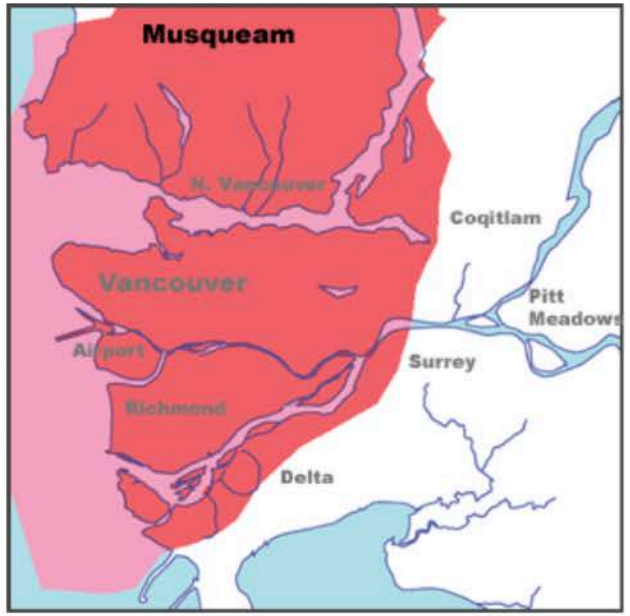
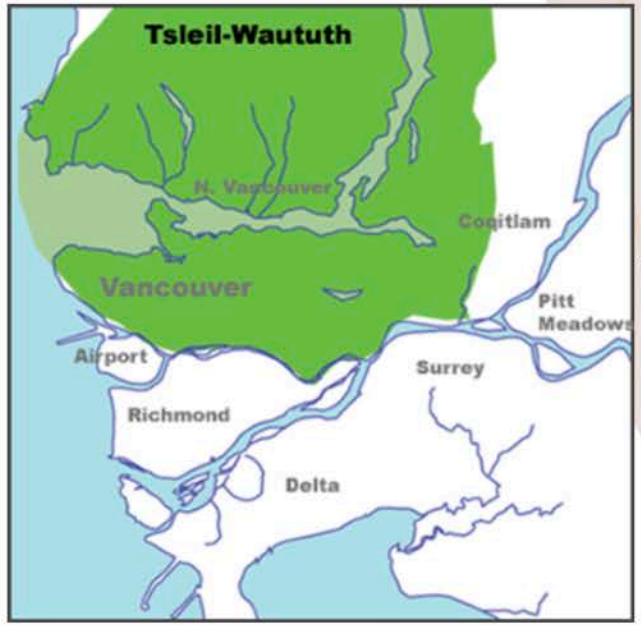
We would like to acknowledge that we are gathered today on the traditional territories of the Musqueam, Squamish and Tsleil-Waututh peoples.

Source: www.johomaps.net/na/canada/bc/vancouver/firstnations/firstnations.html





One Health – what is it?

- Terminology
  - Historical context

- Illustrative case studies of zoonotic and emerging infectious diseases
  - Nipah
  - Influenza
  - COVID-19
  - Antibiotic resistance

- Discussion and ways forward
  - Legislative and policy changes
  - Individual actions

Jan Hajek
janjhajek@gmail.com

Immigrants and international travelers
Infectious disease considerations

- ***Strongyloides***
  - chronic intestinal infection, risk of hyper infection with immunosuppression
  - never ignore an elevated eosinophil count
  - screen people from tropical countries with serology – especially prior to steroids

- **Tuberculosis**
  - IGRA screening for new immigrants with risk factors*

- **Malaria**
  - Fever in returned traveler is malaria until proven otherwise

- **Chagas**
  - April 14 – World Chagas Day
    - “time to integrate Chagas disease into primary care”
  - screen persons born in South America

Immigrants and international travelers
Infectious disease considerations

1. **Weekly UBC Tropical Medicine Rounds**
   - Friday mornings – 8am
   - ZOOM
     - janjhajek@gmail.com
   - * Leprosy this week

2. **Annual UBC Tropical and Geographic Medicine Course**
   - May 8 – 12, 2023
     - https://spph.ubc.ca/programs/continuing-education/tgm2023/

3. **Future VCH family medicine rounds**

One Health - terminology

- **Health**
  - Absence of disease
  - '*A state of complete physical, mental and social wellbeing and not merely the absence of disease and infirmity*' – WHO

- **Public Health**
  - Population level, preventative programs - e.g., clean water

- **Global Health**
  - Clinical care as well as preventative programs - e.g., access to an ophthalmologist
  - Emphasis on global cooperation, multidisciplinary approaches, and equity

- **One Health**
  - Interconnectedness between human health and animal health
  - Our dependence on a healthy environment

Historical perspective

- 1800's – R. Virchow
- Introduced the term **zoonosis**
  - "Between animal and human medicine there is no dividing line – nor should there be."

- 1900's – C. Schwabe
- Introduced the term **One Medicine**
  - "There is no difference of paradigm between human and veterinary medicine."

- 2000's – post-SARS
- Introduced the term **One Health**
  - Human – Animal
  - Emphasis on a heathy environment

One Health definitions

World Health Organization

- *An integrated, unifying **approach** to sustainably balance and optimize the health of people, animals and the environment.*

World Organisation for Animal Health
Founded as OIE

- *A collaborative **approach**… [recognizing that] human health and animal health are interdependent and bound to the health of the ecosystems in which they exist.*

One Welfare

- **One Welfare** - captures other connections of human and animal welfare
    - Better welfare for Humans <– > Better welfare for Animals

One Welfare

- Human-animal bond
- Need for coordinated actions

Nepal

United States

One Welfare

- Human-animal bond
- Need for coordinated actions

Nepal

United States

CANADA

Homeless youth with pets less likely to suffer depression: study

Jordan Press
The Canadian Press

Published Friday, March 18, 2016 4:27AM EDT

Canada

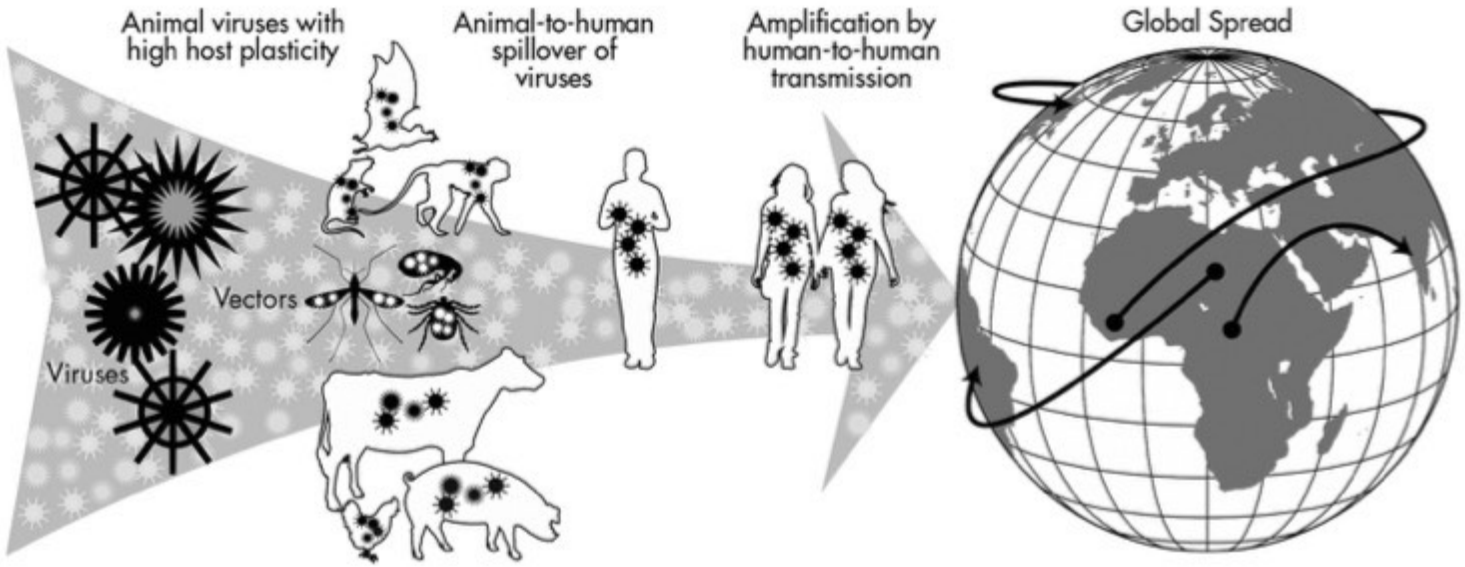
One Welfare

- Connections between abuse of animals and abuse of people
  - Domestic violence and child abuse

- Abuse to *any* living being is unacceptable and endangers *everyone*

One Health

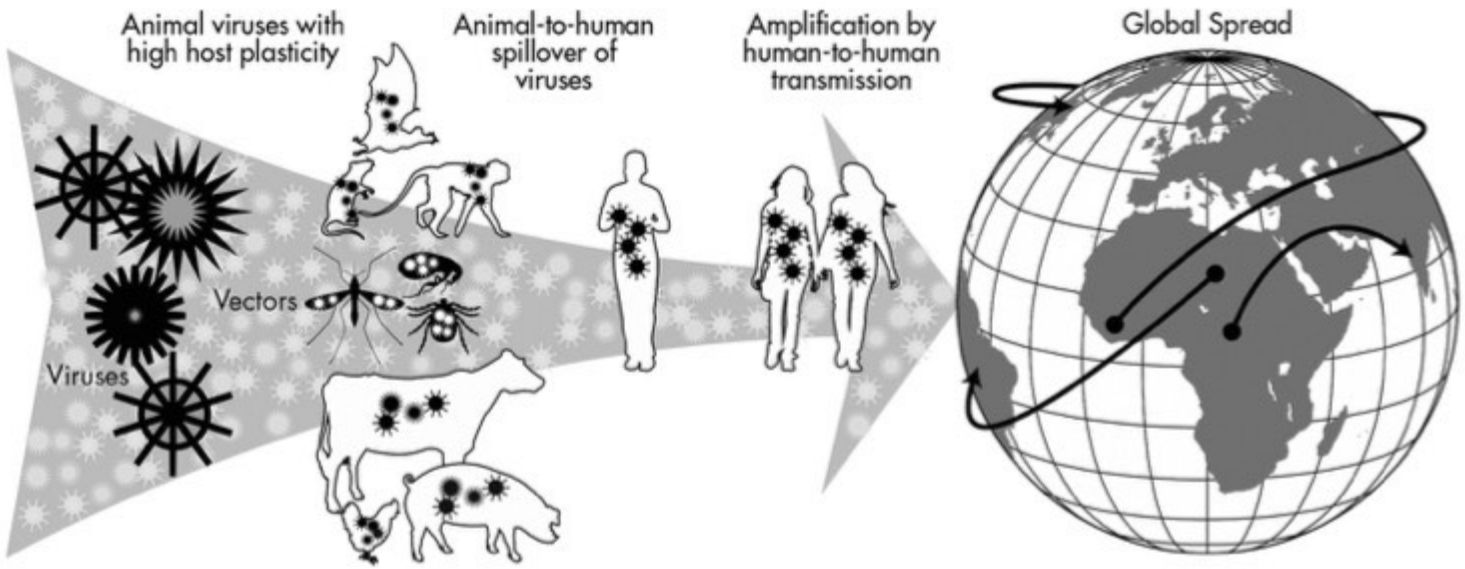
- **Infectious diseases**
  - ~ **75%** of **new human infections** come from interactions with other animals
  - ~1.7 million viruses in animals



Sci Rep. 2015 Oct 7;5:14830.

One Health

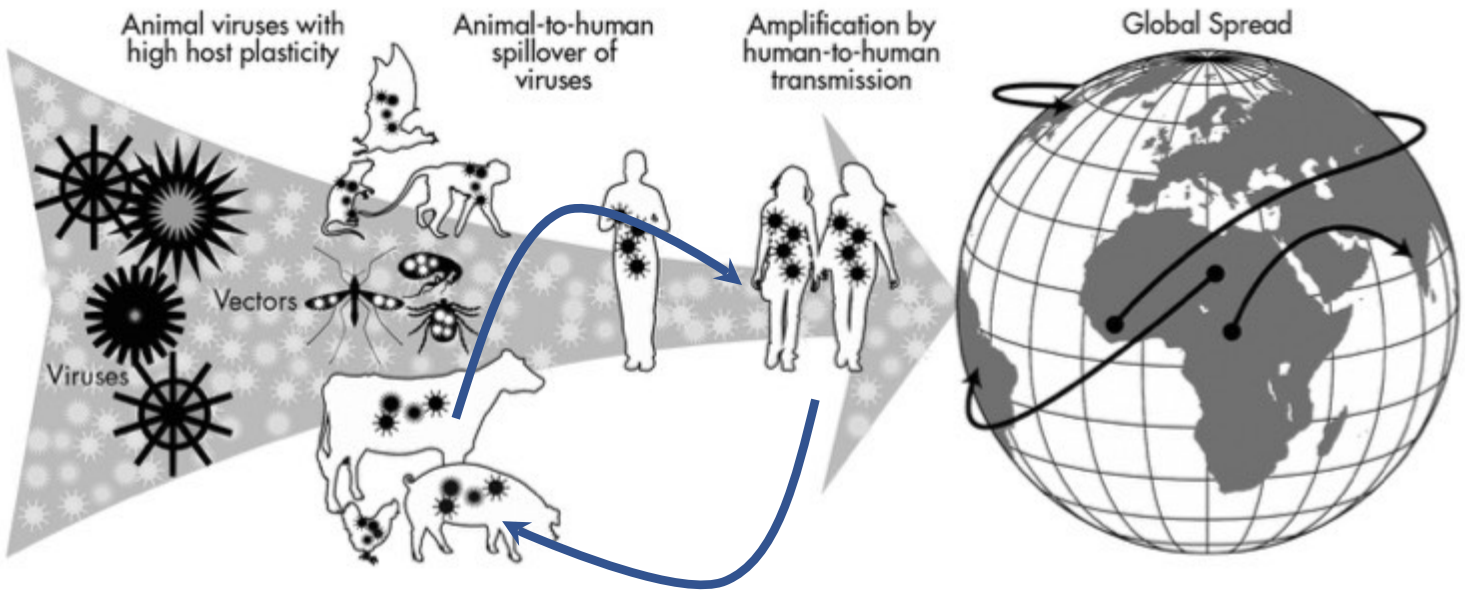
- **Infectious diseases**
  - Nature is an overall benefit not a threat
  - It is more the human activity that drives the spillovers



Sci Rep. 2015 Oct 7;5:14830.

