | am 08. November 2021

Vogelgrippe: Das ist bei der Aufstallung zu beachten

Die Vogelgrippe rückt mit diversen Funden bei Wildvögeln wieder in gefährliche Nähe und Hamburg verhängt bereits die Stallpflicht für Geflügel. Stress pur für Hühner und Gänse, die das nicht gewohnt sind. Wie kann man sie bestmöglich auf die Ausnahmesituation vorbereiten?

The Animal Welfare Context

Redaktion agrarheute, agrarheute
am Donnerstag, 25.05.2023 - 10:05

Immer wieder gibt es Ausbrüche der Vogelgrippe. In Bayern müssen 60.000 Hühner wegen des Verdachts der Vogelgrippe gekeult werden. In Rheinland-Pfalz wurde zum ersten Mal bei einem Fuchs der Erreger der Vogelgrippe nachgewiesen. Diese und weitere News zur Vogelgrippe und aktuellen Fällen lesen Sie hier.

Im Landkreis Regensburg (Bayern) besteht der Verdacht, dass die Geflügelpest ausgebrochen ist. Vorsorglich werden deshalb 60.000 Hühner eines Betriebs gekeult. Das hat die bayerische Kontrollbehörde für Lebensmittelsicherheit und Veterinärwesen (KBLV) mitgeteilt.

Die Allgemeinverfügung soll folgen. In ihr werden alle notwendigen tierseuchenrechtlichen Maßnahmen angeordnet wie die Einrichtung einer Schutz- und Überwachungszone.

Mit Material von AHO

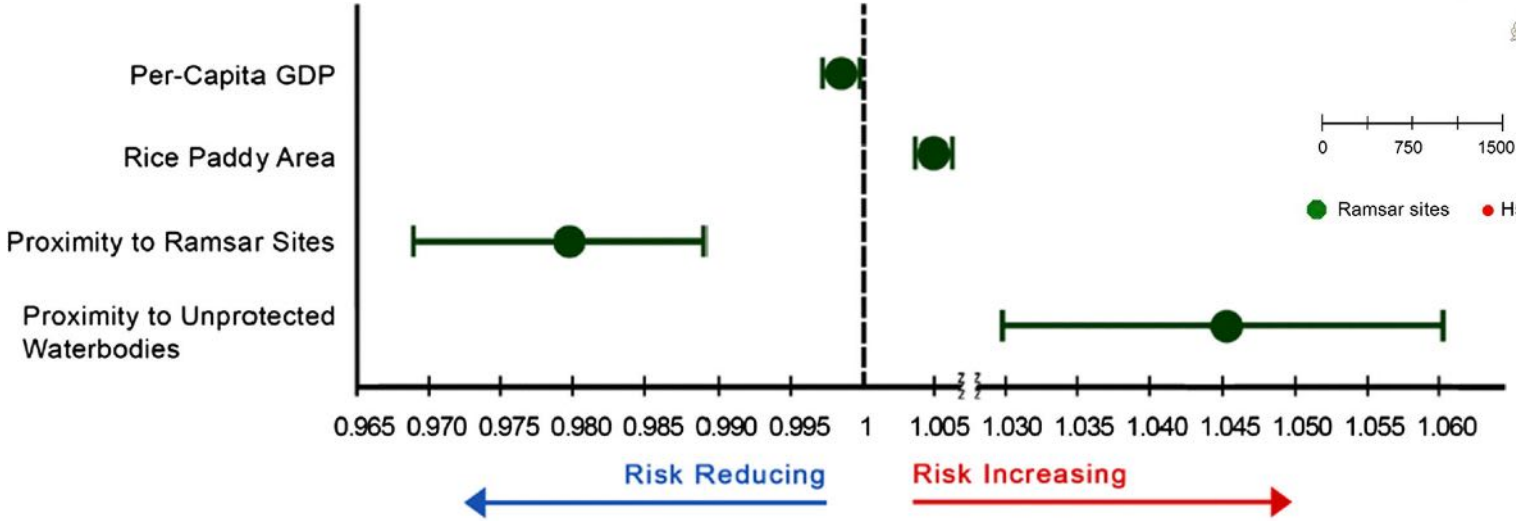
Niedersachsen | am 08. November 2021

as ist bei der Aufstallung

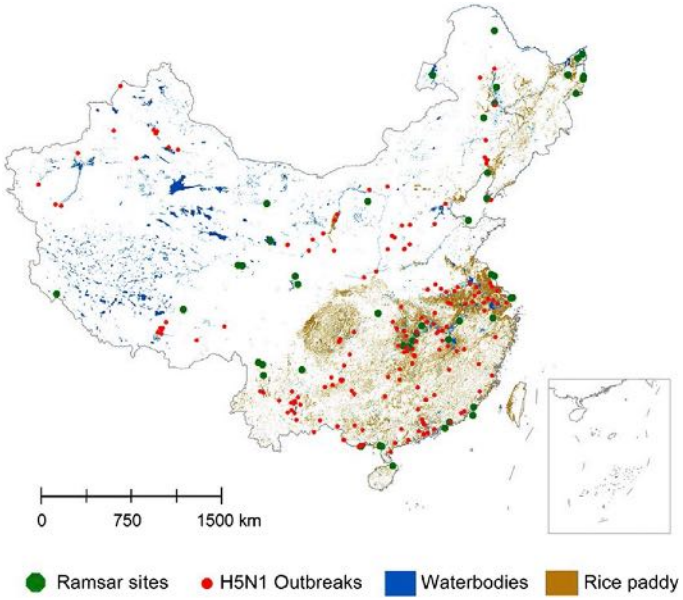
Die Vogelgrippe rückt mit diversen Funden bei Wildvögeln wieder in gefährliche Nähe und Hamburg verhängt bereits die Stallpflicht für Geflügel. Stress pur für Hühner und Gänse, die das nicht gewohnt sind. Wie kann man sie bestmöglich auf die Ausnahmesituation vorbereiten?

