One Health:
Wildlife health and welfare – a human responsibility

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Health connects all species

Drivers of Global Change

Habitat Deterioration

Pathogen Pollution

Global Toxification

Rapid global travel

Urbanization

Climate Change

With thanks to A. Aguirre

The Changing Interface

# Increasing wildlife/human/livestock interface

Increasing wildlife/human/livestock interface

- Increased opportunities for contact between wildlife and humans
- Encroachment into wildlife habitat
- Wildlife trade
  - 40,000 primates, 4 million birds, 640,00 reptiles, 350 million tropical fish transported live/year
  - Bushmeat – 570 million wild animals consumed annually
  - Estimated one billion direct and indirect contacts among wildlife, human and domestic animals through wildlife trade annually (Karesh et al 2005)
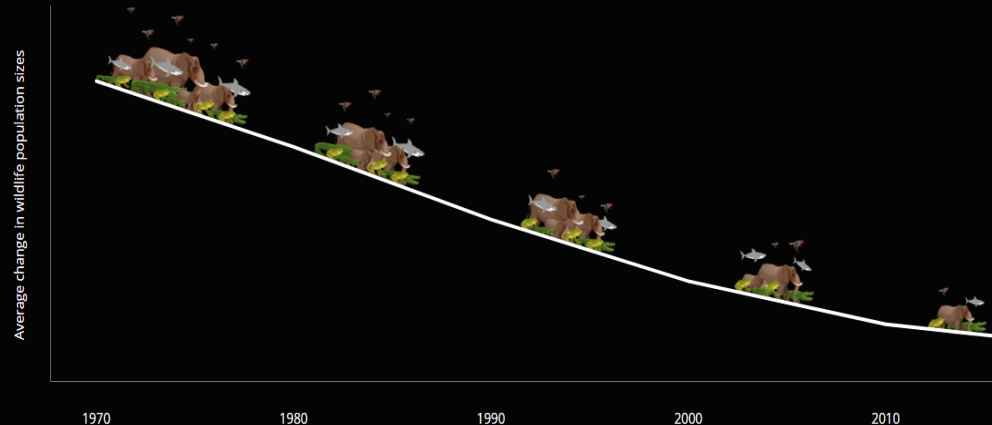
Global trends for wildlife

Species Extinctions Since 1800
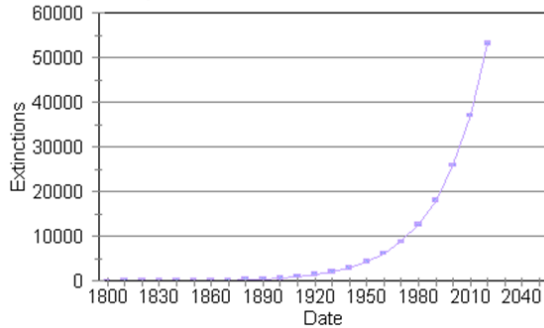
THE LIVING PLANET INDEX

The population sizes of mammals, birds, fish, amphibians and reptiles have seen an alarming average drop of 68% since 1970.

THREATS

Habitat loss and degradation

This refers to the modification of the environment where a species lives, by either complete removal, fragmentation or reduction in quality of key habitat characteristics. Common causes are unsustainable agriculture, logging, transportation, residential or commercial development, energy production and mining. For freshwater habitats, fragmentation of rivers and streams and abstraction of water are common threats.

Species overexploitation

There are both direct and indirect forms of overexploitation. Direct overexploitation refers to unsustainable hunting and poaching or harvesting, whether for subsistence or for trade. Indirect overexploitation occurs when non-target species are killed unintentionally, for example as bycatch in fisheries.

Pollution

Pollution can directly affect a species by making the environment unsuitable for its survival (this is what happens, for example, in the case of an oil spill). It can also affect a species indirectly, by affecting food availability or reproductive performance, thus reducing population numbers over time.

Invasive species and disease

Invasive species can compete with native species for space, food and other resources, can turn out to be a predator for native species, or spread diseases that were not previously present in the environment. Humans also transport new diseases from one area of the globe to another.