One Health

- **Infectious diseases**
  - Nature is an overall benefit not a threat
  - It is more the human activity that drives the spillovers



Sci Rep. 2015 Oct 7;5:14830.

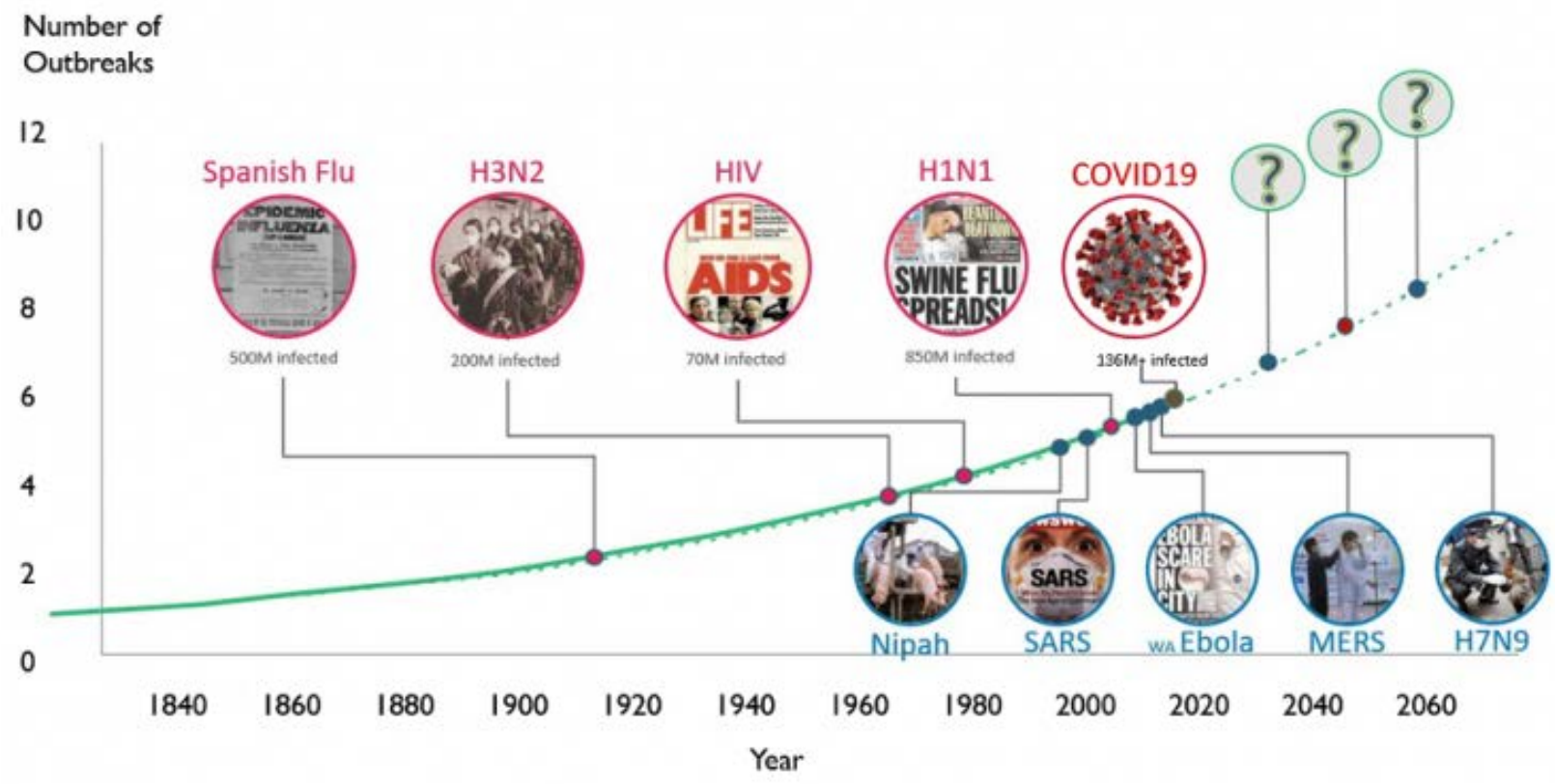
One Health

- Humans and other animals share biology

EMBO J. 2014; 33, 823–841

The next pandemic: “When” not “If”

- Likely to be zoonotic, mRNA virus – maybe influenza or coronavirus



How do new zoonotic human infections occur?

1. Introduction of new pathogen → Wild animals
    - Bats → Ebola, Marburg

2. Amplify and worsen an existing pathogen → Farmed animals
    - Chickens and pigs → Influenza
    - Antibiotic resistant bacteria

Malaysia, September 1998

- Outbreak of **acute encephalitis**
  - 1998 - 1997: 265 cases, 105 deaths
  - Initially thought to be Japanese Encephalitis

- What was the virus and where did it come from?

Malays J Pathol. 2007 Dec;29(2):63

Malaysia, September 1998

- Outbreak of **acute encephalitis**
  - 1998 - 1997: 265 cases, 105 deaths
  - Initially thought to be Japanese Encephalitis

- What was the virus and where did it come from?
- **Nipah**
  - Deforestation + introduction of pig farms

Malays J Pathol. 2007 Dec;29(2):63

Nipah virus
Why the outbreak?

- Deforestation, slash and burn agriculture
  - Reduced habitat for the bats
- Large pig farms were built near the forests and bat habitat
  - Fruit trees planted near the farms
- High densities of pigs amplified virus and spread to people
  - Transport of pigs led to spread to southern Malaysia and Singapore.

Malays J Pathol. 2007 Dec;29(2):63

Nipah
Delayed recognition

- Outbreak of respiratory illness and death in pigs
  - Live pigs continued to be transported across the country

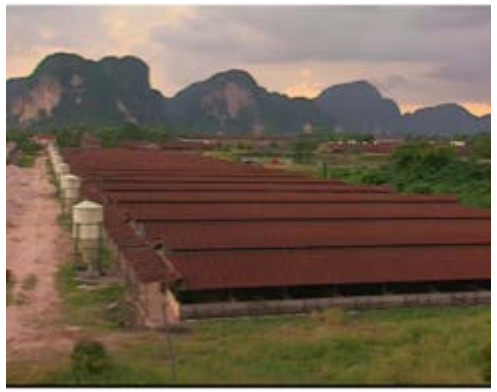
    → need for collaboration

Nipah

Previous unrecognized spillover events

- 1996 and 1997
  - Prior cases of febrile illness among workers at a pig farm
  - Pigs also sick with respiratory illness
- One worker got sick, coma in hospital, recovered
  - Years later, blood tests confirmed antibodies to Nipah

→ need surveillance, especially at animal-human interface



Nipah, Journeyman documentary 2016

Nipah Culling

- 1 million pigs killed in response to the outbreak

Pig farm workers push live pigs into a large grave in Nipah in 1999. To stop the outbreak, the Malaysian government culled almost 1 million pigs, nearly destroying the country's pork industry.

Nipah
Culling

- 1 million pigs killed in response to the outbreak

? One Health

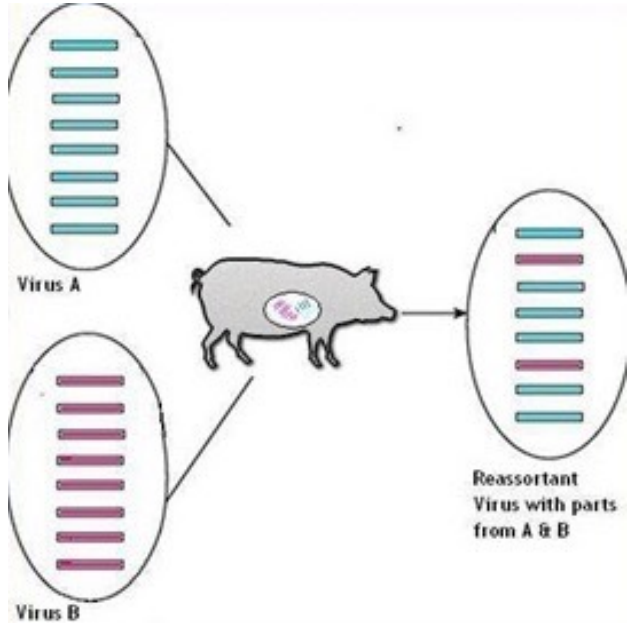
Pig farm workers push live pigs into a large grave in Nipah in 1999. To stop the outbreak, the Malaysian government culled almost 1 million pigs, nearly destroying the country's pork industry.

Influenza Culling

- Influenza naturally occurring in wild birds
- Highly pathogenic avian influenza (HPAI) typically emerge in commercial poultry farms
  - Low Path AI → High Path AI