The Ecosystem Health Context

The relative risks of environmental and socioeconomic predictors in HPAI H5N1 poultry outbreaks (in China)



Odds ratios and 95% confidence intervals



(Wu et al. 2019. Ambio)

Per-Capita GDP as proxy for biosecurity
Ramsar Sites: Protected wetlands

Bird communities composed of more high-risk host species and closely related species are more likely experiencing H5N1 outbreaks. Huang et al. 2019. J Anim Ecol.

Agriculture – A Complex and Highly Dynamic System

Livestock producers are changing production systems to cope with climate change

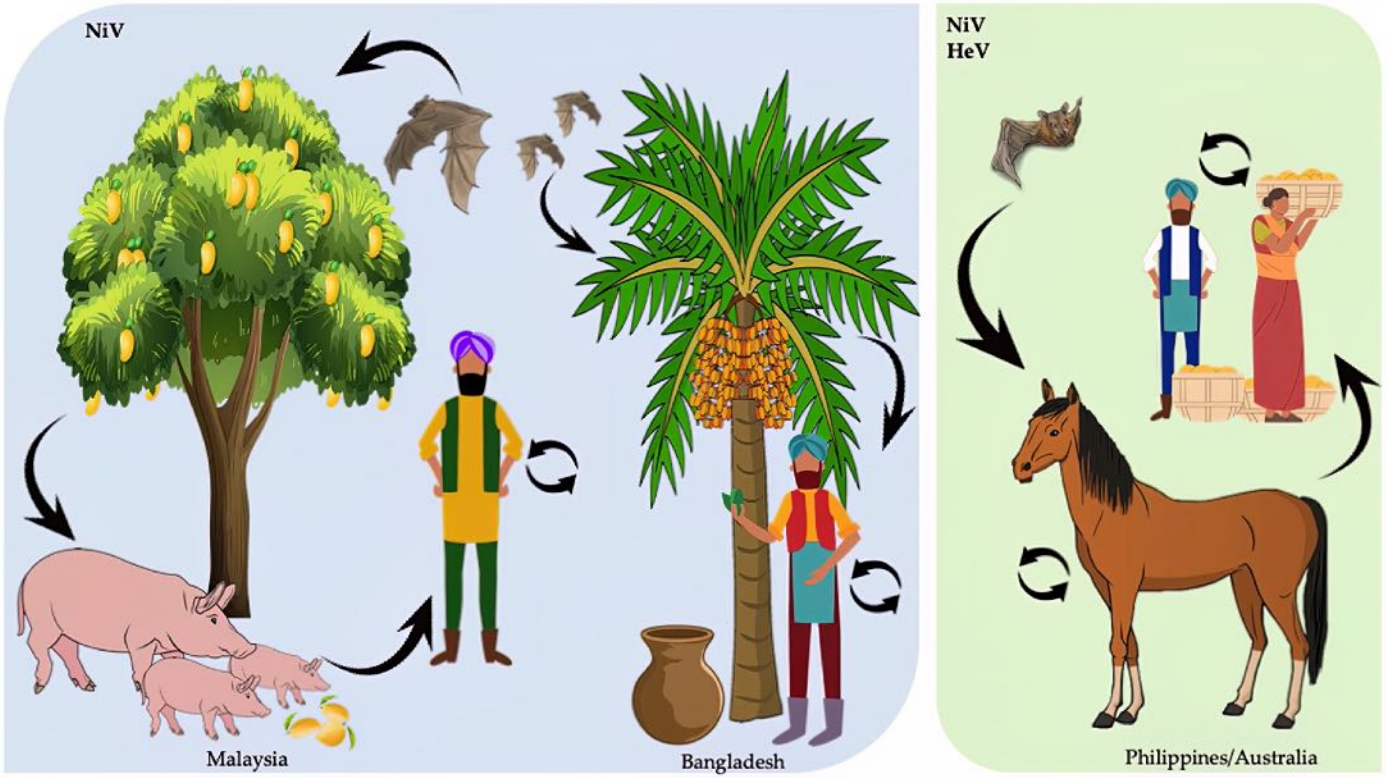
- **Nipah** virus outbreaks in pigs in Malysia after intensification of pig industry to compensate loss from fruit production
- **Q-fever** outbreak in response to increased goat milk production
- **Brucellosis** emerged when livestock numbers in Mongolia increased
- Short-generation-interval poultry production systems support the emergence and spread of **AI**

Reviewed in Black et Butler. 2014. Rev sci tech Off int Epiz

Impact of Climate Change on Disease Ecology

Livestock producers are changing production systems to cope with climate change

- **Nipah** virus outbreaks in pigs in Malaysia after intensification of pig industry to compensate loss from fruit production