Climate change

As temperatures change, some species will need to adapt by shifting their range to track suitable climate. The effects of climate change on species are often indirect. Changes in temperature can confound the signals that trigger seasonal events such as migration and reproduction, causing these events to happen at the wrong time (for example misaligning reproduction and the period of greater food availability in a specific habitat).

What is wildlife health?

A modern definition of wildlife health should emphasize that

- health is the result of interacting biologic, social, and environmental determinants that interact to affect **capacity to cope with change**;

- health cannot be measured solely by what is absent but rather by characteristics of the animals and their ecosystem that affect their **vulnerability and resilience**;

- wildlife health is not a biologic state but rather a **dynamic social construct based on human expectations** and knowledge.

TOWARD A MODERNIZED DEFINITION OF WILDLIFE HEALTH

Craig Stephen

J Wildl Dis (2014) 50 (3): 427–430.

https://doi.org/10.7589/2013-11-305

What is wildlife health?

Wildlife health can be defined as the physical, physiological, behavioural and social wellbeing of free-ranging animals at an individual, population and wider ecosystem level, and their resilience to change.

(*Meredith, Skerratt, Peters, Carver 2019*)

HABITAT
Food/water
Shelter
Social interaction/behaviour

CLIMATE
Heat
Cold
Humidity

HAZARDS
Predators
Human disturbance
Bushfire
Noise
Light
Fruit tree netting

'HEALTHY' FLYING FOXES

EVOLUTIONARY/ ECOSYSTEM ROLE
Reproduction
Pollination
Seed dispersal
Soil fertilisation

SOCIETAL ROLE
Cultural and inherent value
Pest
Disease threat

PATHOGENS
Toxins/pollutants
Infectious agents

Why is wildlife health important?

- SOURCES of disease
- VICTIMS of disease
- SENTINELS for disease **and** ecosystem health

We tend to focus on detecting and describing (infectious) disease, looking at harms/problems in isolation rather than as a system, and not addressing solutions and sustainable adaptation

Health is holistic, complex, and cumulative

Wildlife as a SOURCE of disease (for humans and domestic animals)

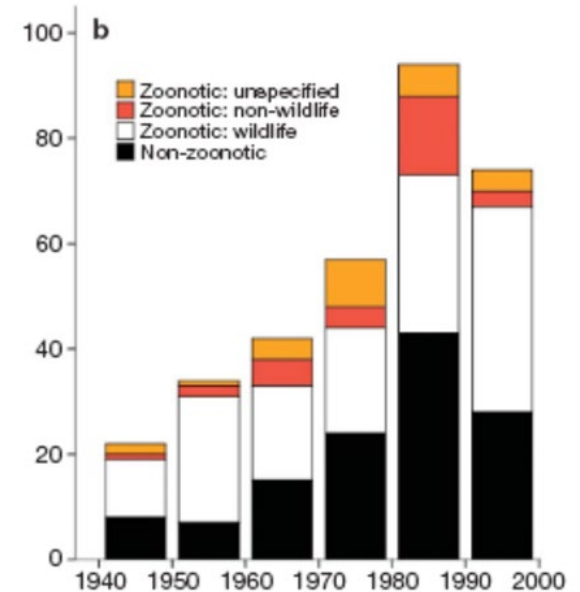1415 human pathogens, **61%** are zoonotic