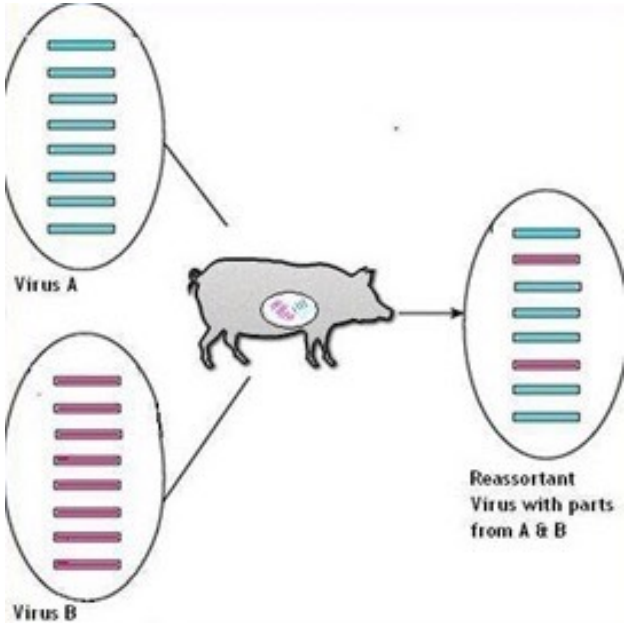
Influenza

- mRNA virus, with 8 strands
- Mixing of influenza viruses - reassortment

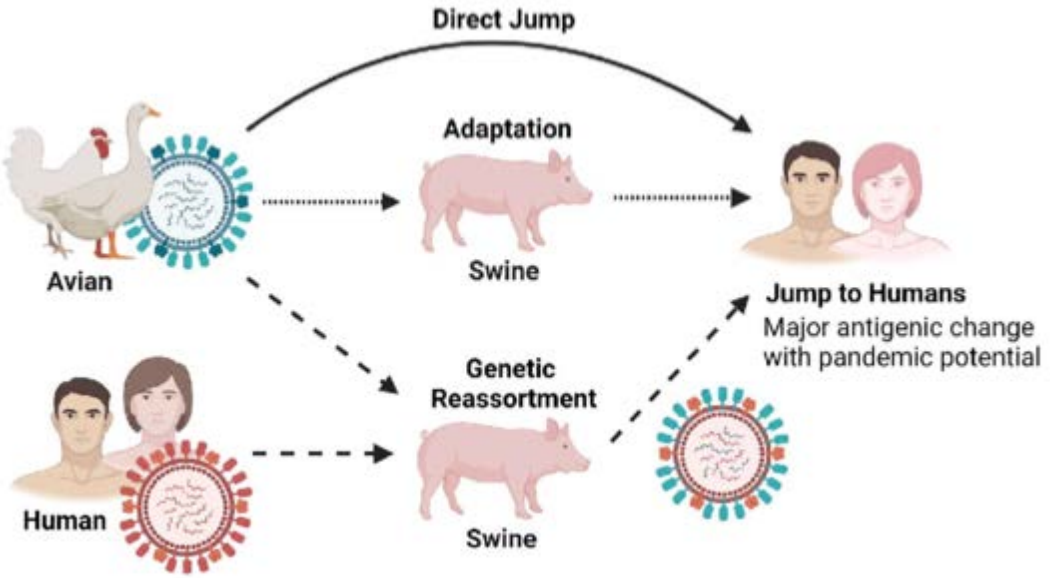


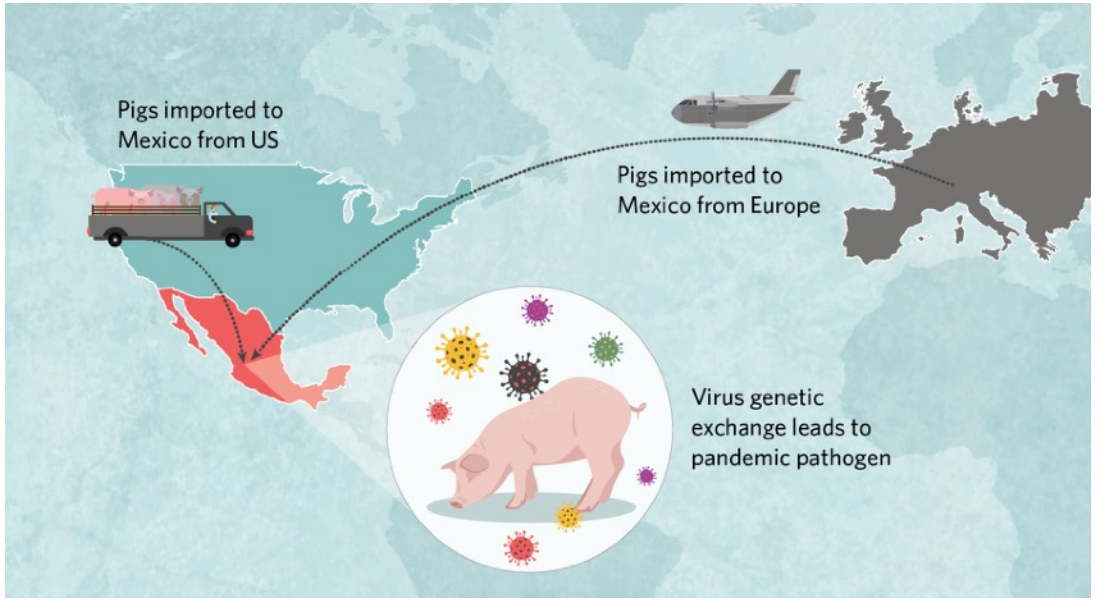
Influenza

- mRNA virus, with 8 strands
- Mixing of influenza viruses - reassortment



2009 H1N1

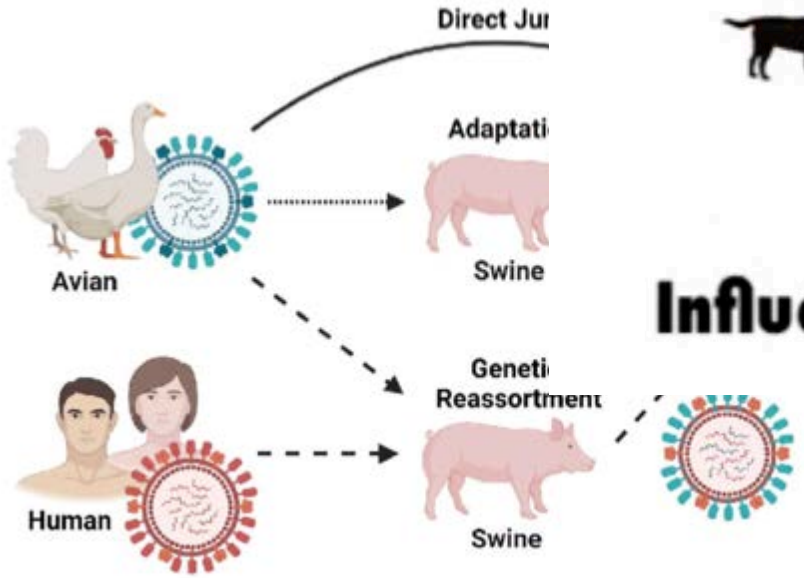


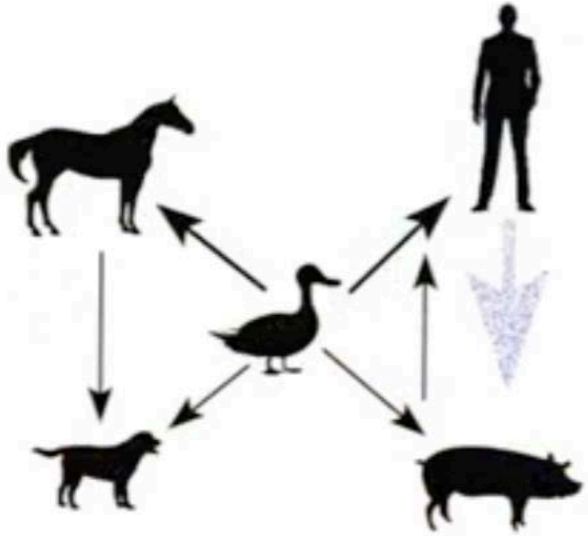


Influenza

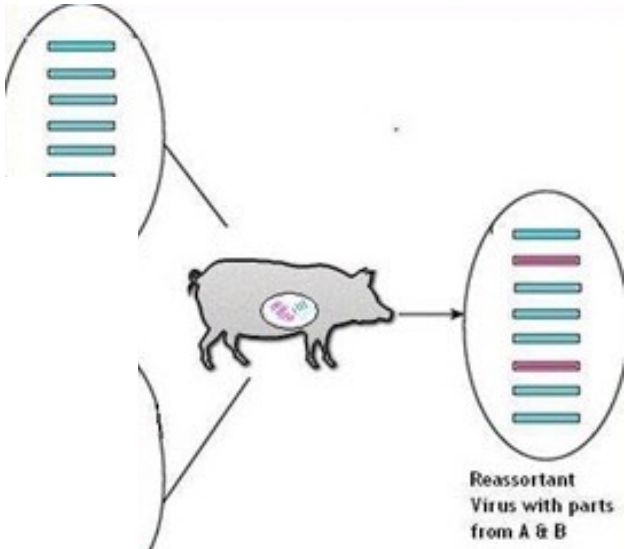
- mRNA virus, with 8
- Mixing of influenza

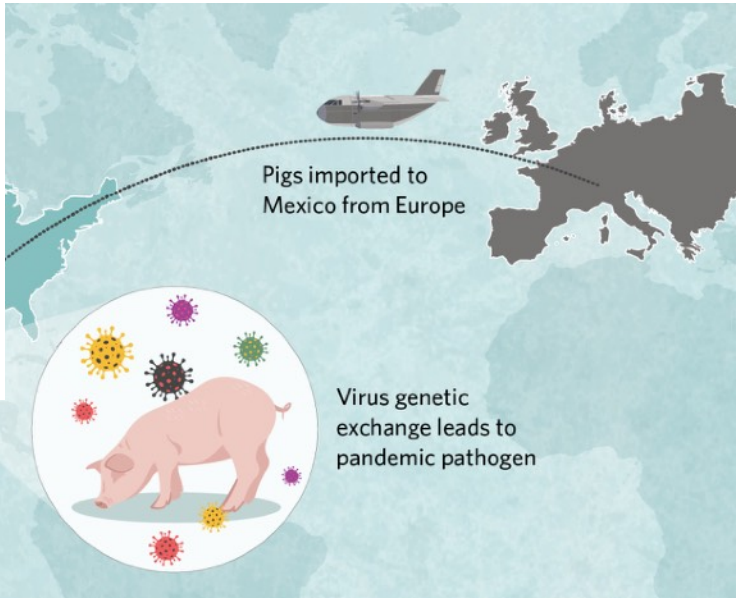
2009 H1N1





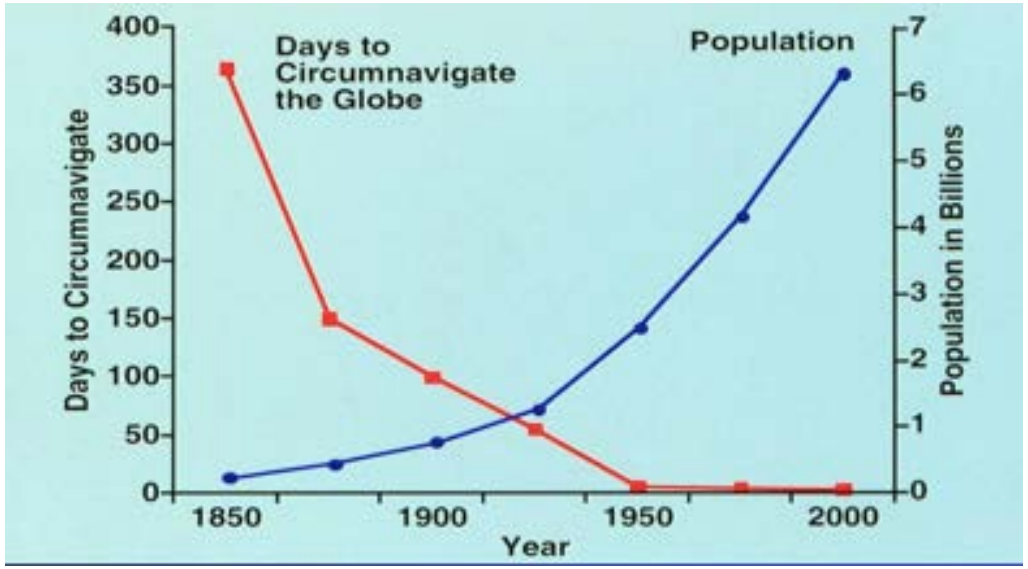
Influenza A virus ecology





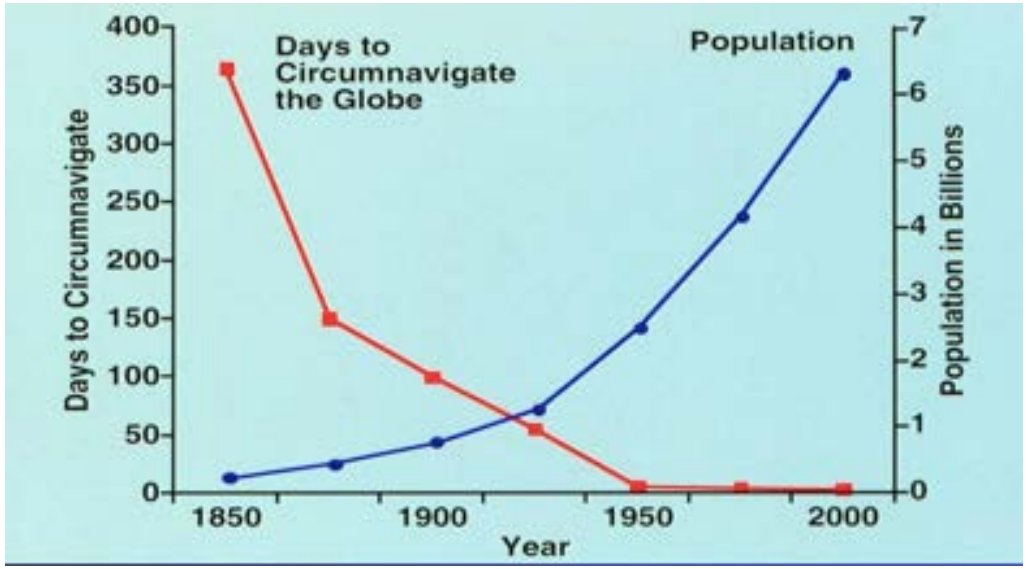
Anthropocene

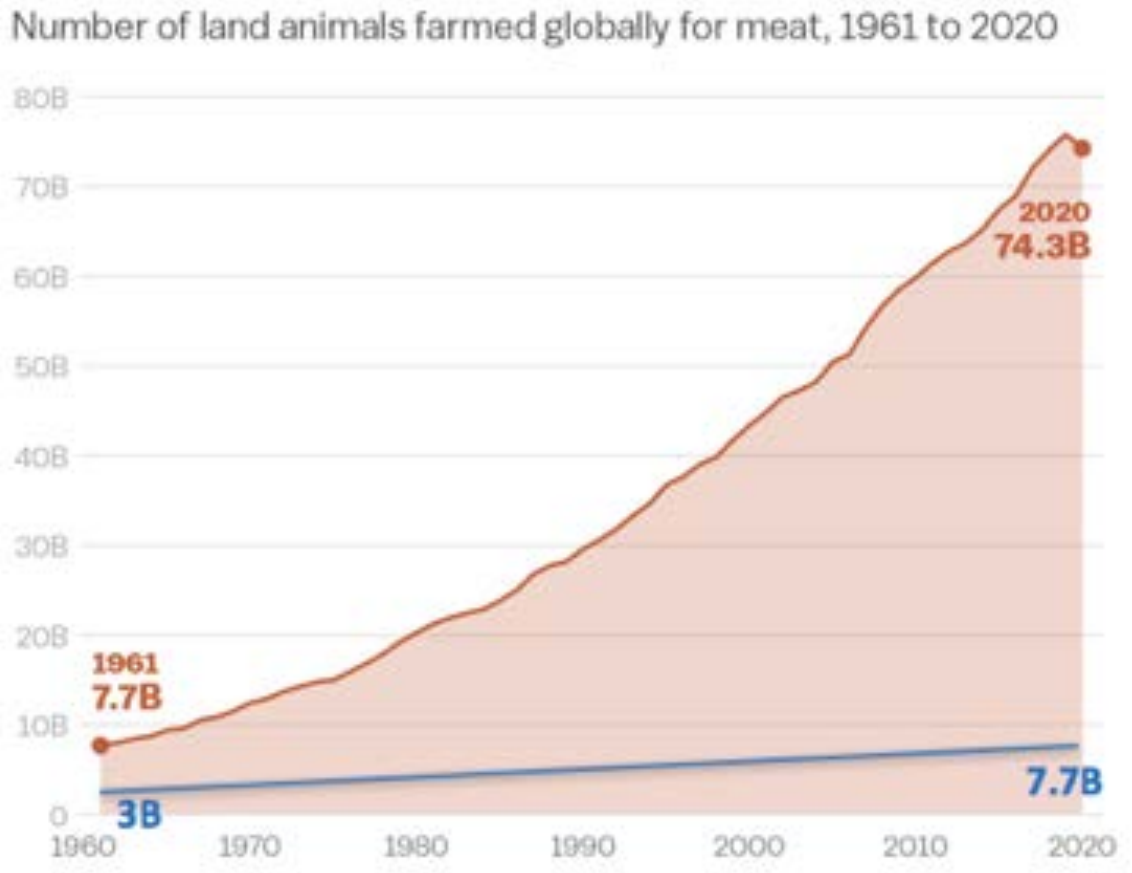
Humans are now the biggest drivers of changes on earth today