Lawrence and Escudero-Pérez. 2022. Viruses

i0.wp.com

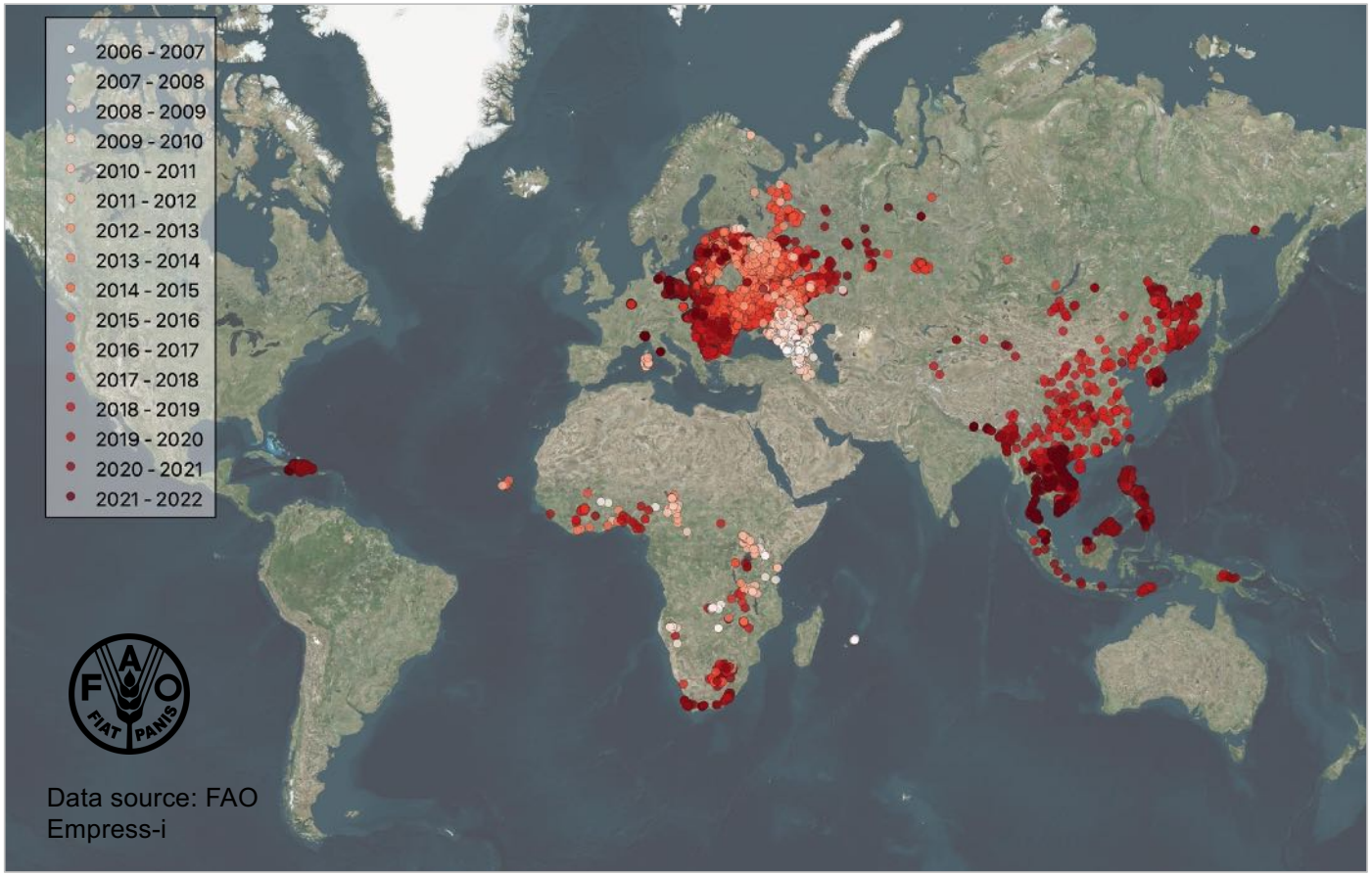
- Dangerous interaction of two or more diseases in a population
- Leads to worse health outcomes

Classical examples

- Flu and bacterial infection
- HIV & tuberculosis
- Syphilis & HIV

Under the One Health approach we should also include non-zoonotic diseases!

African Swine Fever – The Forgotten Pandemic



Data source: FAO Empress-i

e.g. Viet Nam (2019)

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A quarter of all pigs have died this year due to African swine fever

LIFE 5 November 2019, updated 8 November 2019

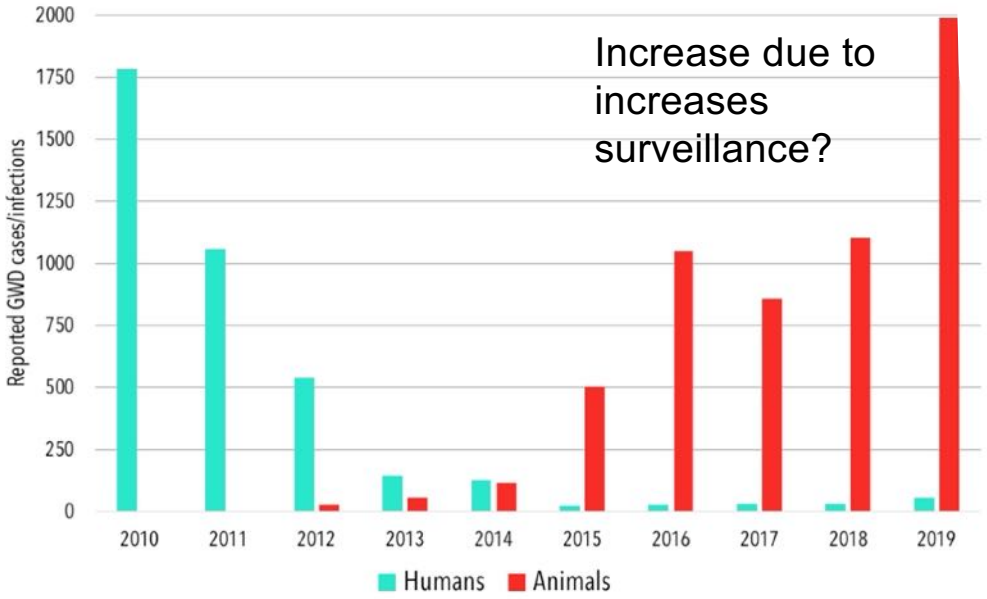
By Debora Mackenzie

A dead pig is put into a quarantined pit in Hanoi to stop the spread of African swine fever