75% of emerging infectious diseases are zoonotic, originating principally from wildlife
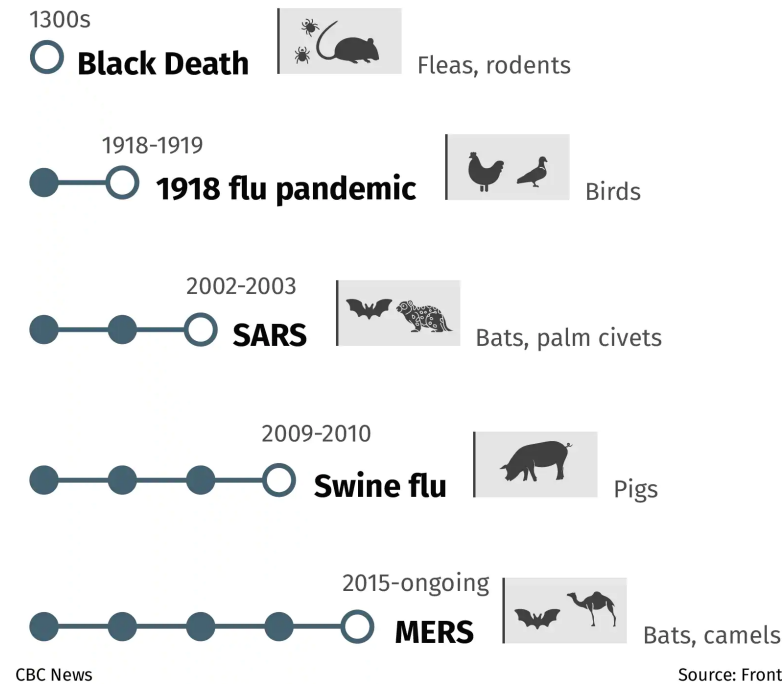

West Nile Virus

Bovine tuberculosis

Jones et al (2008)., Nature 451

Wildlife reservoirs – Global pandemics

Animal vectors linked to pandemics

1300s
Black Death — Fleas, rodents

1918-1919
1918 flu pandemic — Birds

2002-2003
SARS — Bats, palm civets

2009-2010
Swine flu — Pigs

2015-ongoing
MERS — Bats, camels

CBC News

Source: Frontiers in Microbiology

https://www.sciencenews.org/article/evidence-mounts-bat-origins-sars

www.nbcnews.com

http://www.abc.net.au/science/news/img/health/civetcats300904.jpg

Wildlife as VICTIMS of disease

Extinctions:

- Amphibians (chytridiomycosis)
  - '*the greatest disease-caused loss of biodiversity in recorded history*'

- Non-infectious disease
  - Toxins e.g. lead, diclofenac,
  - Heat stress
  - Trauma

# Impacts of disease

Significant population declines:

- Distemper: *Black-footed ferrets, lions, tigers*
- Rabies: *African wild dogs, Ethiopian wolf*
- Squirrelpox: *Red squirrels*
- Devil Facial Tumour Disease
- White nose syndrome: B*ats*
- Toxoplasmosis: *Sea otters*

- Colony collapse disorder (varroa mites, deformed wing virus, pesticides):   *Honey bees*