Anthropocene

Humans are now the biggest drivers of changes on earth today

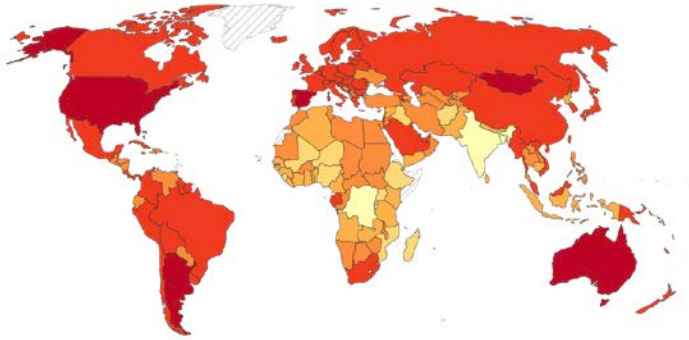




Meatification of diets

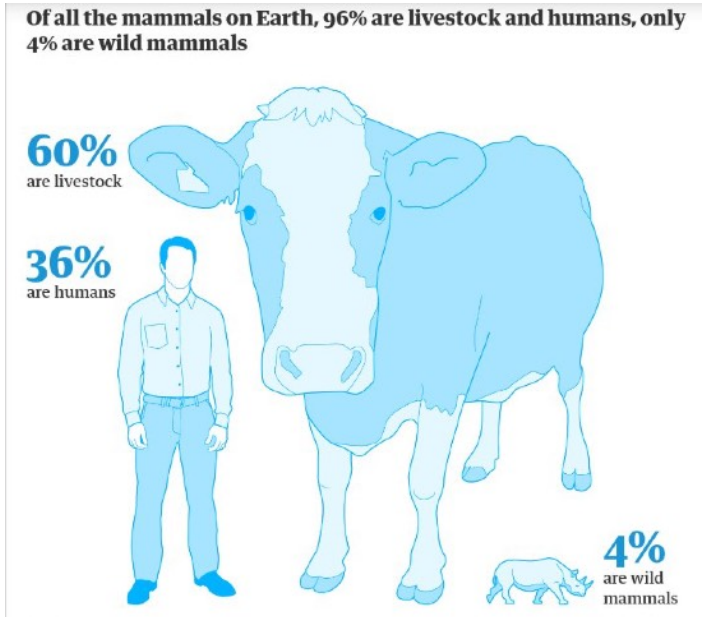
Meat consumption per capita (1961 – 2021)

	US	120 kg
	China	60 kg
	India	5 kg
	DRC	< 4 kg



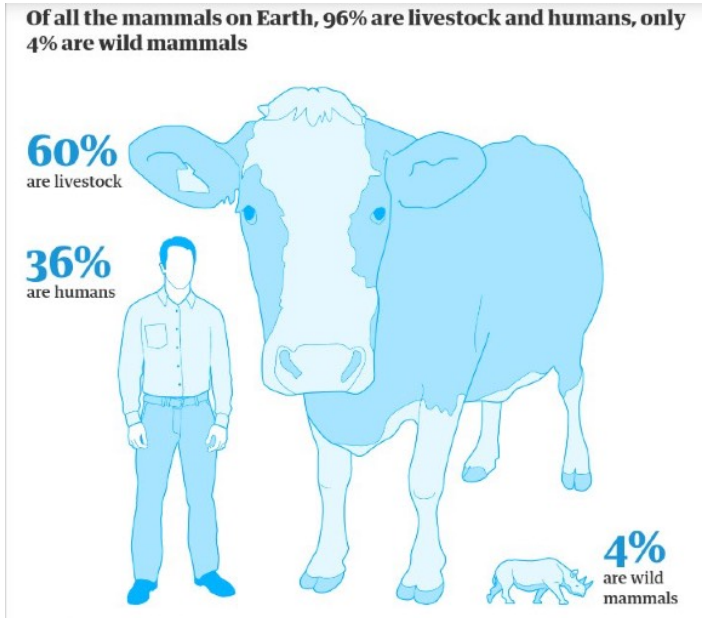
Tony Weis, UoW

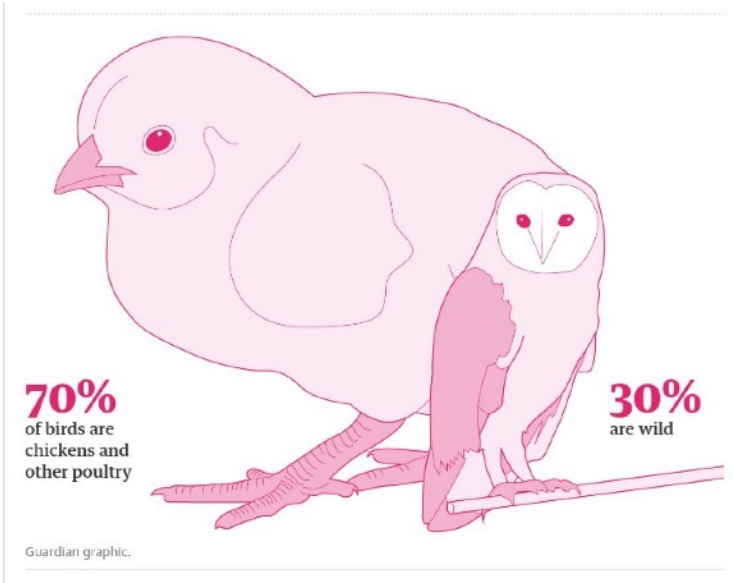
Biodiversity loss
Mammals on earth



PNAS. 2018;115(25):6506-6511

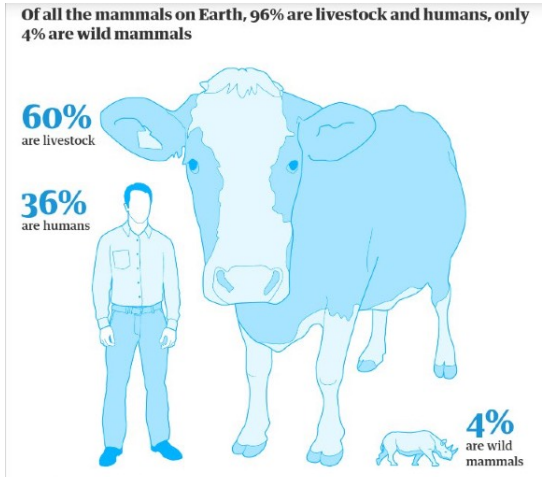
Biodiversity loss
Birds on earth

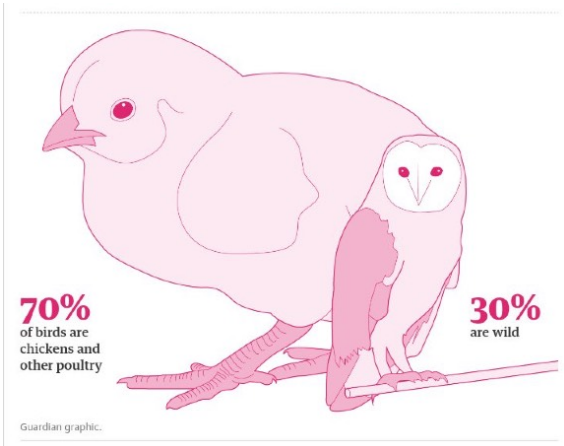


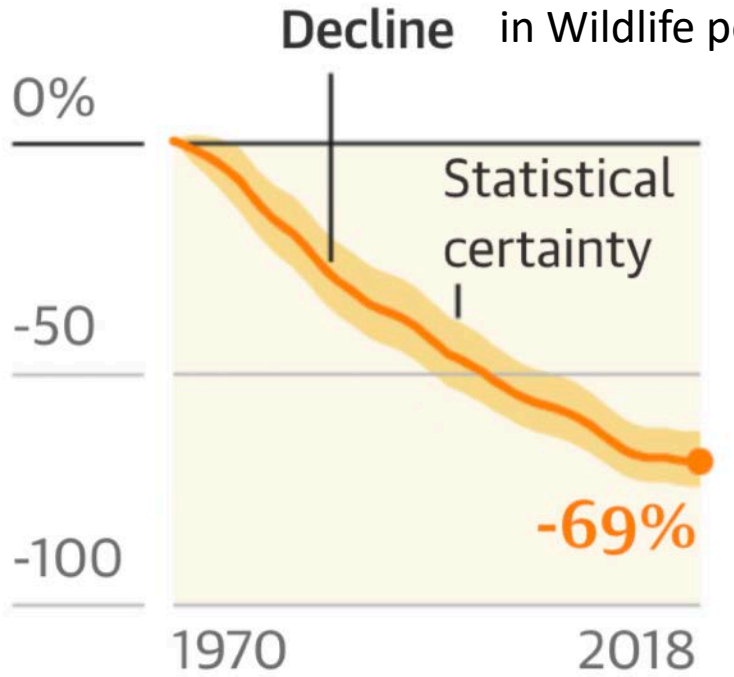


PNAS. 2018;115(25):6506-6511

Biodiversity loss
69% drop in wildlife population over past 50 years



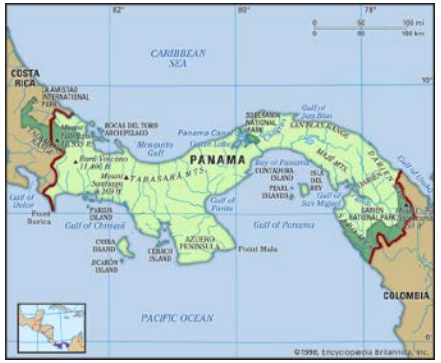




WWF Living Planet Report, 2022

Deforestation and biodiversity loss

- Each year 18 million acres of forest are lost
  - 30% of the worlds forests are gone
  - 50% of the worlds mature tropical forests are gone
    - By 2030 only 10% will remain



- Livestock farming, both pasture and monocrops, is leading cause

https://ourworldindata.org/

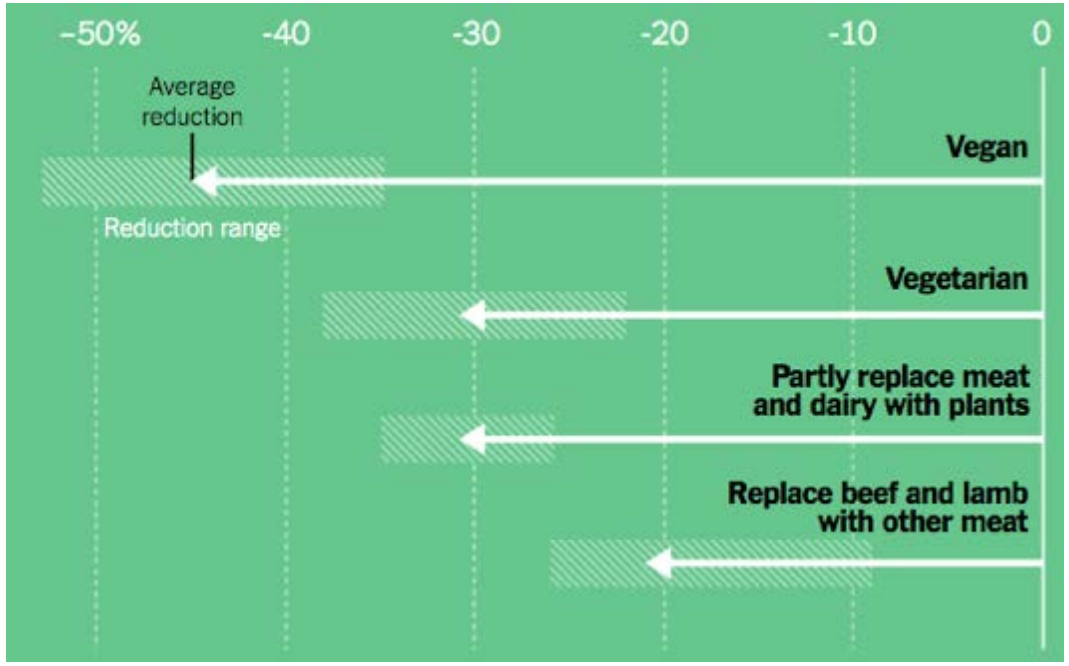
Modern pig farms

Feedlots, and food for animals

Climate change

- Livestock farming is responsible for ≥ 15% of Greenhouse Gas Emissions

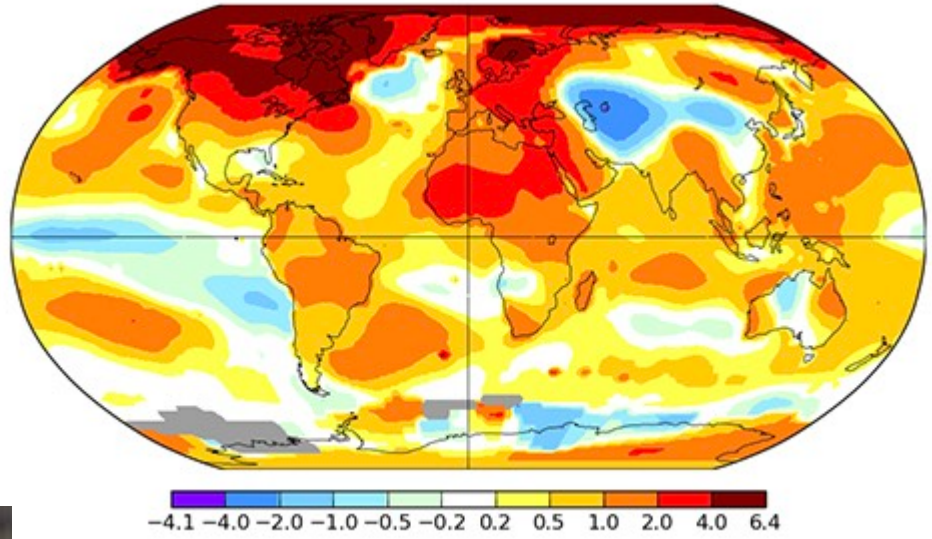
Average reduction in food related GHG emissions
- Persons eating a Standard Western Diet



