Pandemics & Environmental Health

Exploring the links between Environmental Health, Climate Change and Pandemics present, past and future

Learning Objectives

1. **Understand links between environmental health and pandemics**
   - To understand the interactions between environmental health and pandemics.
2. **Assess Impact on Pandemic Severity and Healthcare**
   - To analyse how human and climate-driven events impact healthcare and increase health disparities during pandemics.
3. **Draw Lessons from Historical and Current Examples**
   - To explore how climate change has influenced past pandemics and recent outbreaks.
4. **Propose Synergistic Solutions and Strategies**
   - To understand strategies that address both environmental change and pandemic preparedness.

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INTRODUCTION

Humans interact with their environment in many ways. Being in close proximity with other animals and wildlife increases the risk of zoonotic disease transmission, where diseases ‘jump’ from one species to another.

INTRODUCTION

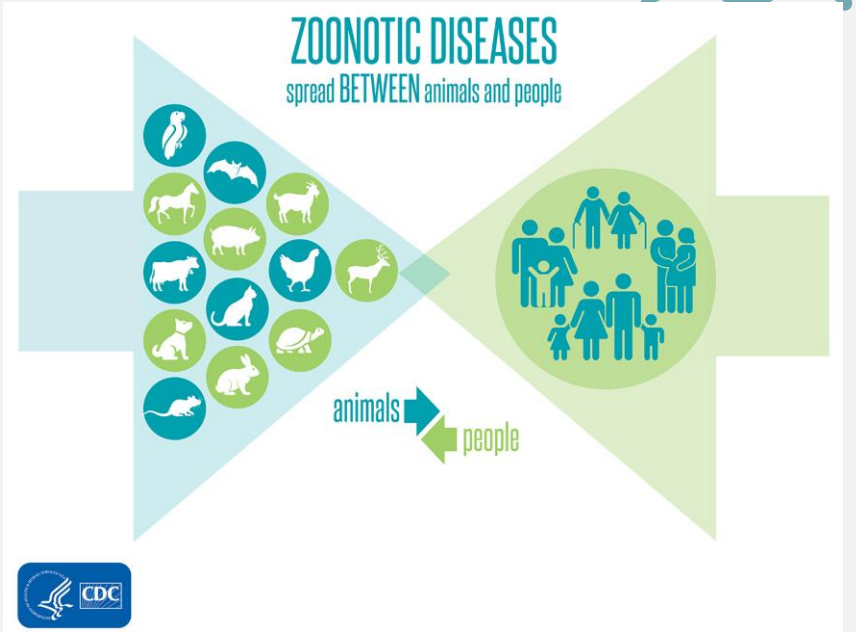
Climate change alters the way we interact with other species on Earth.

This inevitably has an impact on our health, and increases the risk for infections

Definitions

Zoonotic transmission refers to spread of disease between animals and people.

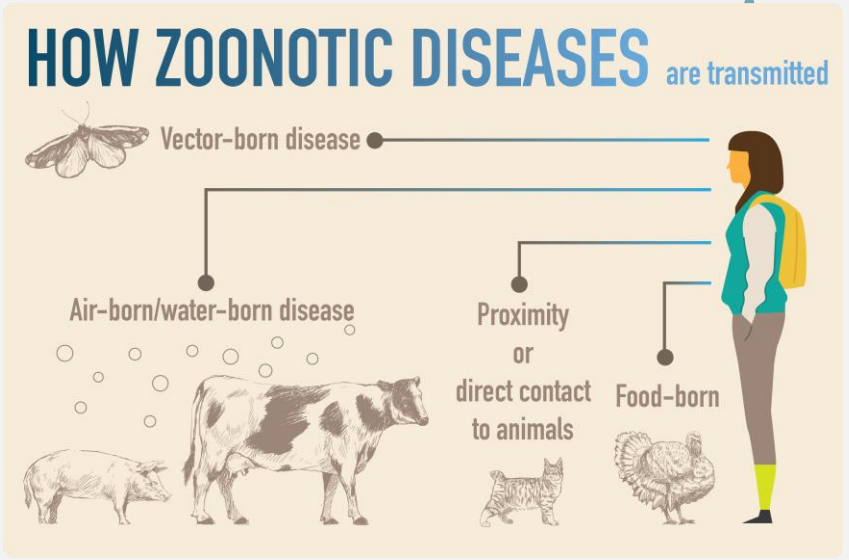
COVID-19 may be one such example. Other diseases, such as bird flu, are also on the rise due to the sheer number of people on the planet, habitat destruction and cultural factors