Importance of Emerging Disease in Wildlife
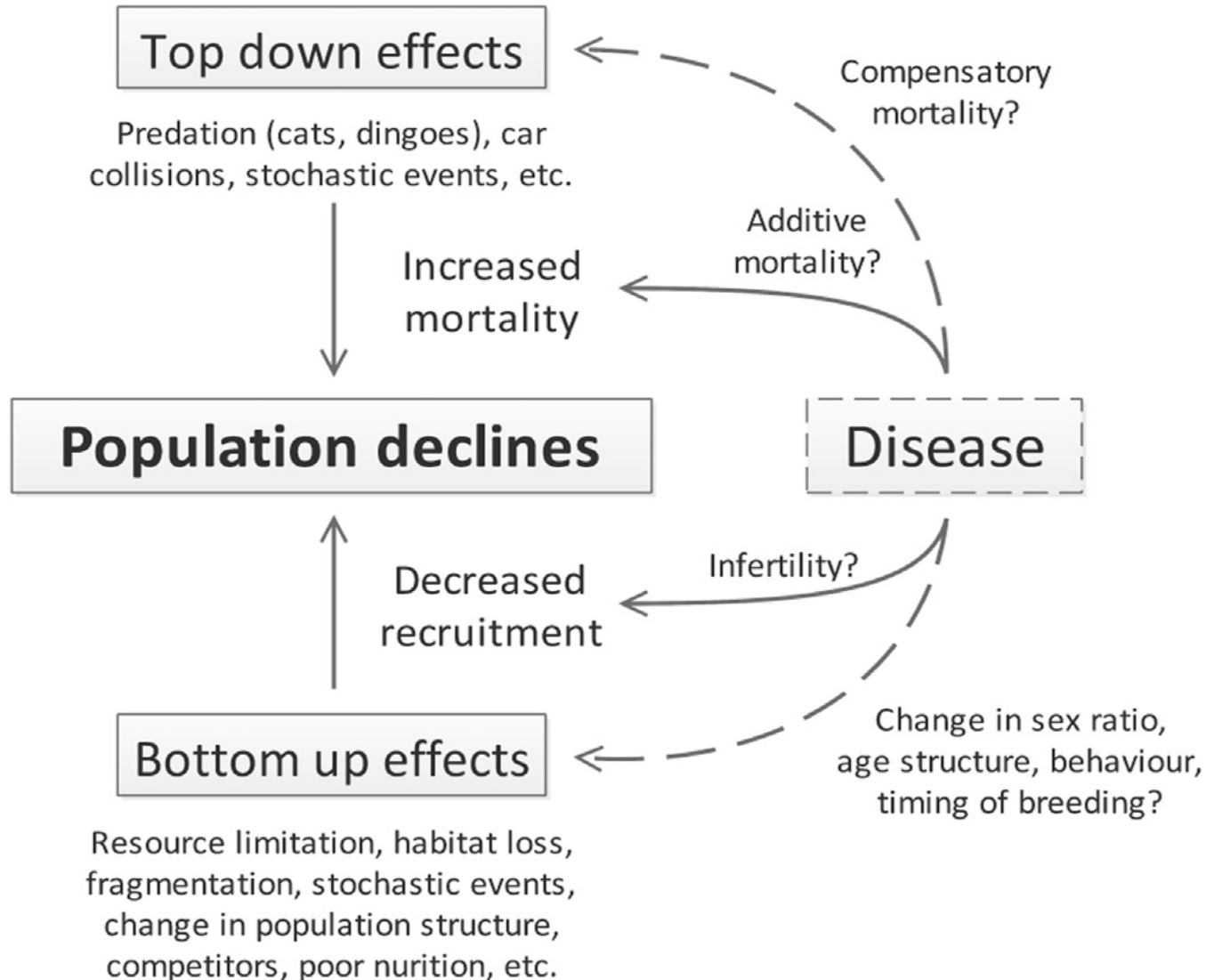
(Preece et al *BC* 2017)

WILDLIFE DISEASE

Red squirrels in the British Isles are infected with leprosy bacilli

Charlotte Avanzi,[1]* Jorge del-Pozo,[2]* Andrej Benjak,[1]* Karen Stevenson,[3] Victor R. Simpson,[4] Philippe Busso,[1] Joyce McLuckie,[3] Chloé Loiseau,[1]† Colin Lawton,[5] Janne Schoening,[6] Darren J. Shaw,[2] Jérémie Piton,[1] Lucio Vera-Cabrera,[7] Jesùs S. Velarde-Felix,[7] Fergal McDermott,[6] Stephen V. Gordon,[6,8,9,10] Stewart T. Cole,[1]‡ Anna L. Meredith[2]‡

Source and victim

TB lung lesions badger

Ringtail possum *Mycobacterium ulcerans* (Buruli ulcer)