Intergovernmental Panel on Climate Change

https://www.ipcc.ch/srccl/chapter/chapter-5/

Climate change

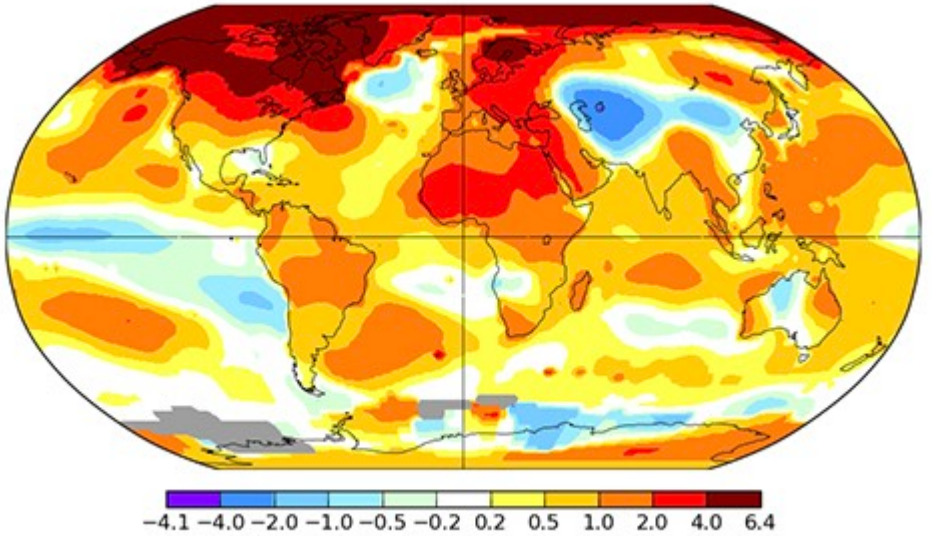


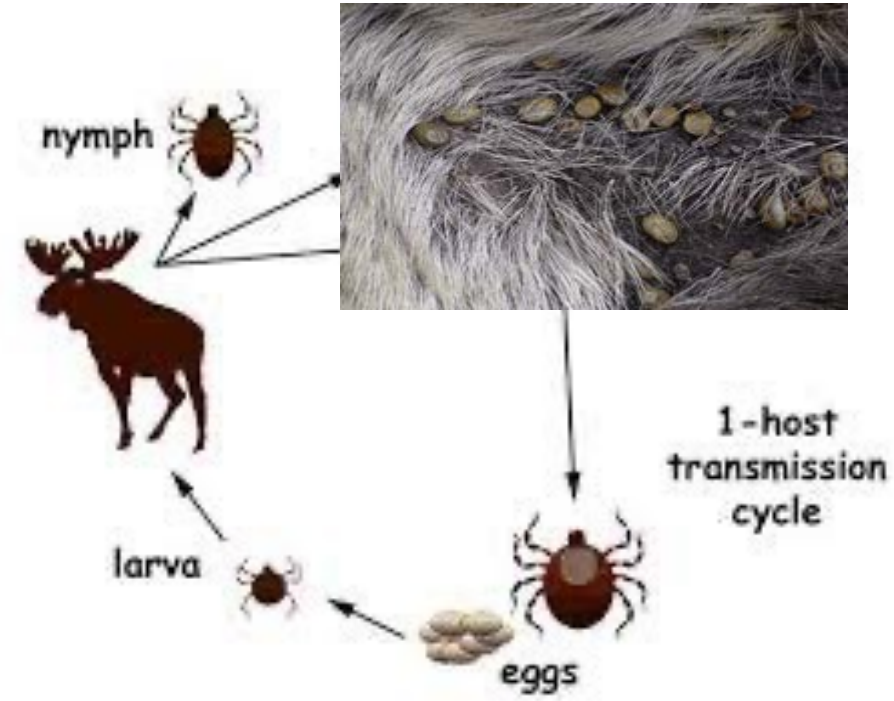
Polar bears threatened with extinction

https://www.nytimes.com

Climate change

- Warmer winters
- Increased numbers of **Moose ticks**



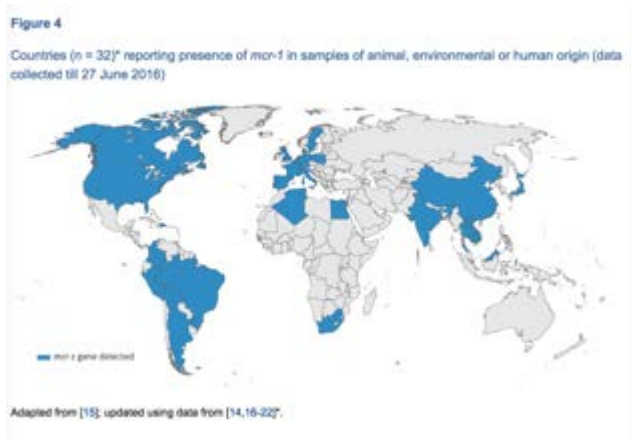


Antibiotic use as “growth promotion”

- 1950’s discovered that low levels of **antibiotics** promotes weight gain
- Used as part of intensification of animal farming; increase efficiency

Colistin

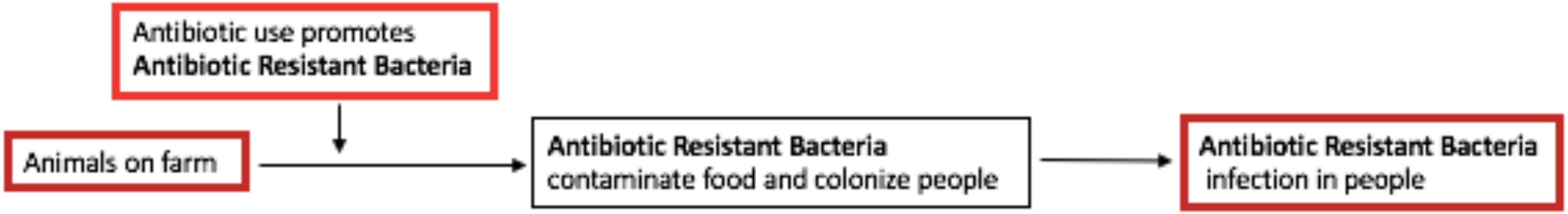
- China – 2015
  - Bacteria with Colistin Resistance were found:
    - **20% of pigs** in slaughterhouses
    - **15%** of pig **meat in stores**
    - **1% patients** in hospital
  - Spread globally



Lancet Infect Dis. 2016 :16(2):161-8

UTI – as Foodborne infections

- Identical strains of E. coli in chicken, meat, and in people with UTI
- All UTIs are NOT foodborne
  - But some are; **some E. coli causing UTI have been acquired through food**

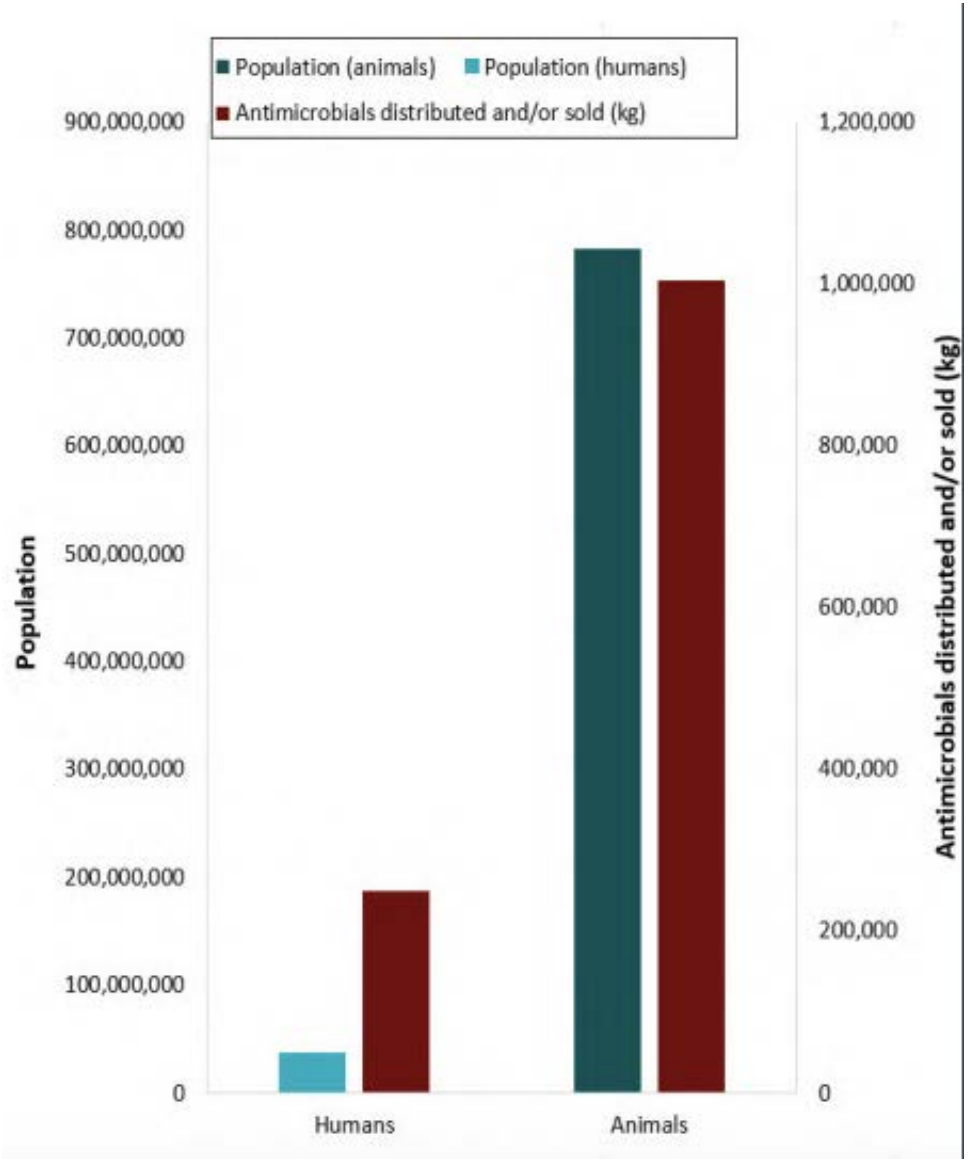


Lancet Infect Dis. 2019; 19;1269

Antibiotic use in Canada

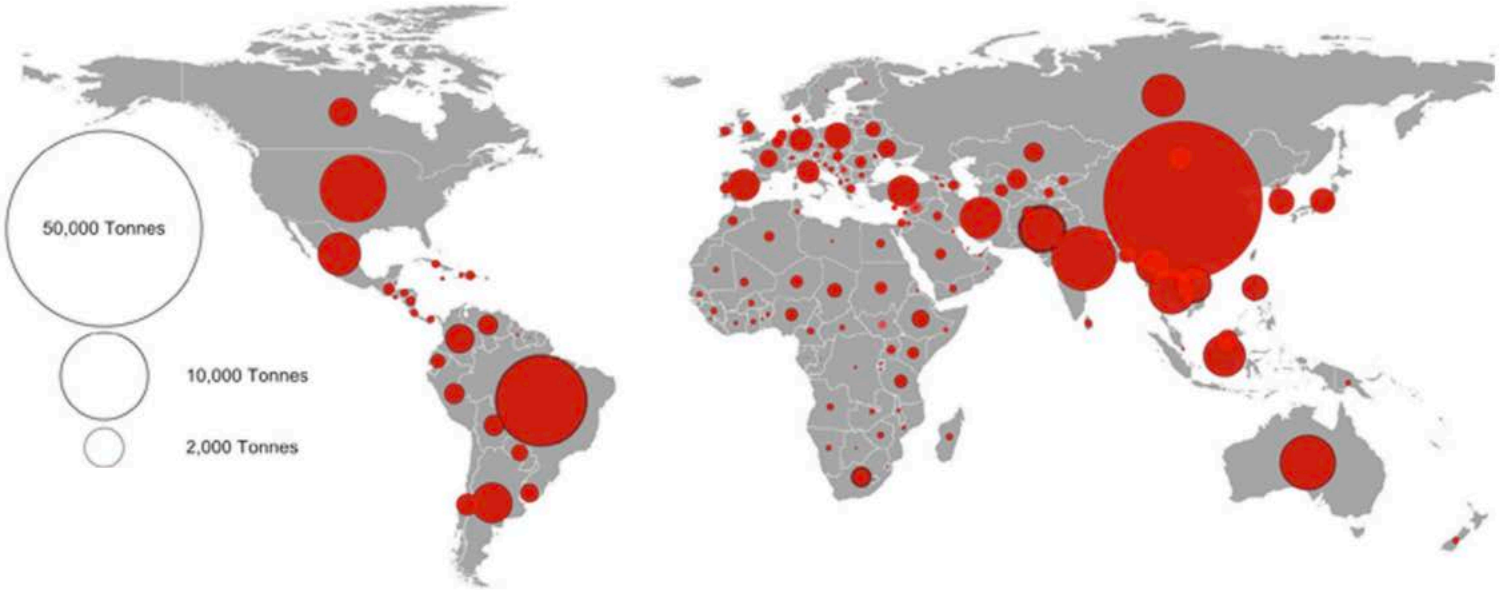
- **80%** of all antibiotics in Canada are for animals
  - **90%** are given to healthy animals