Definitions

Disease can spread through:

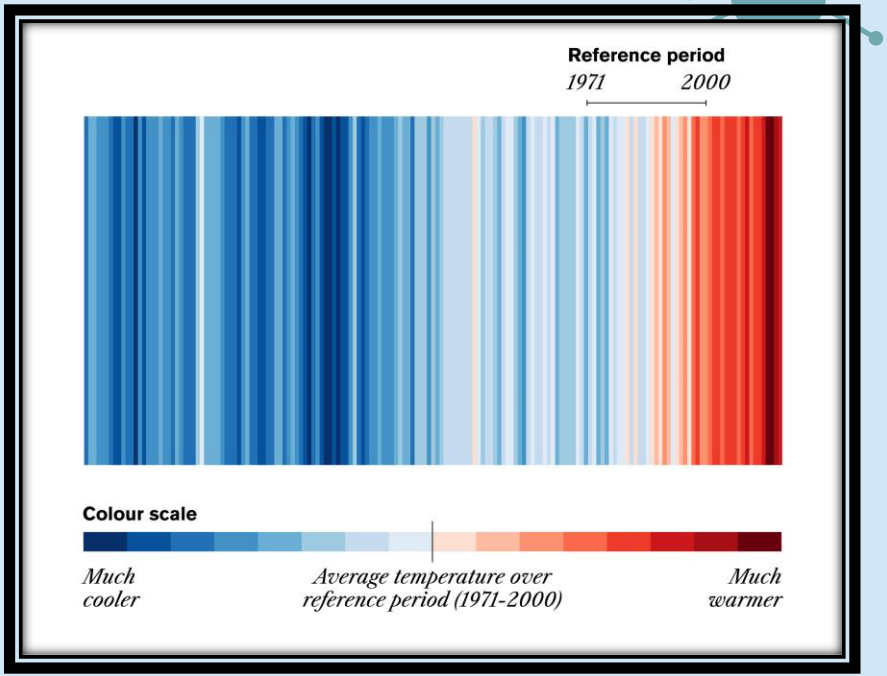
- Food
- Proximity or direct contact with animals
- Airborne or waterborne diseases
- Vector-borne disease



Definitions

Climate Change refers to long-term shifts in temperatures and weather patterns. These shifts can be natural, or human-caused.

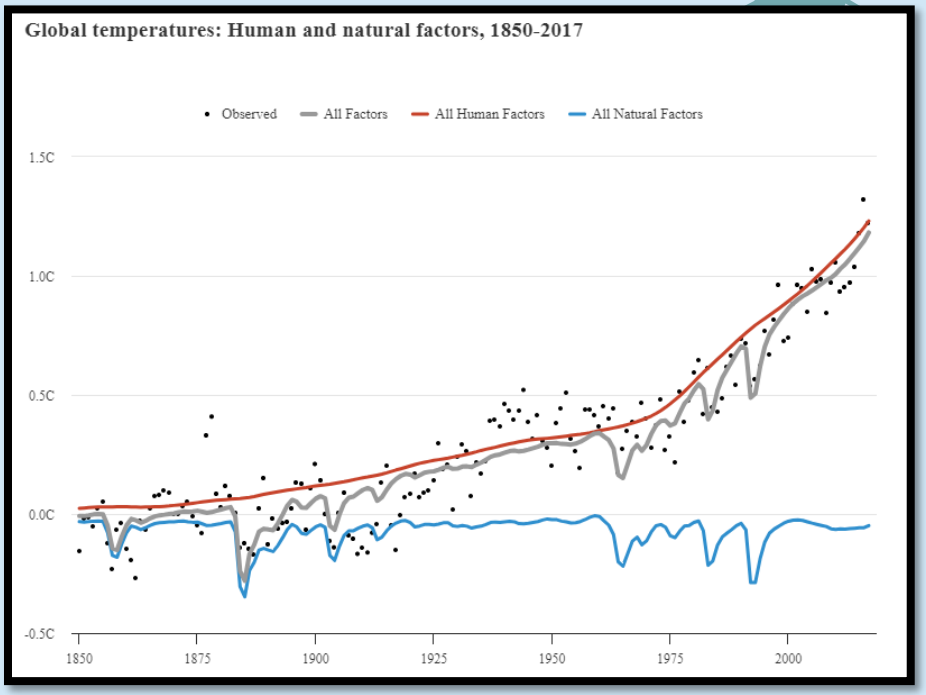
We are currently experiencing warming due to human activities, called “anthropo-genic” warming.