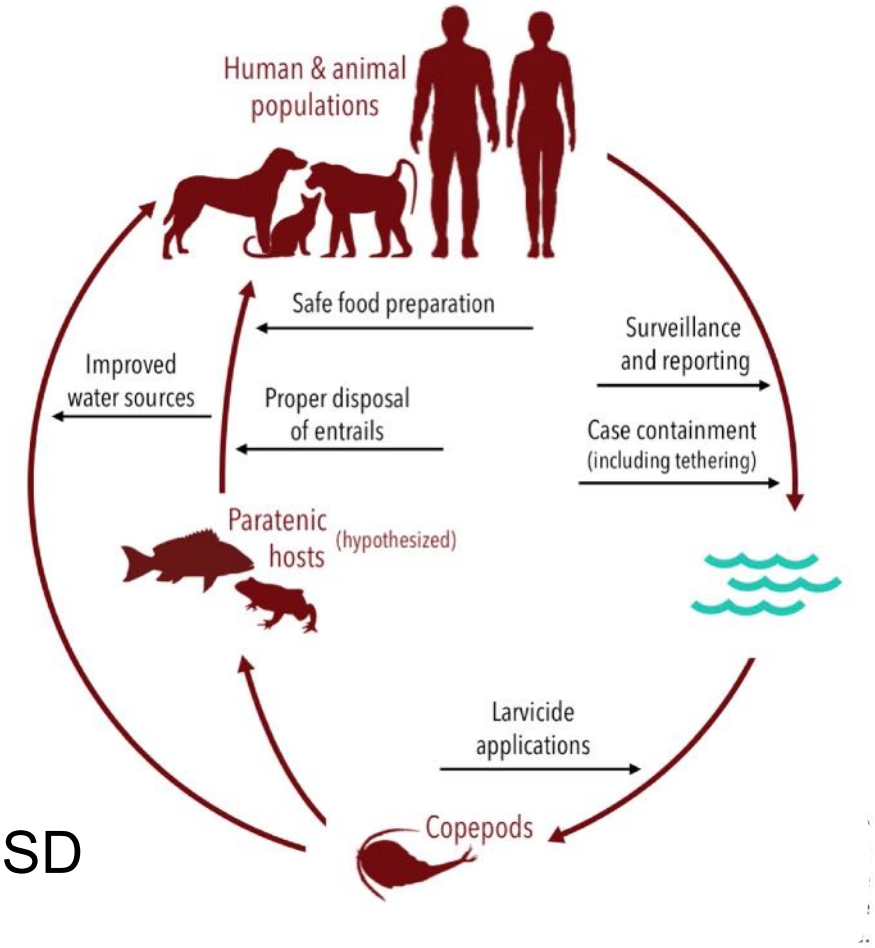
Dracunculiasis

- Target to eradication (NTD road map 2021-2030)

Dracunculisis



Boyce et al. 2020. Tropical Medicince Infect.



- Eradication costs (1987-98) ~88 Mio. USD
- One Health strategy required

Public Veterinary Service – Stable to Table

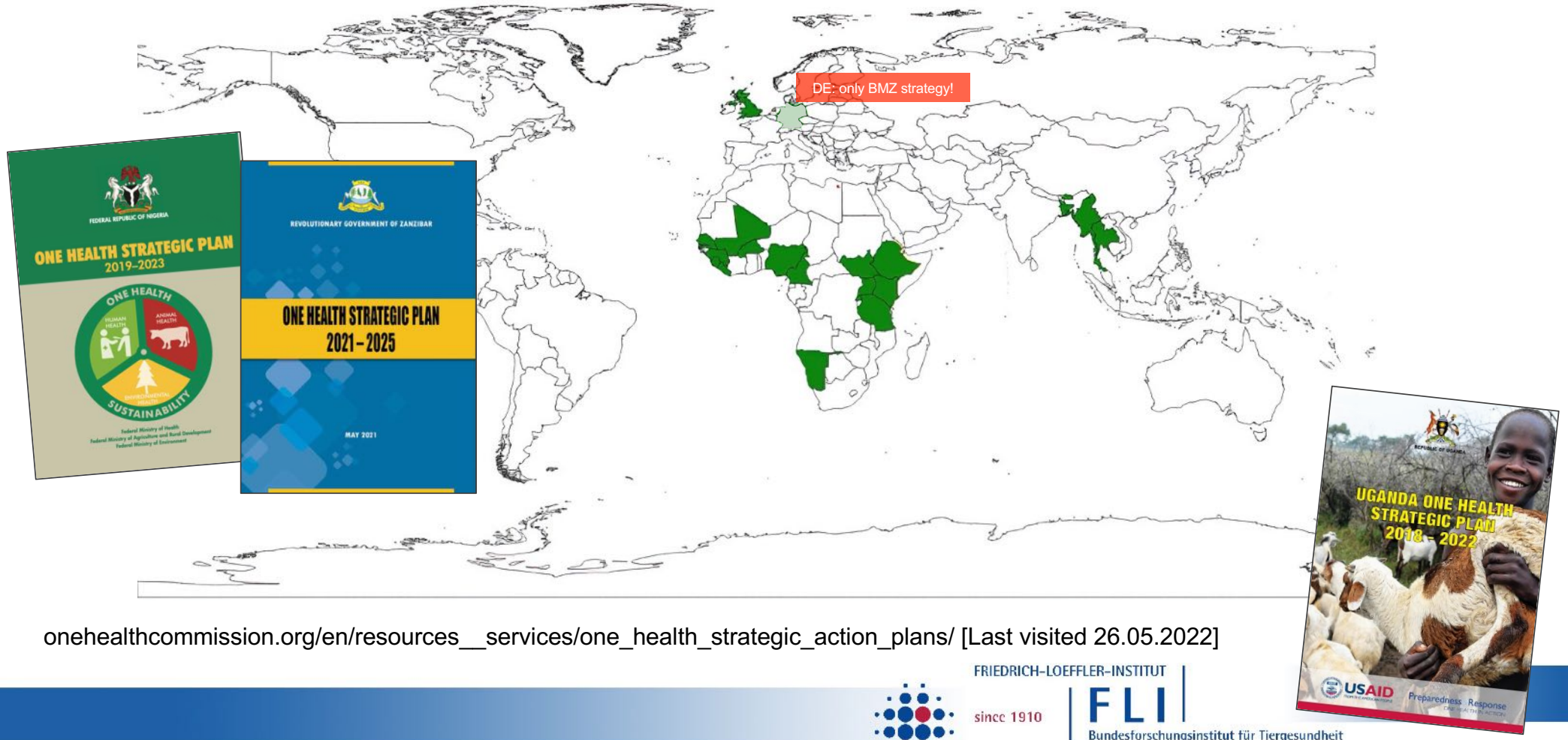
sustainabledevelopment.un.org

commons.Wikimedia.org

echo-online.de

borchelhof.de

National One Health Strategic Plan



onehealthcommission.org/en/resources__services/one_health_strategic_action_plans/ [Last visited 26.05.2022]