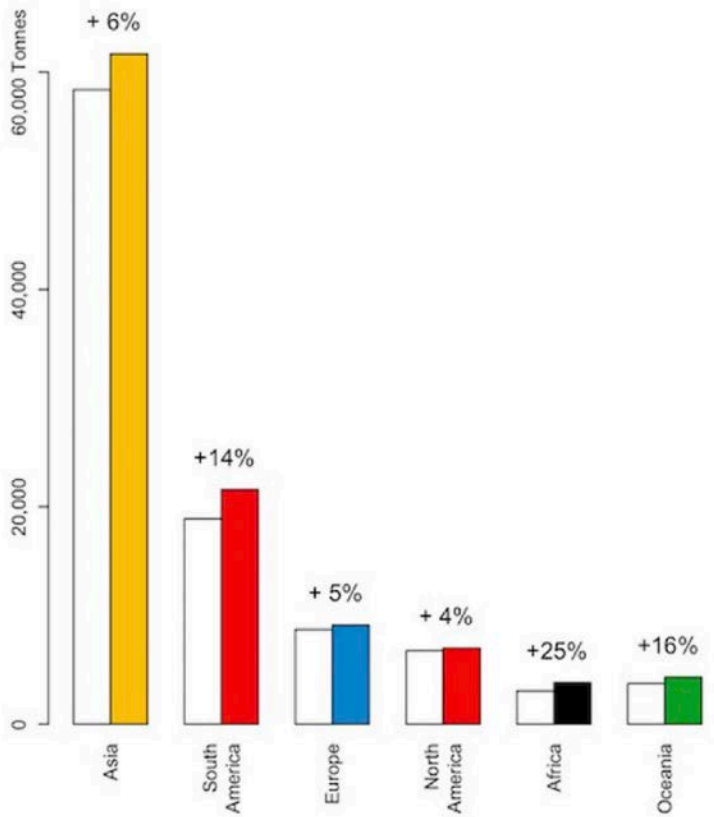
- Legislative changes to reduce overall use and especially reduce use of medically necessary antibiotics



CIPARS report 2018

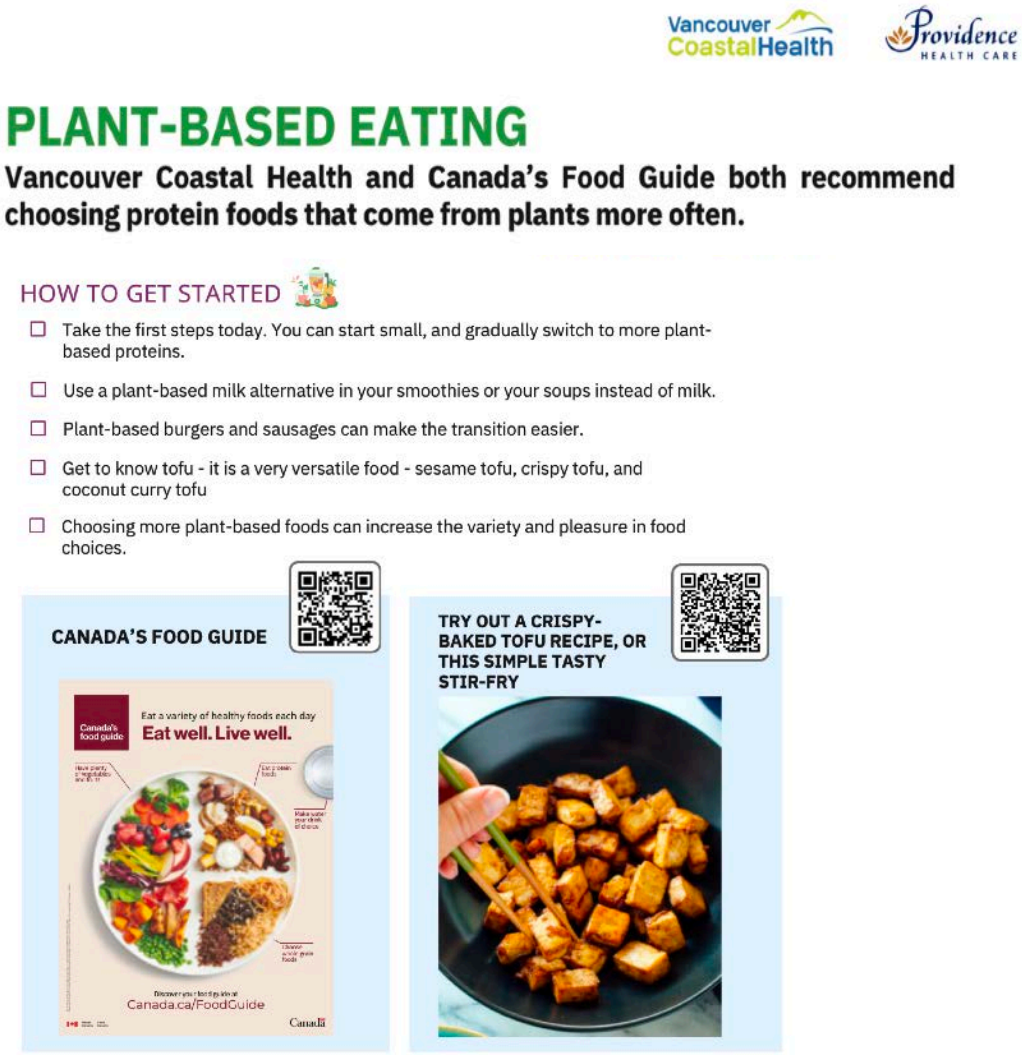
Antibiotic use for food animals globally
Expected to continue to increase….





PLOS Glob Public Health. 2023;3(2):e0001305.

Eating meat, dairy and eggs is not necessary



Position of the US Academy of Nutrition and Dietetics:

- **appropriately planned vegan diets are healthful, nutritionally adequate, and may provide health benefits**

- appropriate for all stages of life cycle

- more environmentally sustainable than diets rich in animal products

- vegans diets need supplementation with reliable sources of B-12

J Acad Nutr Diet. 2016 Dec;116(12):1970-1980.

The Province

Opinion / Op-Ed

Dr. Crystal Heath and Dr. Jan Hajek: Dogs can be healthy — and happy — on a plant-based diet

Opinion: This idea can be shocking to many, but the research to back up this claim is solid and can provide us with greater freedom when it comes to choosing food for the dogs in our families.

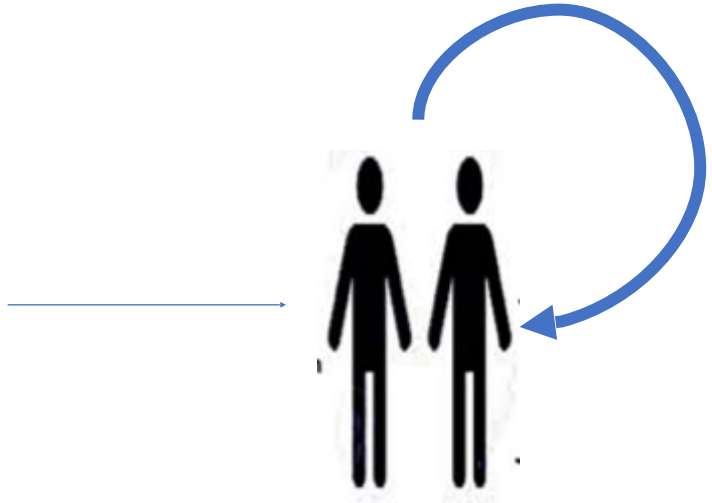
Dr. Crystal Heath, Dr. Jan Hajek

Published Feb 28, 2023 • Last updated Mar 01, 2023 • 3 minute read

Join the conversation

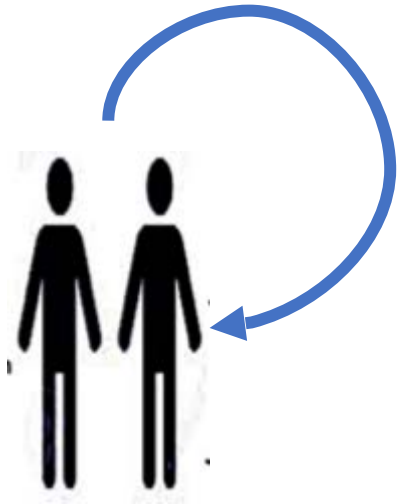
SARS

- China, 2003
  - Outbreak of atypical pneumonia
  - Cases in humans were linked to markets/restaurants with civet cats
  - SARS virus found in civet cats and racoon dogs



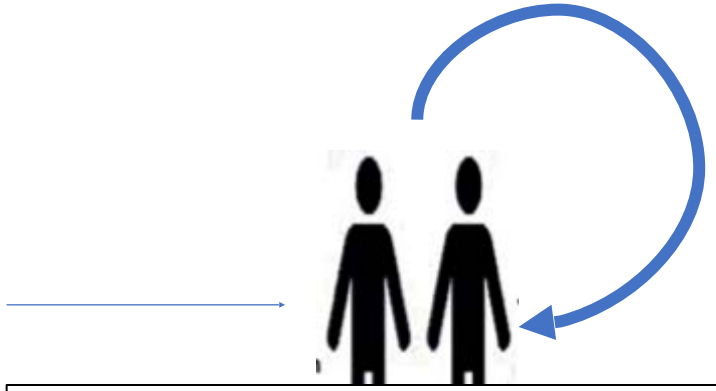
SARS

- China, 2003
  - Outbreak of atypical pneumonia
  - Cases in humans were linked to markets/restaurants with cive
  - SARS virus found in civet cats and racoon dogs



SARS

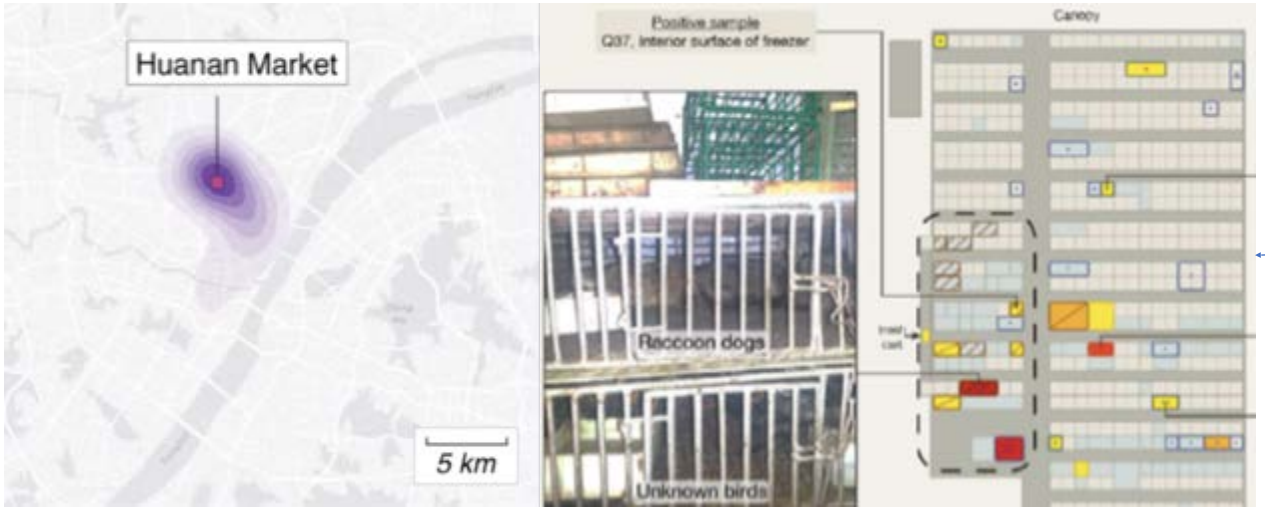
- China, 2003
  - Outbreak of atypical pneumonia
  - Cases in humans were linked to markets/restaurants with cive
  - SARS virus found in civet cats and racoon dogs



Ban on trade of civet cats
- Temporary

COVID - 2019

- Strongly linked to a live animal market, Wuhan
  1. Initial human cases clustered around the market
  2. Animals sold in the market were susceptible to SARS-CoV-2
  3. Animals removed – but, cages tested positive for SARS-CoV-2



?

Worobey et al. *Science*, 377, 2022

Fur farms

- Millions of animals globally
- Susceptible to SARS-CoV
  - Mink
  - Raccoon Dogs
  - Foxes

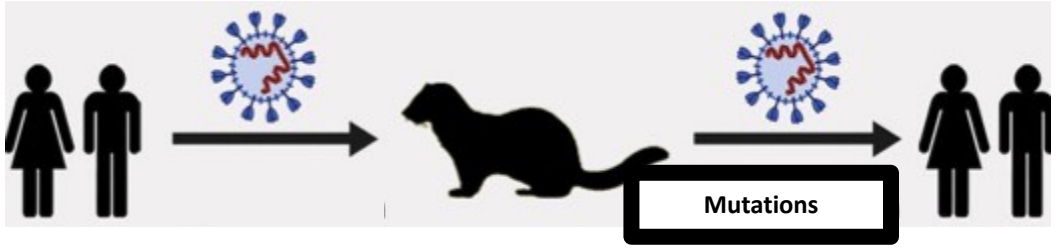
Fur farms

- Millions of animals globally
- Susceptible to SARS-CoV
  - Mink
  - Raccoon Dogs
  - Foxes

?