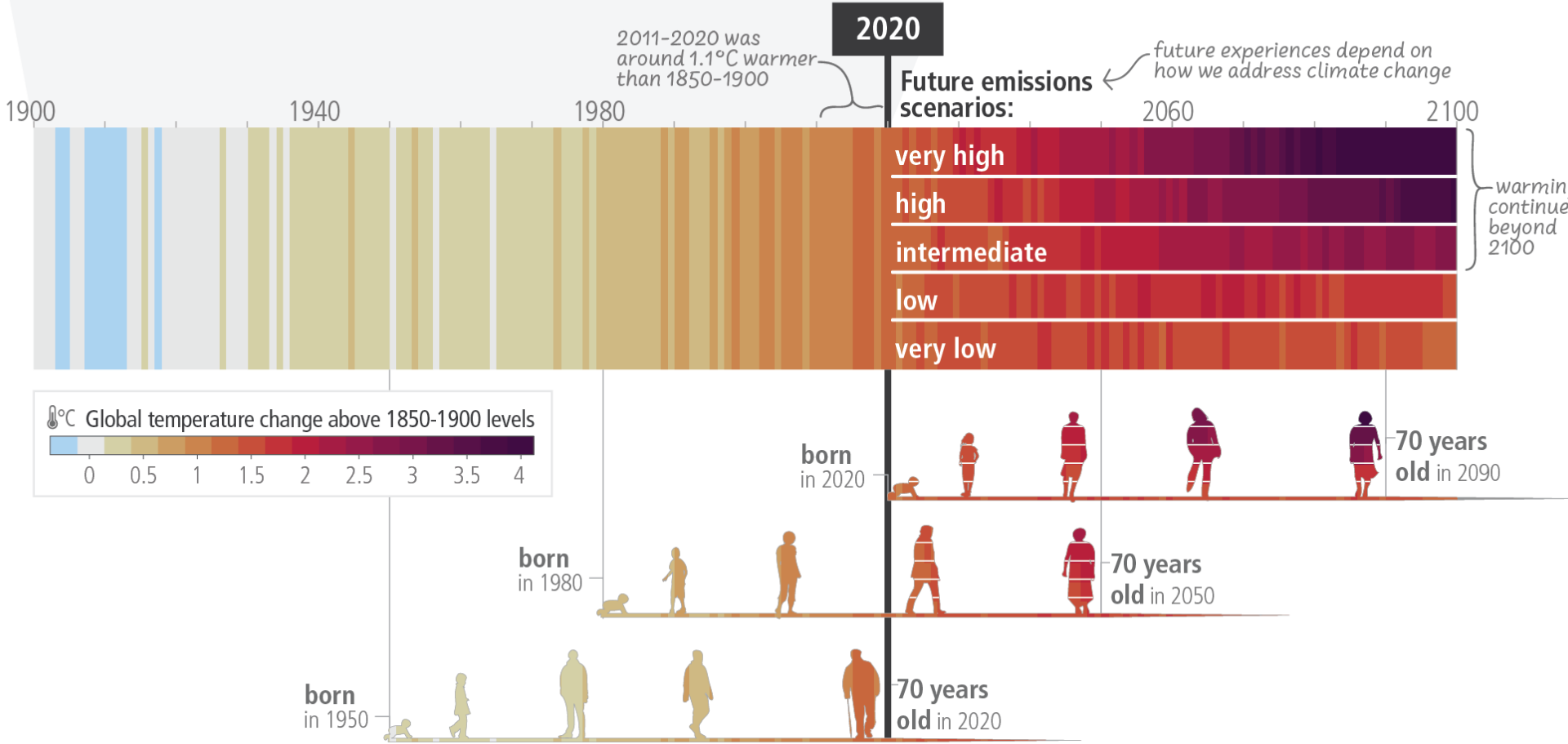
Definitions

The evidence overwhelmingly shows that current **climate change** is unprecedented in speed, intensity and magnitude during human history.

The world has warmed 1.2°C since the start of the Industrial revolution.



c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term



Definitions

A **pandemic** is a widespread occurrence of infectious diseases over a region or the whole world at a particular time.