National One Health Strategic Plan

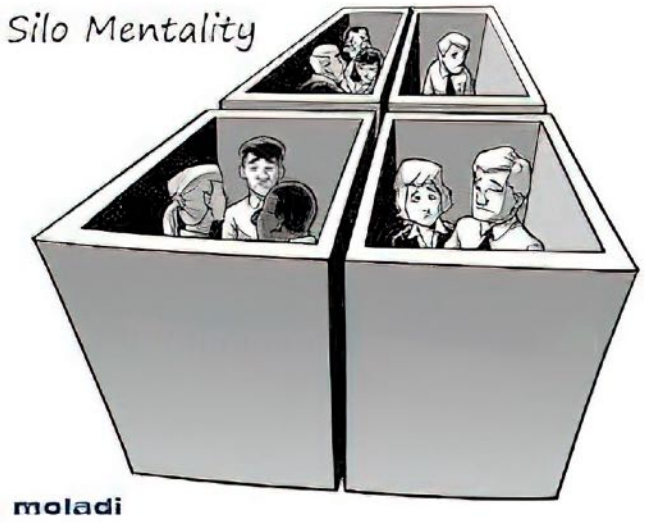
Page 22

"Veterinarians trained in public health, including graduates of NFELTP programs, are employed by the Ministry of Agriculture and Rural Development at the national and state levels.

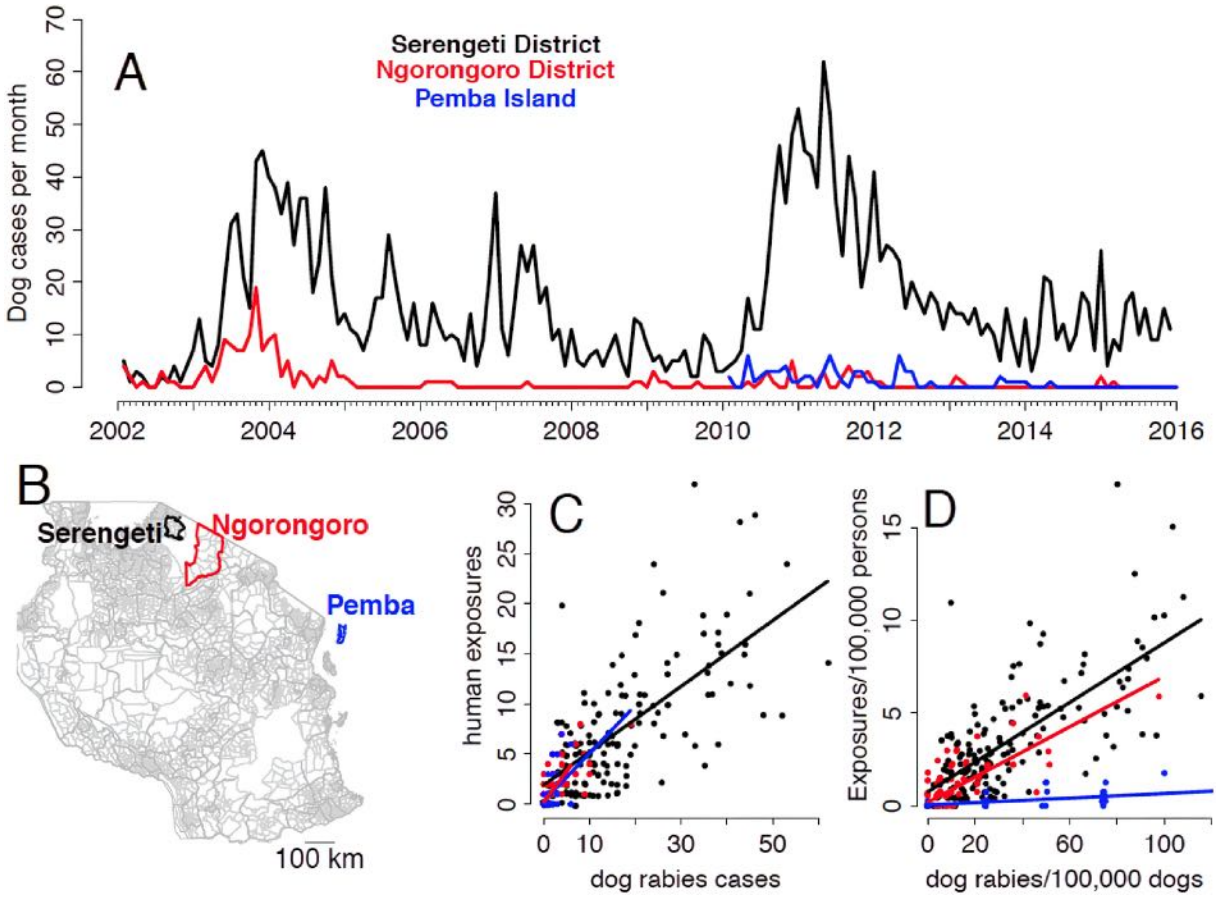
Joint field investigations of outbreaks of zoonotic diseases, including Lassa fever and rabies, have been conducted, particularly by the NFELTP, **and have included veterinarians**."

National One Health Strategic Plan

- 3 years after the SARS-CoV2 pandemic started, Germany has still no National OH Strategic Plan
- Disease outbreak investigations are traditionally ‘siloed’ approaches (disciplinary)
- Limited cross-sectoral data sharing
  - No exchange
  - No standardized interface
- Legal and organizational restrictions