Source and victim

Enzootic Cycle

New evidence strongly implicates bats as the reservoir hosts for ebolaviruses, though the means of local enzootic maintainance and transmission of the virus within bat populations remain unknown.
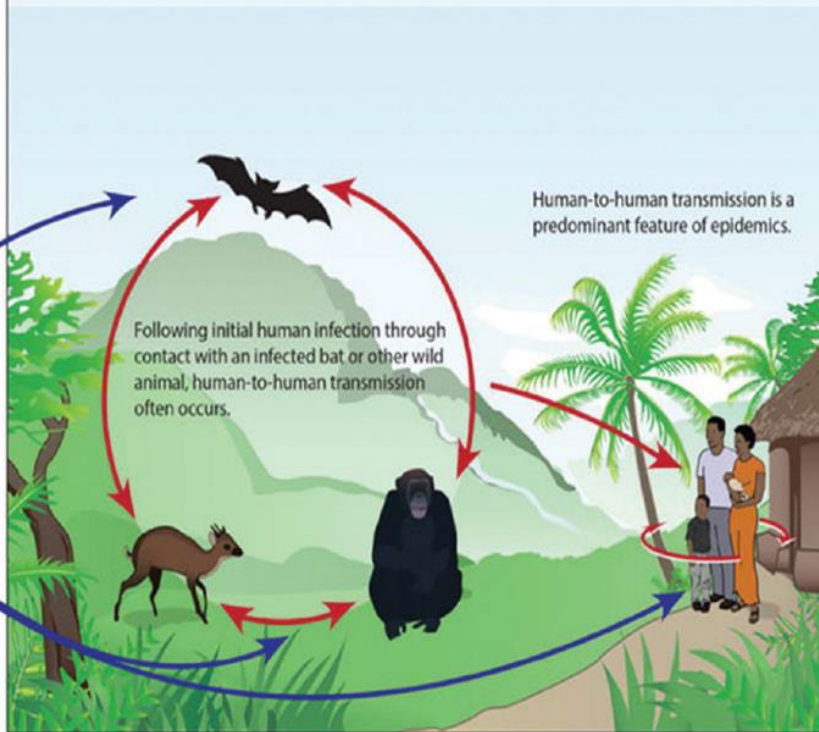
Ebolaviruses:
Ebola virus (formerly Zaire virus)
Sudan virus
Taï Forest virus
Bundibugyo virus
Reston virus (non-human)

Epizootic Cycle

Epizootics caused by ebolaviruses appear sporadically, producing high mortality among non-human primates and duikers and may precede human outbreaks. Epidemics caused by ebolaviruses produce acute disease among humans, with the exception of Reston virus which does not produce detectable disease in humans. Little is known about how the virus first passes to humans, triggering waves of human-to-human transmission, and an epidemic.

Human-to-human transmission is a predominant feature of epidemics.

Following initial human infection through contact with an infected bat or other wild animal, human-to-human transmission often occurs.