The COVID-19 pandemic is one such example. We will explore others that occurred in history

What's the difference?

Endemic, epidemic and pandemic explained.

Epidemic or Outbreak

Disease occurrence among a population that is more than what is expected in a given time and place, usually a sudden increase

Pandemic

An epidemic that spreads across regions

Endemic

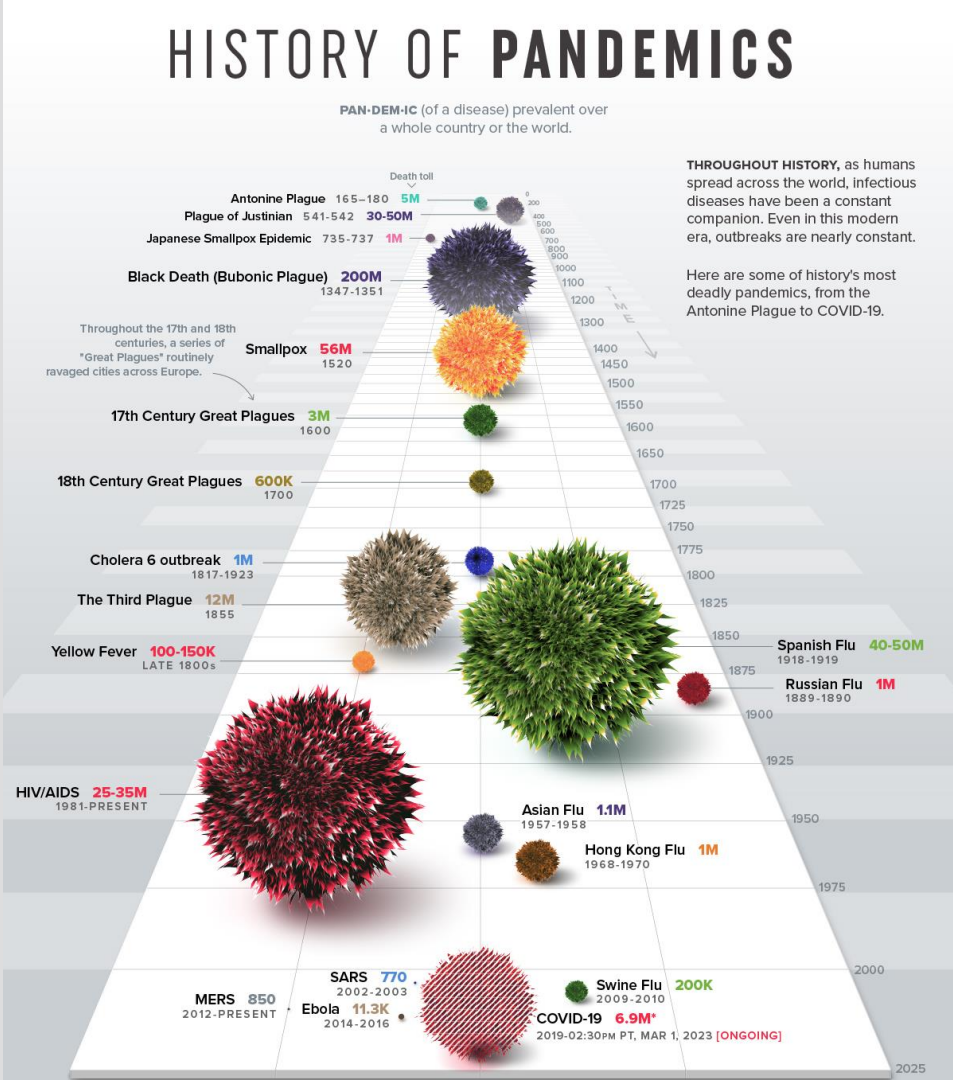
A disease or condition present among a population at all times