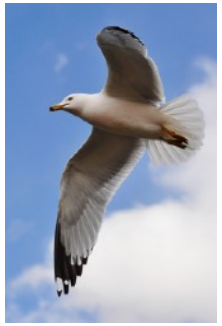
Fur farms

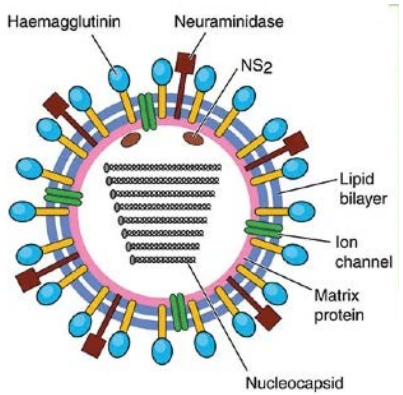
- Millions of animals globally
- Susceptible to SARS-CoV and **influenza**
  - Mink
  - Raccoon Dogs
  - Foxes



Fur farms – and H5N1…

- Mink fur farm, 50,000 animals, Spain
- October 2022, outbreak of deaths from respiratory infection
- H5N1
  - From birds
  - Spread mink → mink
  - Novel mutations*





Euro Surveill. 2023 Jan 19; 28(3): 2300001.

UN environment programme

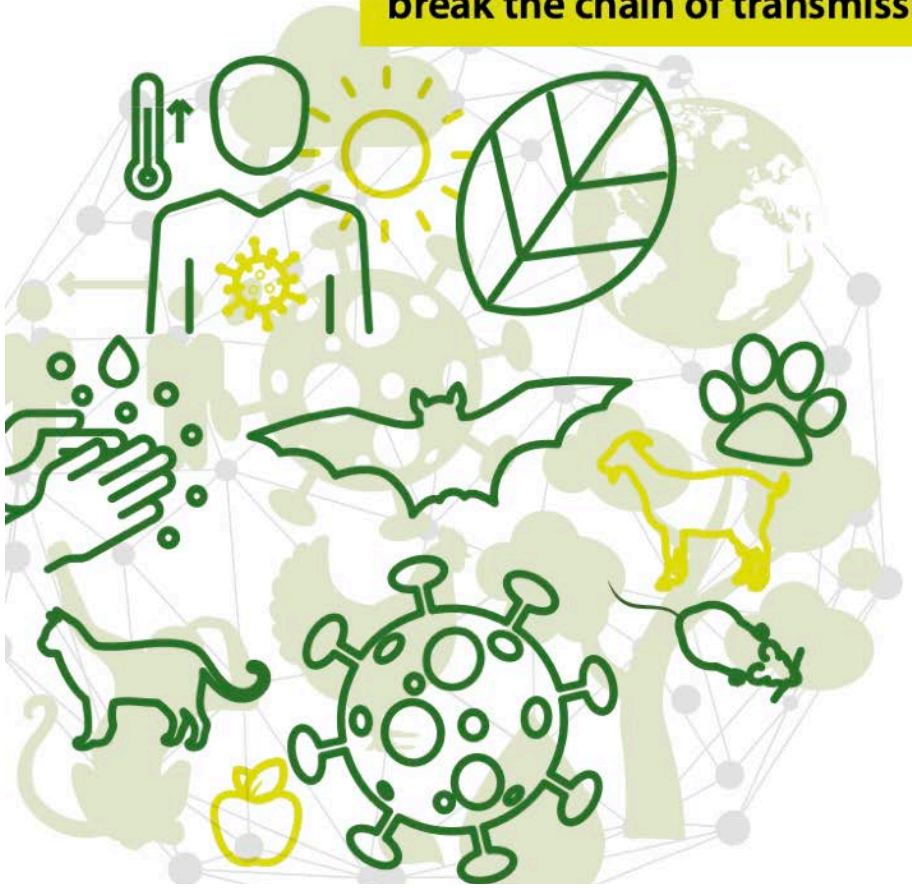
COVID-19 RESPONSE

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR

PREVENTING THE NEXT PANDEMIC

Zoonotic diseases and how to break the chain of transmission



Seven major anthropogenic drivers of zoonotic disease emergence

A broad range of studies on zoonotic disease emergence implicates the following seven main drivers of their emergence.[23,24-26] Many of these drivers are now occurring

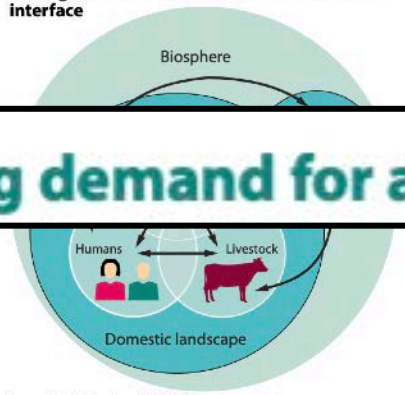
increase: Since the 1960s, the share of the region's daily food supply of proteins from animal products has doubled to 21 per cent; from fish, it has increased by half to 15 per cent. The share of total calories from both fish and animal products doubled to total of 12 per cent of the supply. Meanwhile, South Asia has also seen an increase in animal protein consumption, but not as strong. Sub-Saharan Africa has also followed the pattern seen in Southeast Asia, although it has been less marked. This per capita increase in animal protein consumption in many low- and middle-income countries has been accompanied by significant growths in population. Together, these factors have driven a strong growth in meat production (+260 per cent), milk (+90 per cent), and eggs (+340 per cent) over the last 50 years. This trend is predicted to continue in the coming decades, with most growth in animal-source food consumption occurring in low- and middle-income countries. Compared with other protein sources, livestock product consumption is rising rapidly, whereas the long-

1. Increasing demand for animal protein

intensification and industrialization of animal production. The intensification of agriculture, and in particular of domestic livestock farming (animal husbandry), results in large numbers of genetically similar animals. These are often bred for higher production levels; more recently, they have also been bred for disease resistance. As a result, domestic animals are being kept in close proximity to each other and often in less than ideal conditions. Such genetically homogenous host populations are more vulnerable to infection than genetically diverse populations, because the latter are more li some individuals that better resist disease of pigs, for example, promoted transmissi due to a lack of physical distancing betwe In poorer countries, there are additional ri that livestock production often occurs close to cities, while biosecurity and basic husbandry practices are often inadequate, animal waste is often poorly managed, and antimicrobial drugs are used to mask poor conditions or practices. Since 1940, agricultural intensification measures such as dams, irrigation projects and factory farms have

2. Unsustainable agricultural intensification

Pathogen flow at the wildlife-livestock-human interface



Source: Adapted from Jones et al. (2013)[23]

been associated with more than 25 per cent of all—and more than 50 per cent of zoonotic—infectious diseases that have emerged in humans.[28] Moreover, around one third of croplands are used for animal feed. In some countries, this is driving deforestation.[29]

3. Increased use and exploitation of wildlife

There are many ways in which wildlife are used and traded. Section three provides more detail on the complexities

and money for the poor;
2. Recreational hunting and consumption of wildlife as a status symbol;
3. Consumption of wildlife in the belief that wild meat is fresh, natural, traditional and safe;
4. Trade in live animals for recreational use (pets, zoos) and for research and medical testing; and
5. Use of animal parts for decorative, medicinal and other commercial products.

3. Increased use and exploitation of wildlife

has also been an increased demand for wild animals and their products. In West Africa, for example, exploitation of wildlife for food has increased over the last 10 years.[30]

Infrastructural development can often facilitate wildlife exploitation: new roads in remote areas can increase

Conclusions and Discussion

- One Health approach
  - Human health – Animal health are interconnected
  - Both depend on healthy environment
  - We should work to improve animal and environmental health

- Discussion
  - What are some of the obstacles to a One Health approach?
  - Human rights, yes - animal rights, land rights?
  - More support for cultivated (lab-based) meat?
  - Should doctors eat less animal-based foods?

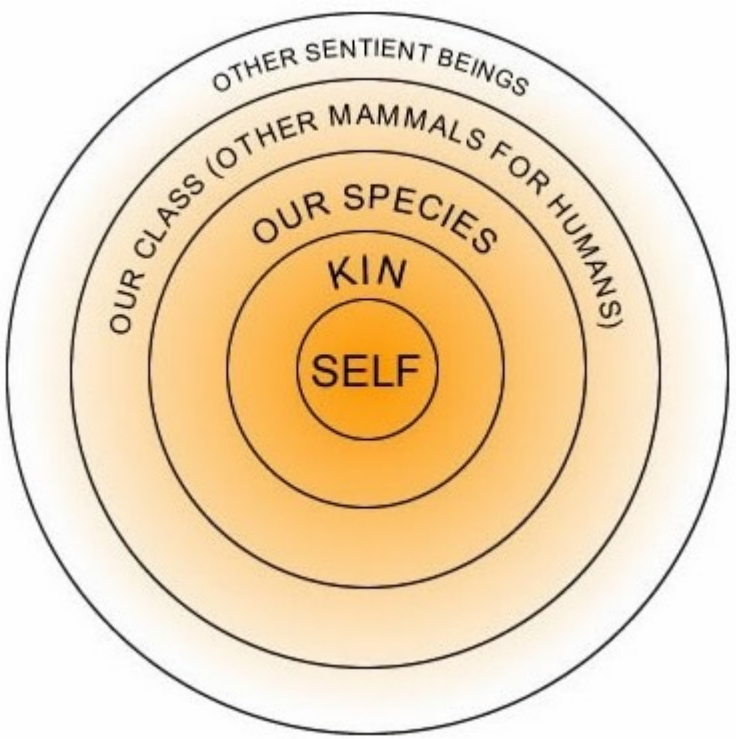
janjhajek@gmail.com

Extra slides

Expanding our circle of moral concern

- An expanding circle of moral concern means, first of all, that we have strong duties to all humans, including peoples whose appearance and culture differ from our own.

- An expanding circle may also mean greater moral consideration to nonhuman animals.



COVID-19 Response and Recovery efforts should include a One Health approach

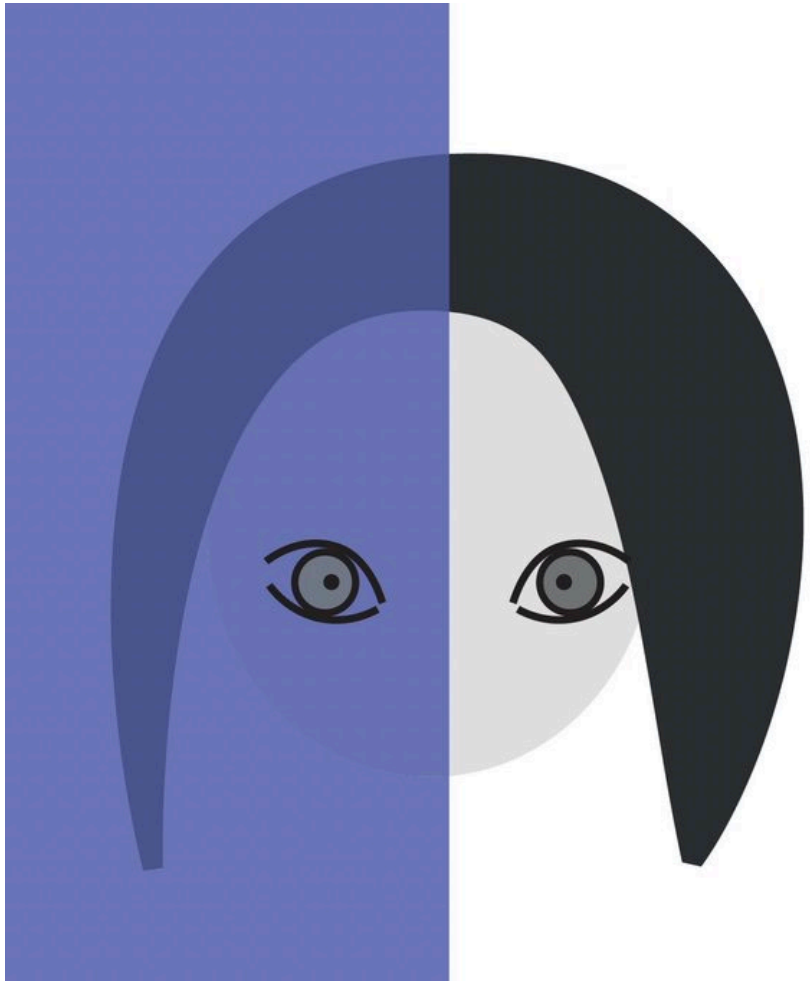
“Pandemics such as COVID-19 are a predictable and predicted outcome of how people source and grow food, trade and consume animals, and alter environments”

- Preventing the Next Pandemic
- UN Environment and international Livestock Research Institute