The Value of Cross-Sectoral Data Sharing

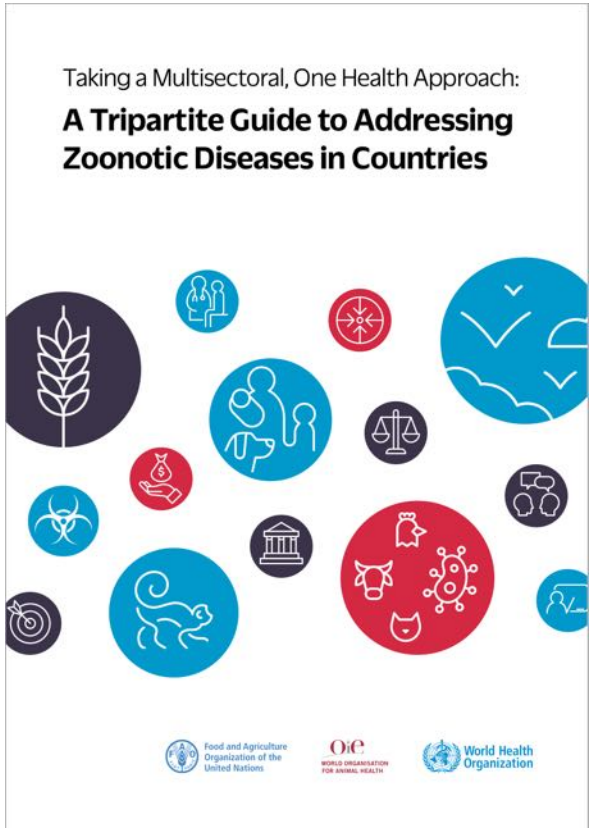


Rabies

- Briefed health care system (improved PEP)
- Evidence guided capacity building
- Resource-oriented prioritisation of intervention methods (vaccination campaigns)

Hampson, K. *et al*. *bioRxiv* (2016)

The Value of Cross-Sectoral Data Sharing



5.4 **Joint risk assessment for zoonotic disease threats**

Best Practice

JRA...

- for zoonotic disease is more widely applicable and more valid than RA done by one sector;
- identifies gaps in knowledge for targeting surveillance and capacity building;
- includes information from the RA done in each sector and provides information to sector-specific assessments;
- provides information needed for action based on specific risks;
- provides agreed options for risk management and communication that are relevant and acceptable to stakeholders, and so more likely to be effective.

Tools to foster intersectoral collaboration

International Health Regulations (IHR)-Public Veterinary Service (PVS) National Bridging Workshop

- Brings together stakeholders from the animal health and human health services within a give country

The Inequity in One Health

- Many countries in the tropics are committed to the One Health thinking (*more than countries in the Northern Hemisphere*)
- Uneven distribution of resources
  - ❖ imbalance of the health system
- Cross-sectoral collaboration only possible when all partners have basic equipment and training

Livestock Health ‘Data Hub’, Zanzibar 2022

One Health High Level Expert Panel (OHHLEP)

- Founded May 2021
- 26 selected key international experts
- Advisory role

Co-chairs:
Thomas Mettenleiter Wanda Markotta

Current focus:

- ❖ Policy relevant scientific assessment
- ❖ Guidance and development of a long-term strategic approach

Food and Agriculture Organization of the United Nations

World Organisation for Animal Health
Founded as OIE

UN environment programme

World Health Organization

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Food and Agriculture Organization of the United Nations

World Organisation for Animal Health
Founded as OIE

UN environment programme

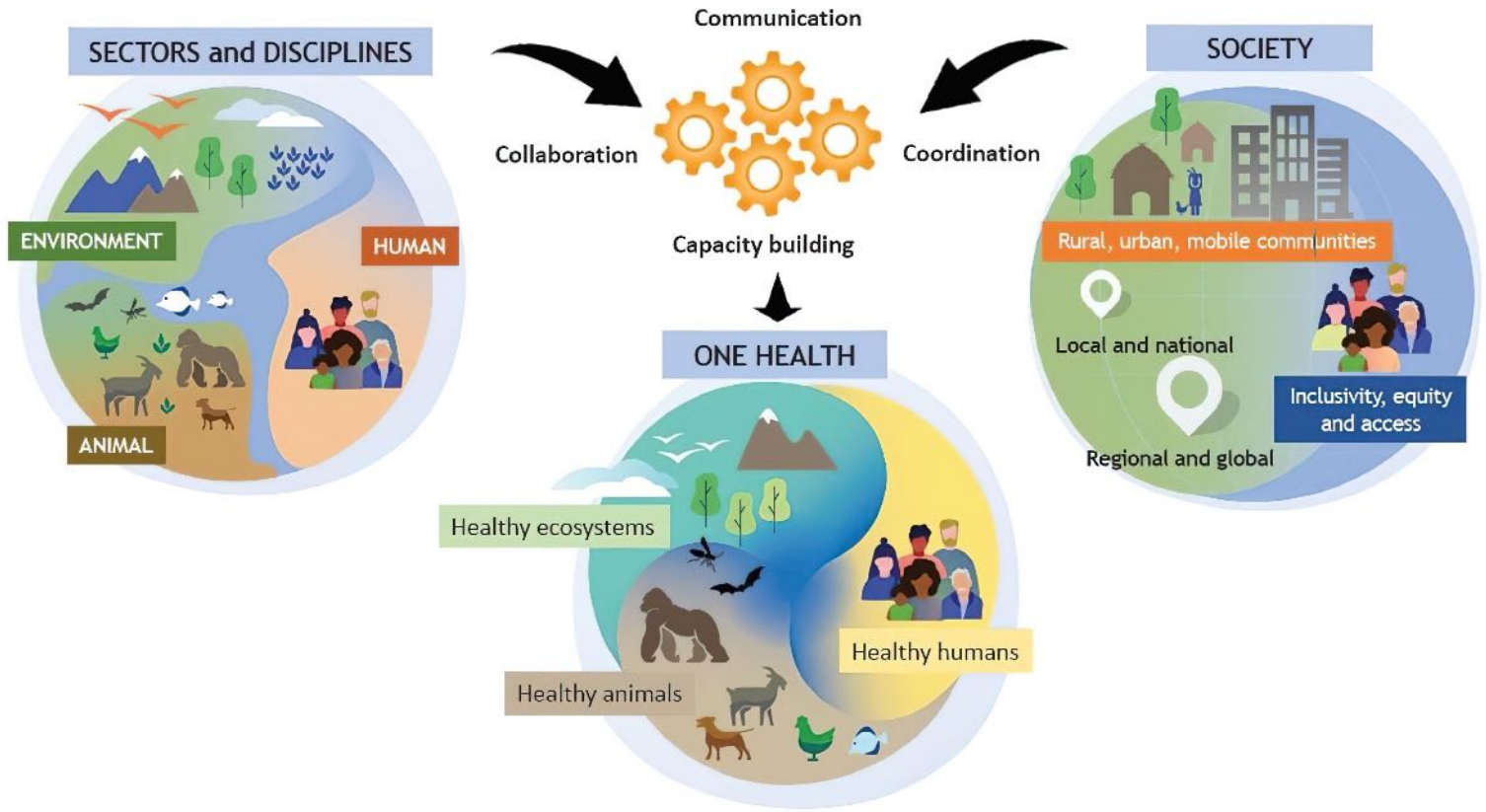
World Health Organization

OHHLEPs Definition of One Health

"One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems."