Source: Centers for Disease Control and Prevention (CDC)

Definitions

Pandemic examples:

- Spanish Flu
- HIV/AIDS
- COVID-19



01

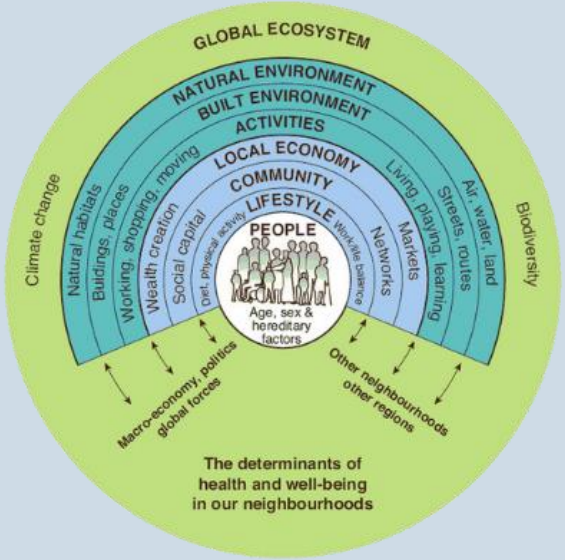
Environmental health, Climate change and Pandemics

How are they related?

Environmental Health

This is a branch of public health concerned with monitoring or mitigating factors in the environment that affect human health and disease.

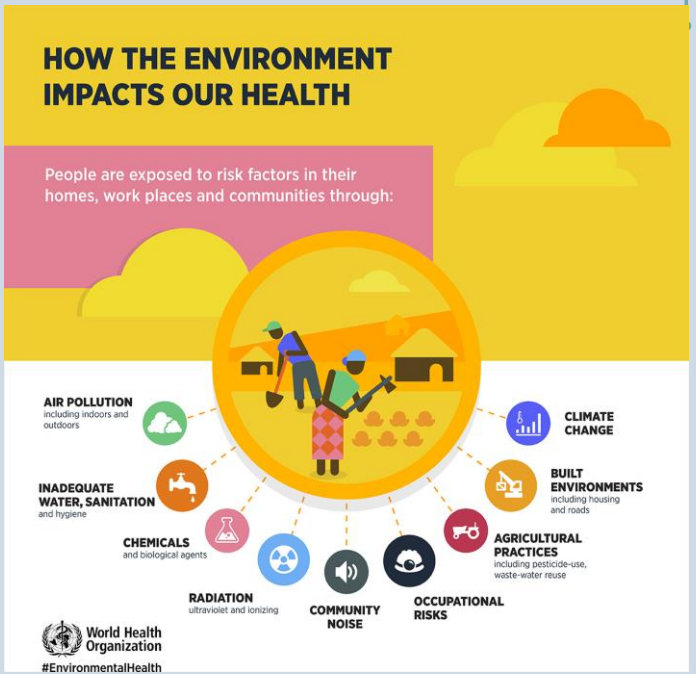
These factors are often called determinants of health and wellbeing, and can be natural or human factors.



Environmental Health and pandemics

An unhealthy environment increases the risk of disease transmission or new diseases emerging.