Ebola has wiped out 1/3 of the world's great apes

By Yaron Steinbuch

January 20, 2015 | 1:40pm

Individual animal welfare

Chronic phalaris toxicity in Kangaroos
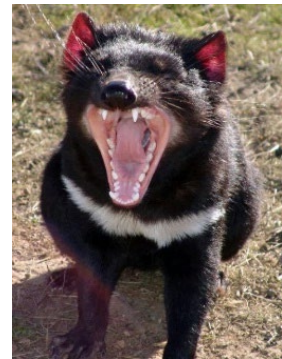

Sarcoptic mange

Heat stress
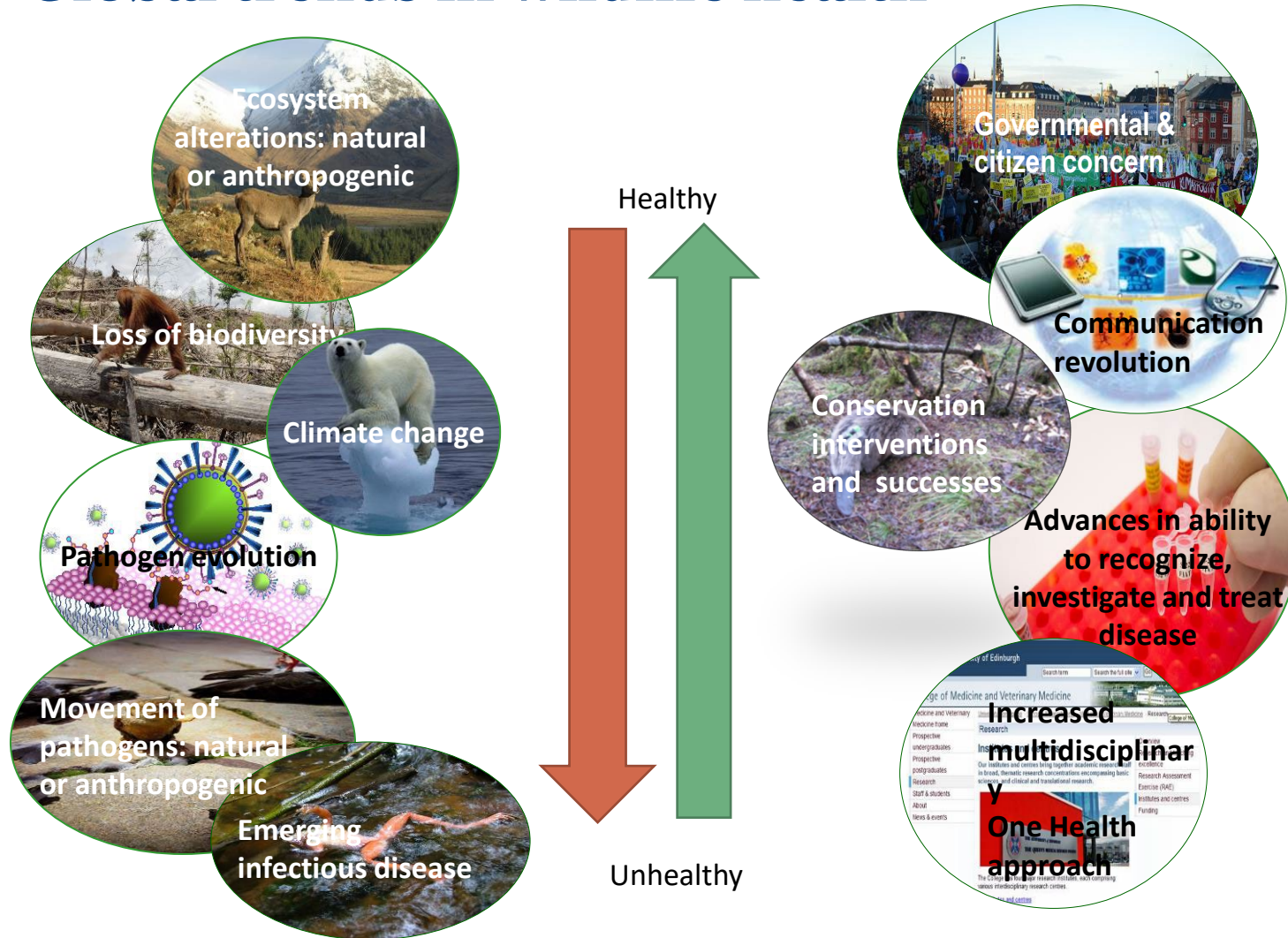(Photo: David Archer
Somers March 2019

Potential drivers of wildlife disease emergence

- Host species or population exposure to an infectious agent from other wild populations.

- Host species or population exposure to an infectious agent from domestic populations.

- Host clustering/overcrowding/stress due to habitat modification.

- Host poor nutrition/food supply variation/dietary shifts.

- Host thermal stress/climate change.

- Waning host immunity/immune variation/immune system modulators.

- Host genetic instability/low genetic diversity/inbreeding.

- Favorable climate for vectors/other drivers of increasing vector numbers.

(Tompkins et al *TiP* 2015)

Global trends in wildlife health

Ecosystem alterations: natural or anthropogenic

Loss of biodiversity

Climate change

Pathogen evolution

Movement of pathogens: natural or anthropogenic

Emerging infectious disease

Healthy

Unhealthy

Governmental & citizen concern

Communication revolution

Conservation interventions and successes

Advances in ability to recognize, investigate and treat disease

Increased multidisciplinary

One Health approach

'Solving today's threats and tomorrow's problems cannot be accomplished with yesterday's approaches'

The Manhattan Principles on
"One World, One Health" 2004
Wildlife Conservation Society

Manhattan 2004 to Berlin 2019

The Berlin principles on one health – Bridging global health and conservation

Kim Gruetzmacher [a], William B. Karesh [b,c], John H. Amuasi [d], Adnan Arshad [e], Andrew Farlow [f,g], Sabine Gabrysch [h,i], Jens Jetzkowitz [j], Susan Lieberman [k], Clare Palmer [l], Andrea S. Winkler [m,n], Chris Walzer [a,o,*]

'For over 15-years, proponents of the One Health approach have worked to consistently interweave components that should never have been separated and now more than ever need to be re-connected: the health of humans, non-human animals, and ecosystems. We have failed to heed the warning signs. A One Health approach is paramount in directing our future health in this acutely and irrevocably changed world. COVID-19 has shown us the exorbitant cost of inaction. The time to act is now.'