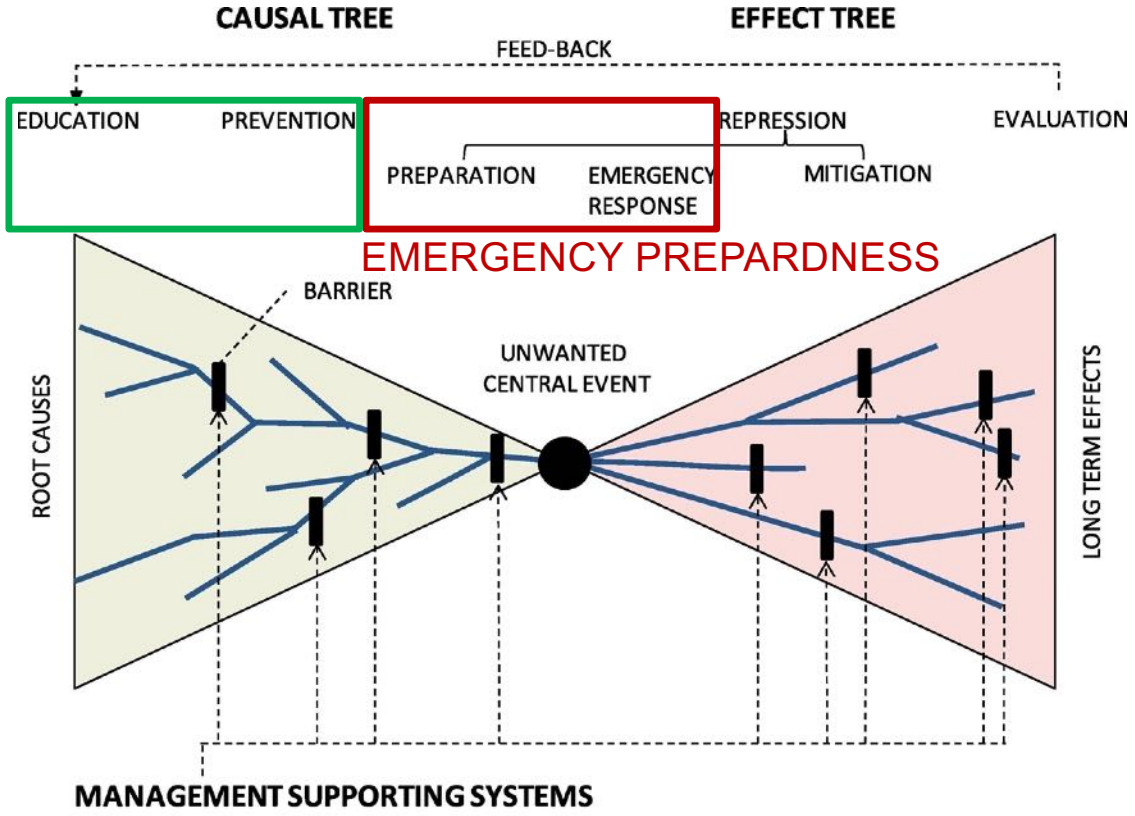
OHHLEP (2021)

OHHLEPs Definition of One Health



OHHLEP (2021)