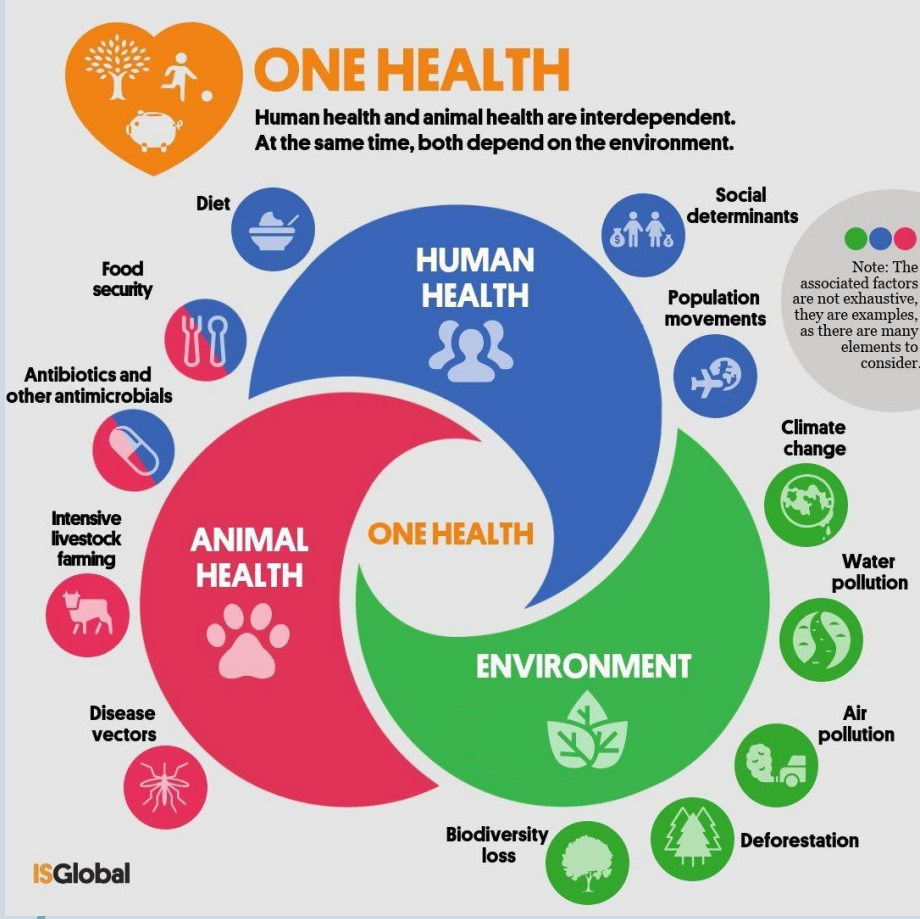
This could set the scene for a new pandemic, especially in our interconnected world.



One Health

One Health refers to a notion that human health and animal health are interdependent, and linked to their shared ecosystems.

This requires a multidisciplinary approach, and increasingly important over time requiring local, national and global cooperation.