One Health High Level Expert Panel (OHHLEP) New definition 1st December 2021

The One Health definition developed by the OHHLEP states:

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent.The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development.
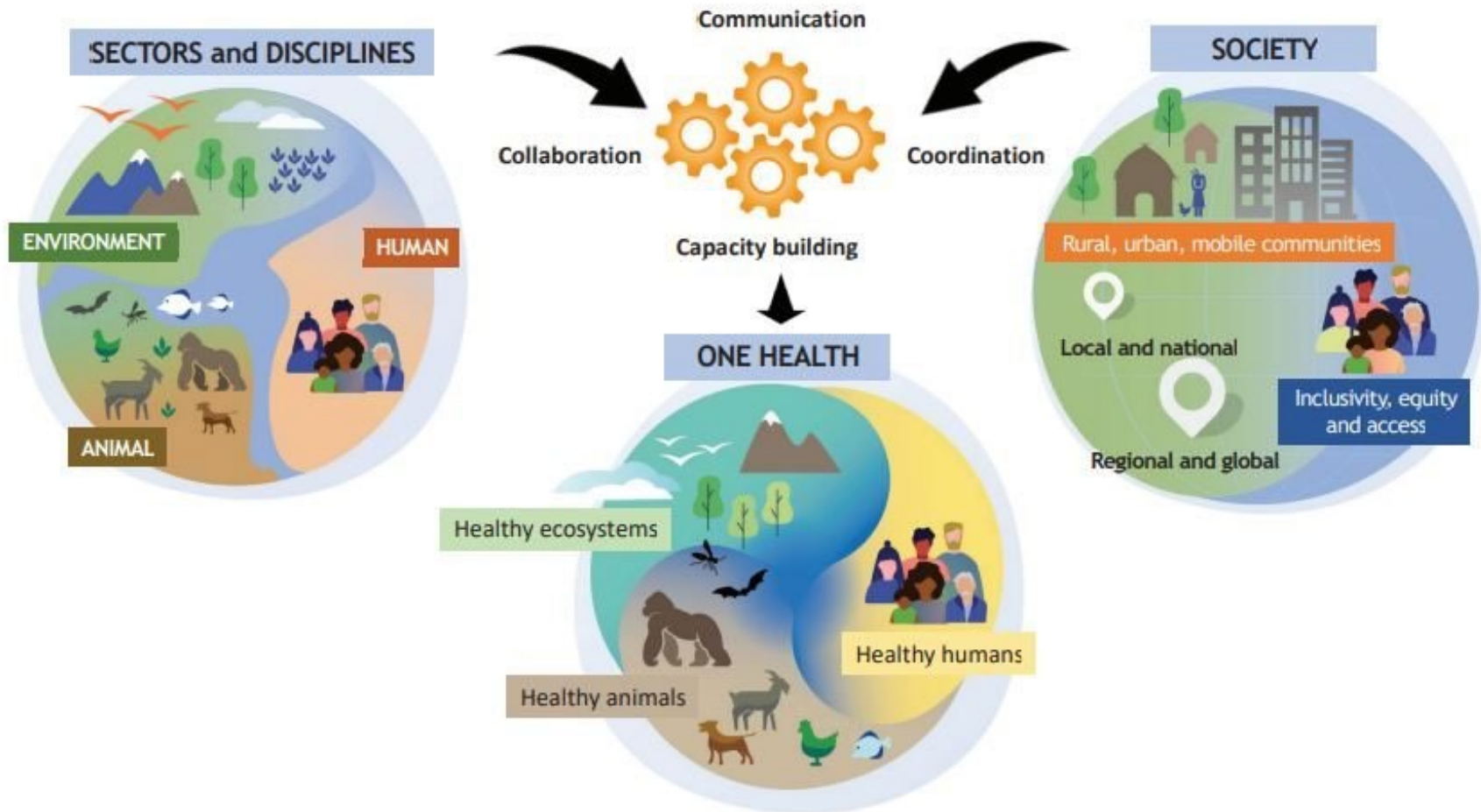
Thank you

THE UNIVERSITY OF
MELBOURNE