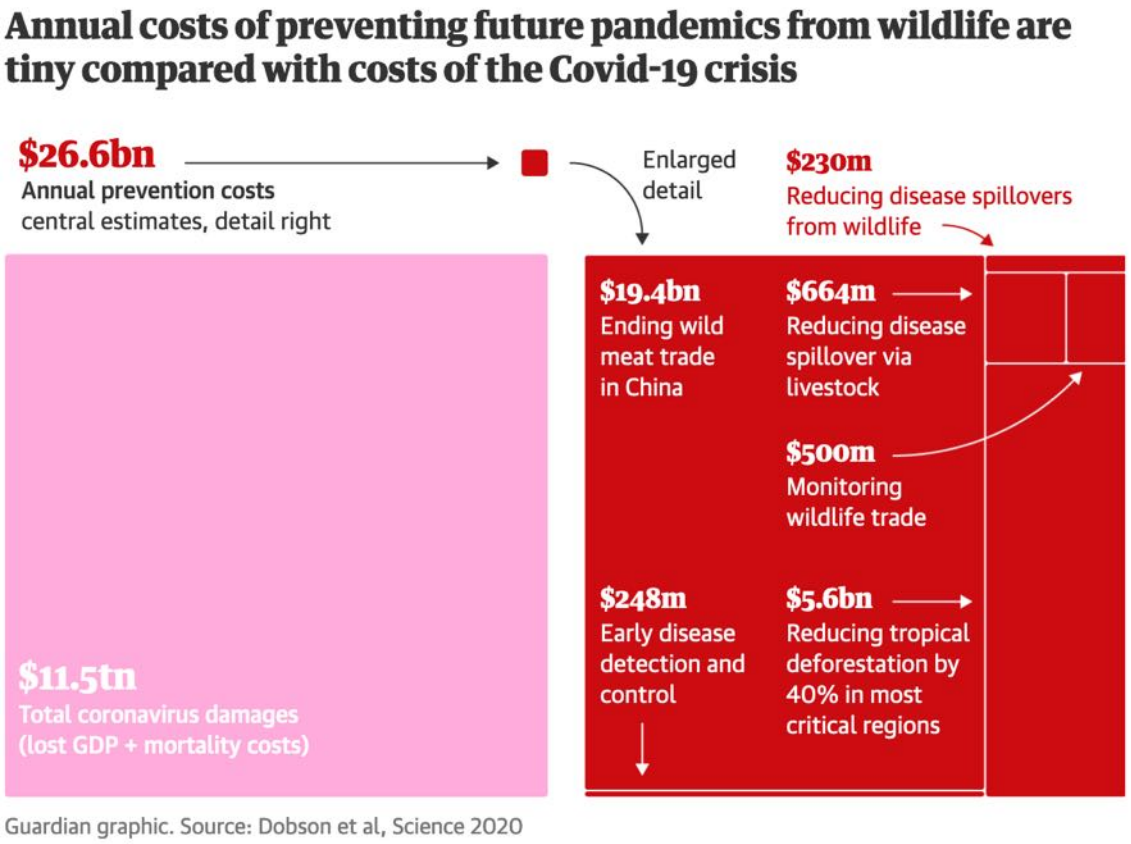
Root Causes and Long-Term Effects



Bow-tie model and the safety hierarchy

Lindout, P. et al. 2017. Safety Sci

The COVID19 aftermath

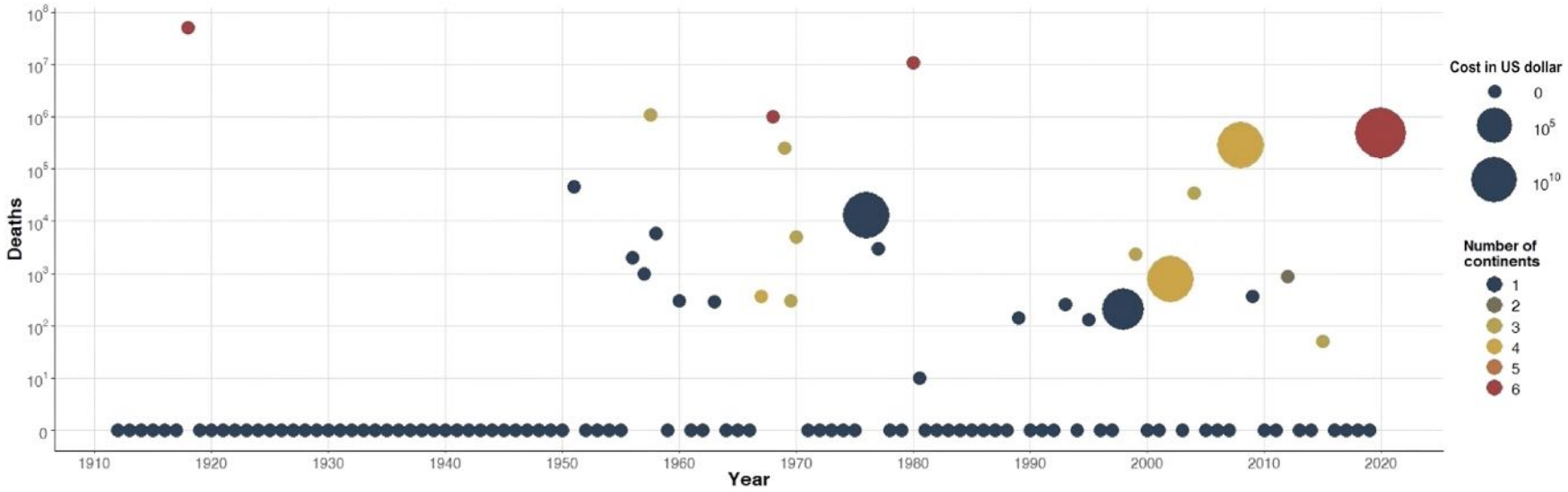


ITEM	VALUES (2020 $)
Expenditures on preventive measures	
Annual funding for monitoring wildlife trade (CITES+)	$250–$750 M
Annual cost of programs to reduce spillovers	$120–$340 M
Annual cost of programs for early detection and control	$217–$279 M
Annual cost of programs to reduce spillover via livestock	$476–$852 M
Annual cost of reducing deforestation by half	$1.53–$9.59 B
Annual cost of ending wild meat trade in China	$19.4 B
TOTAL GROSS PREVENTION COSTS (*C*)	**$22.0–$31.2 B**
Ancillary benefit of prevention	
Social cost of carbon	$36.5/tonne
Annual CO_2 emissions reduced from 50% less deforestation	118 Mt
Ancillary benefits from reduction in CO_2 emissions	$4.31 B
TOTAL PREVENTION COSTS NET OF CARBON BENEFITS (*C*)	**$17.7–$26.9 B**
Damages from COVID-19	
Lost GDP in world from COVID-19	$5.6 T
Value of a statistical life (*V*) adjusted for COVID-19 mortality structure	$5.34 M or $10.0 M
Total COVID-19 world mortality (Q_D) forecast by 28 July 2020, 50th percentile with 95% error bounds	590,643 [473,209, 1,019,078]
Value of deaths in world from COVID-19 = $Q_D \times V$	
Lowest ($5.34 M × 2.5th percentile mortality forecast)	$2.5 T
Middle ($10 M × 50th percentile mortality forecast)	$5.9 T
Highest ($10 M × 97.5th percentile mortality forecast)	$10.2 T
TOTAL DISEASE DAMAGES (*D*):	
Lowest ($5.34 M × 2.5th percentile mortality forecast)	**$8.1 T**
Middle ($10 M × 50th percentile mortality forecast)	**$11.5 T**
Highest ($10 M × 97.5th percentile mortality forecast)	**$15.8 T**

Dobson et al. 2020. Science

The COVID19 aftermath

Deaths per year from novel viral zoonotic outbreaks since 1912



Berstein et al. 2022. Science Advances

Human Well-Being and the SDGs

aer.eu

Agenda for Cooperation in Research and Policy

- There is no magic in One Health
- Lead by example
- On the local, regional and global level
- Don’t allow One Health to become a ‘new’ silo
- Be committed to ‘Good Scientific Practice’
- One Health is politically supported (the momentum is now)

Never Stop Exploring.
One Health – For Good and For All.

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