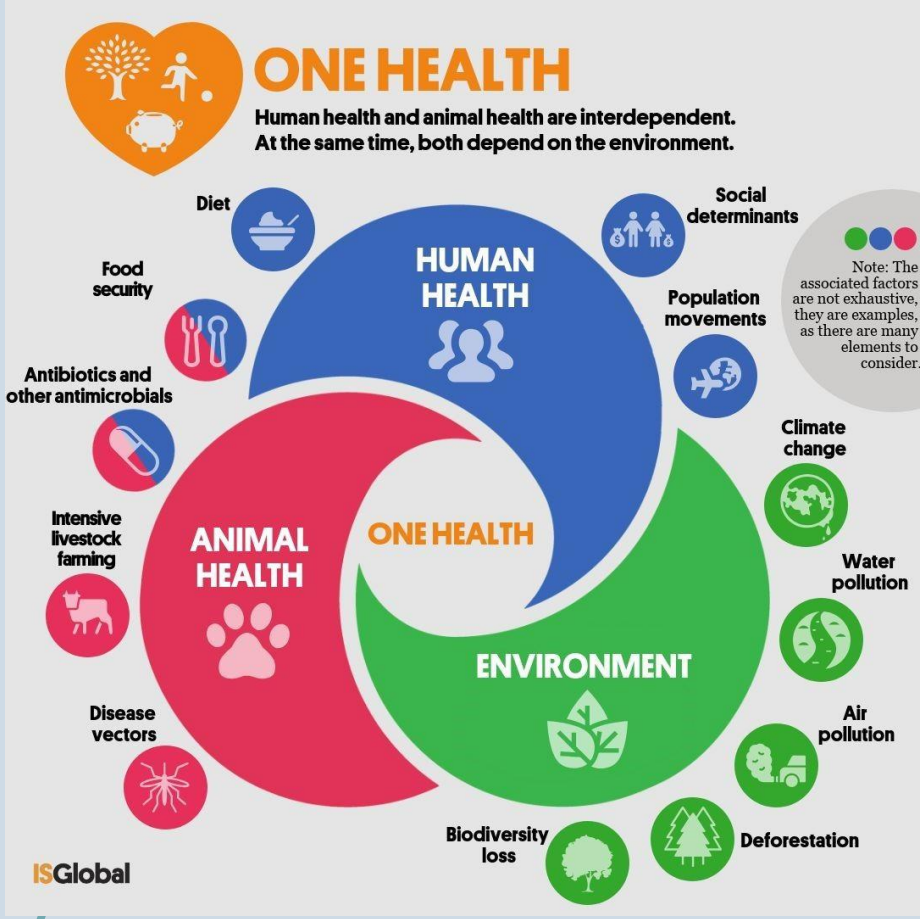


One Health

A healthy environment is conductive to health animals and healthy humans.

This is particularly of note due to

- human population expansion and growth
- climate & land-use changes
- global movements of animals and people



One Health

In the chat during this clip type points of concern from an environmental health perspective.

Video clip: Contagion (2011).