Wildlife trade is growing

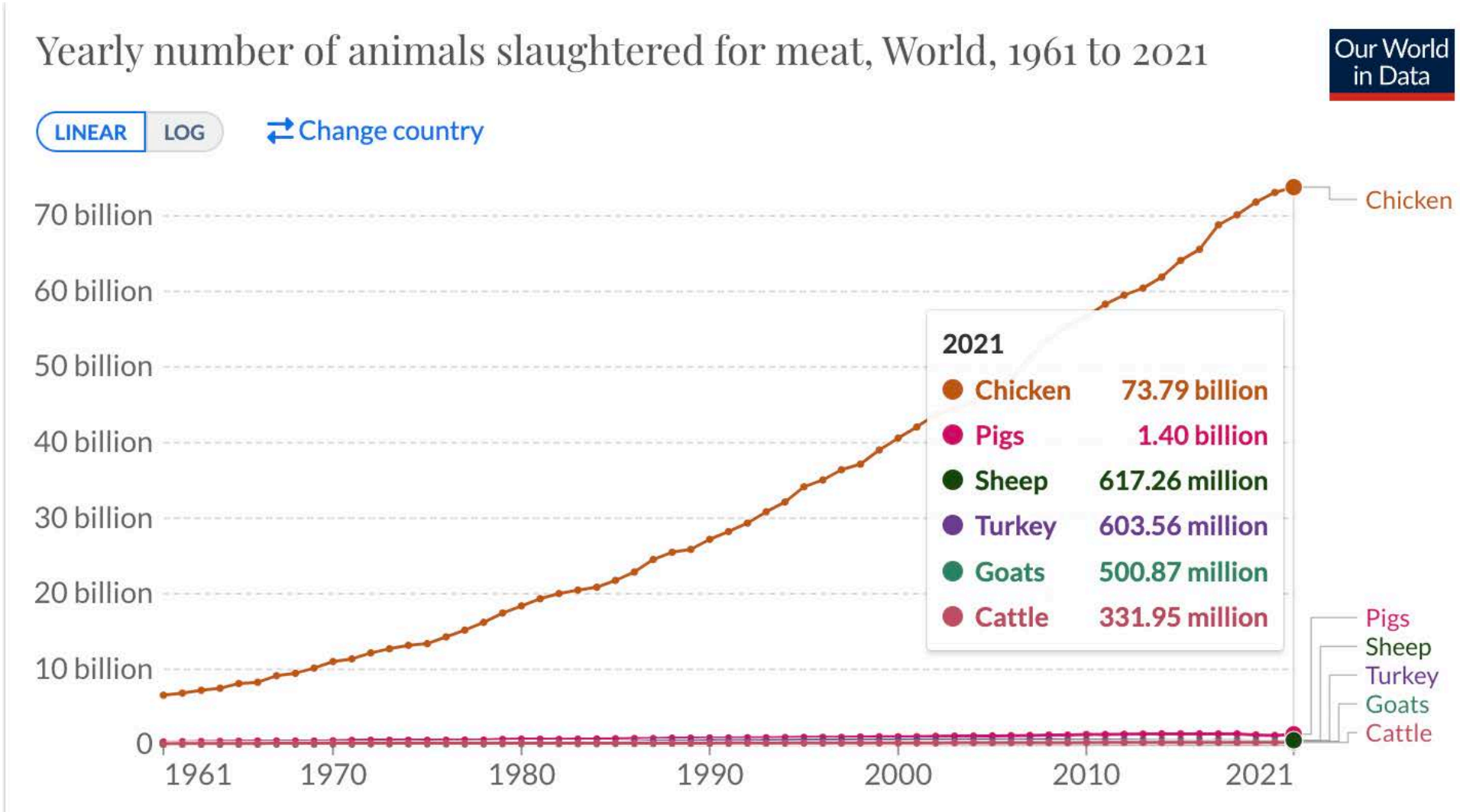
- Multibillion dollar industry
- Wild animals caught
  - Over ~1 million pangolins (Africa, Asia)
  - 100’s of tons of scales
- Mix of wild and farmed animals

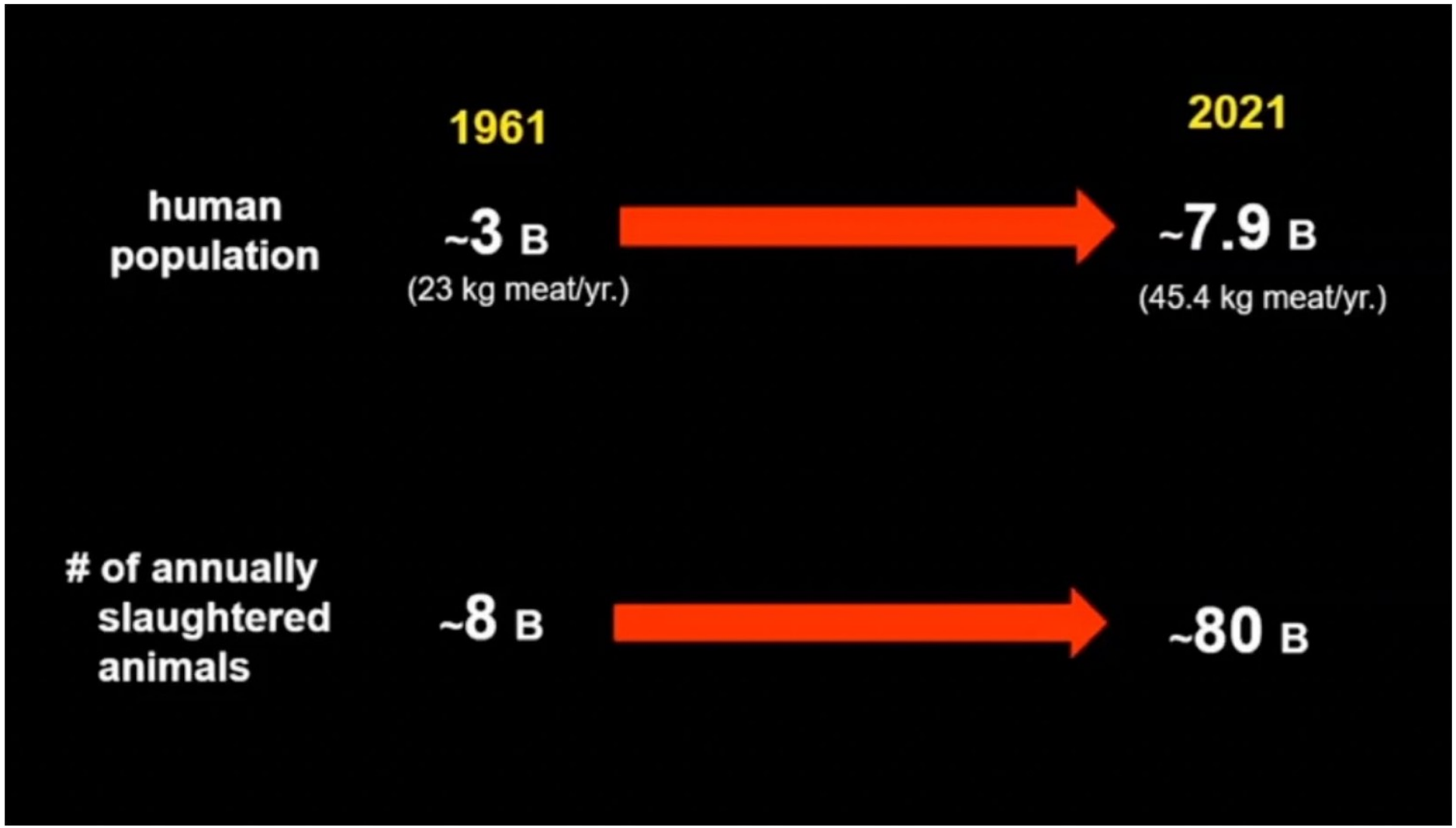
Things aren’t always the way they first appear



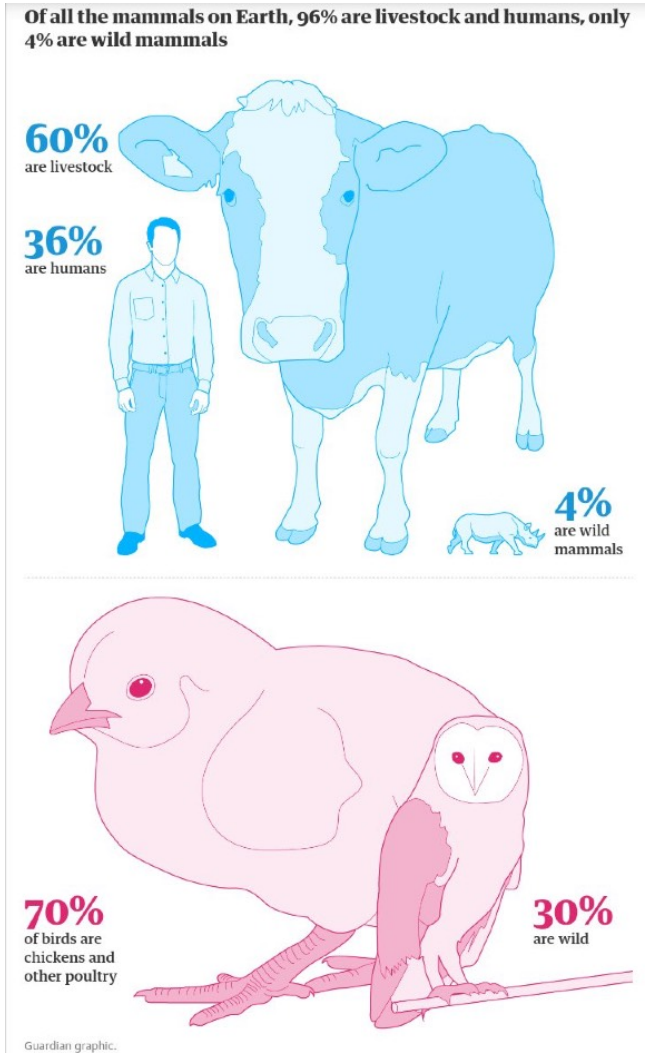
Plant based and cellular meat

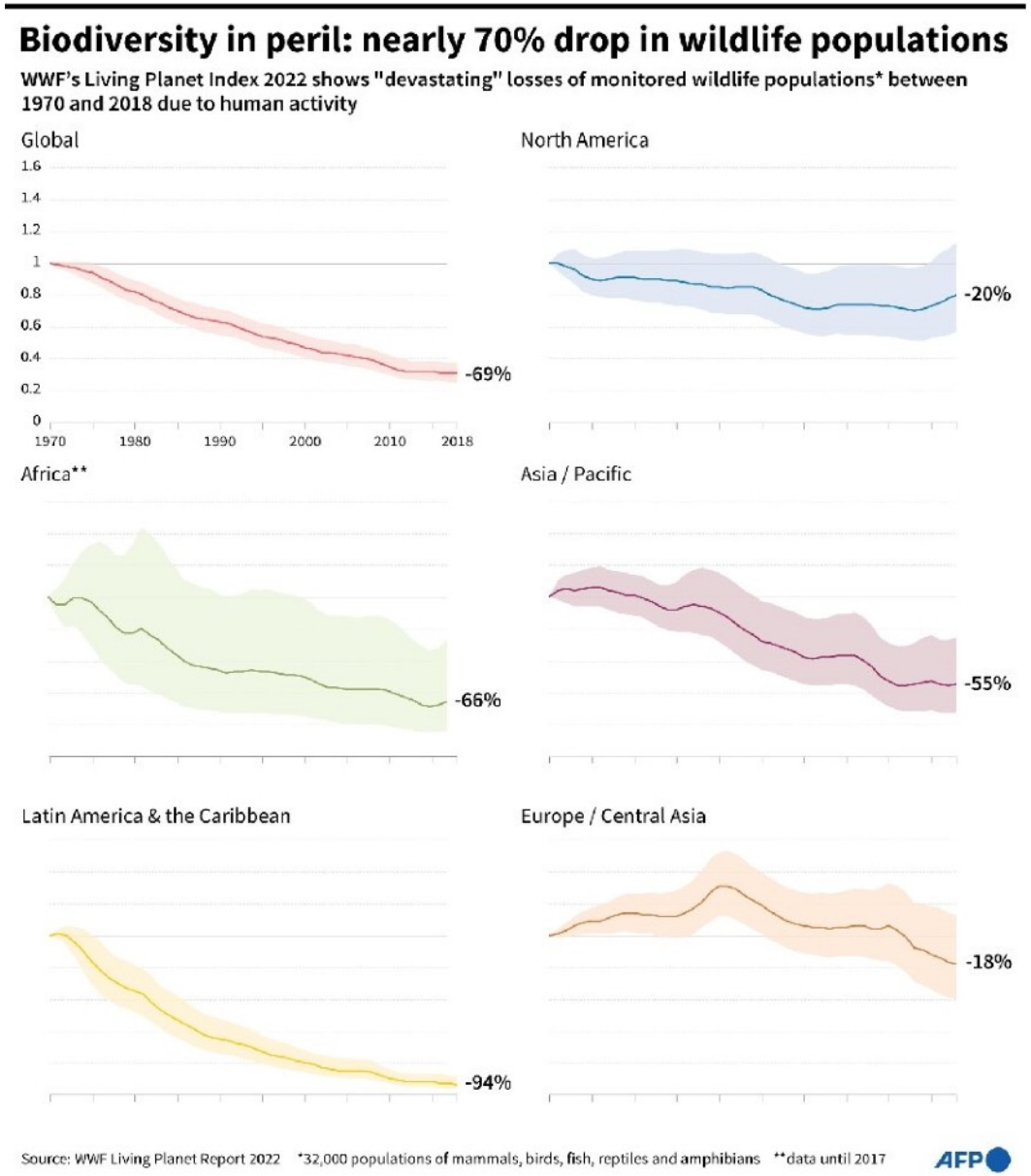
- Provide the opportunity to make a choice first
- Easier for people to be able to think of why they are making that choice after


Yearly number of animals slaughtered for meat, World, 1961 to 2021
Our World in Data
LINEAR
LOG
Change country
70 billion
60 billion
50 billion
40 billion
30 billion
20 billion
10 billion
0
1961
1970
1980
1990
2000
2010
2021
Chicken
Pigs
Sheep
Turkey
Goats
Cattle
2021
Chicken 73.79 billion
Pigs 1.40 billion
Sheep 617.26 million
Turkey 603.56 million
Goats 500.87 million
Cattle 331.95 million


1961
2021
human population
~3 B
(23 kg meat/yr.)
~7.9 B
(45.4 kg meat/yr.)
# of annually slaughtered animals
~8 B
~80 B

Biodiversity loss

- 



- Zoonoses
- Animal suffering
- Biodiversity loss
- Global warming
- ….