One Health

Healthy ecosystems

Healthy humans

Healthy animals

Food and Agriculture Organization of the United Nations

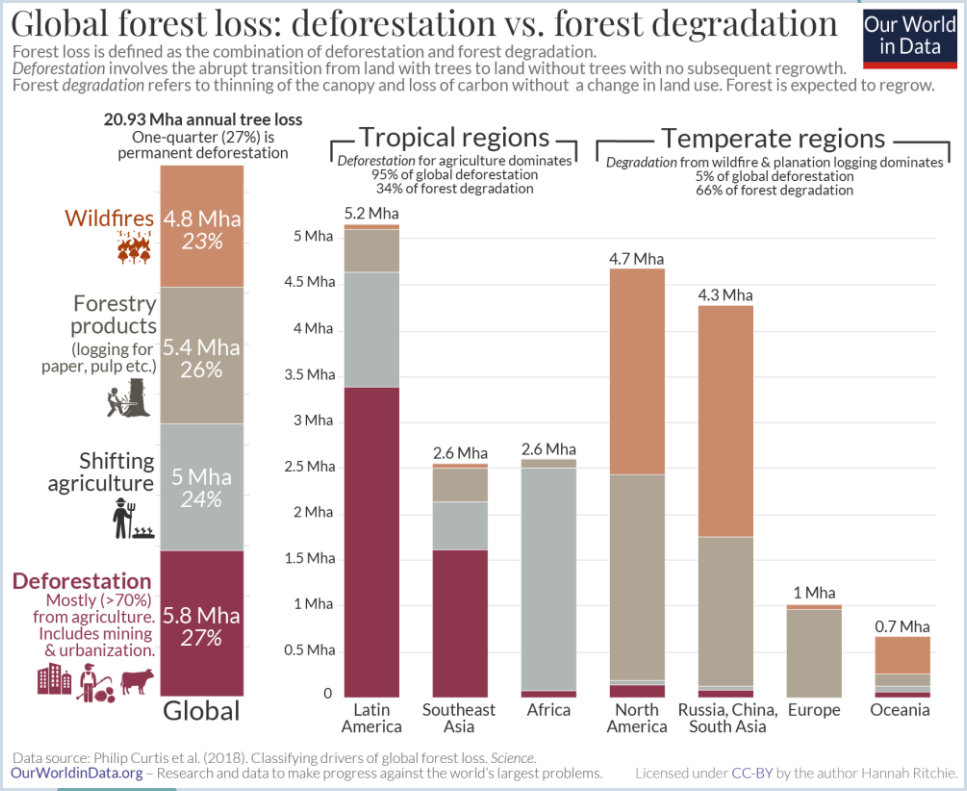
WORLD ORGANISATION FOR ANIMAL HEALTH

World Health Organization

UN environment programme

Environmental Health: Habitat encroachment

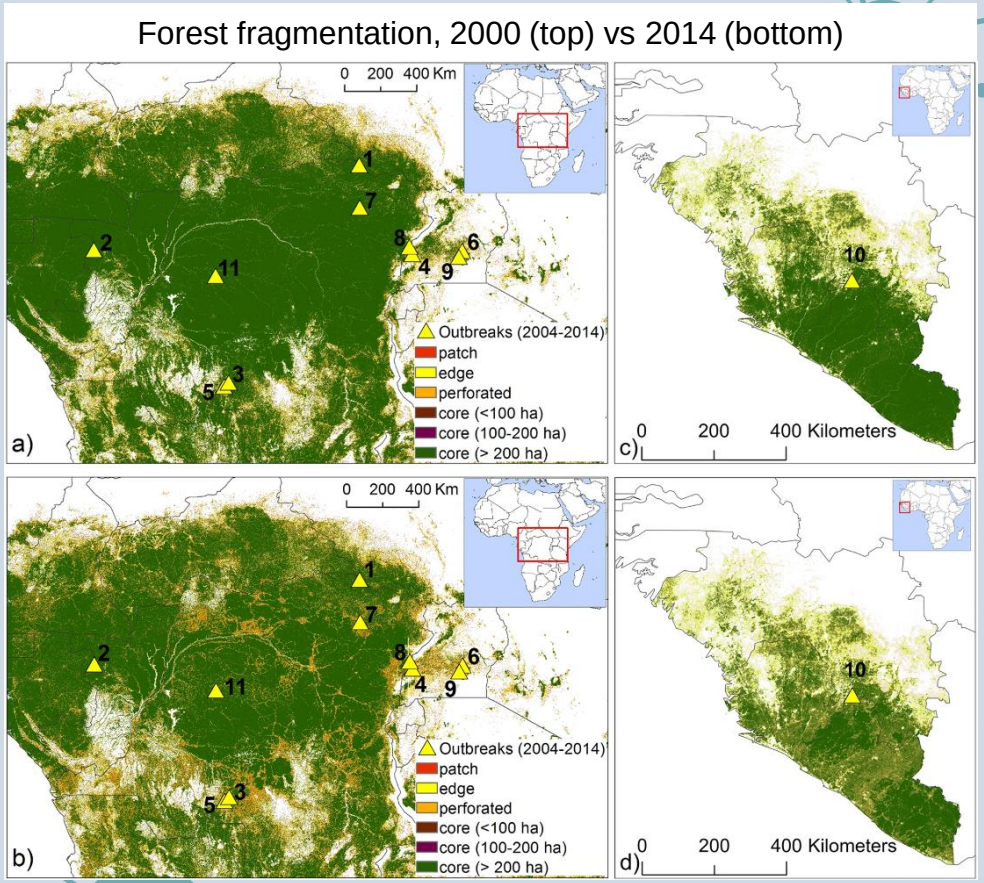
As humans destroy habitats through expansion of activities such as deforestation, mining, agriculture and construction, the risk of disease transmission increases.



Ebola as an Example

Ebola outbreaks are likely to occur in hotspots of forest fragmentation. Through increased human contact with wildlife, the risks of transmission of ebolaviruses from wildlife reservoirs to humans increase.

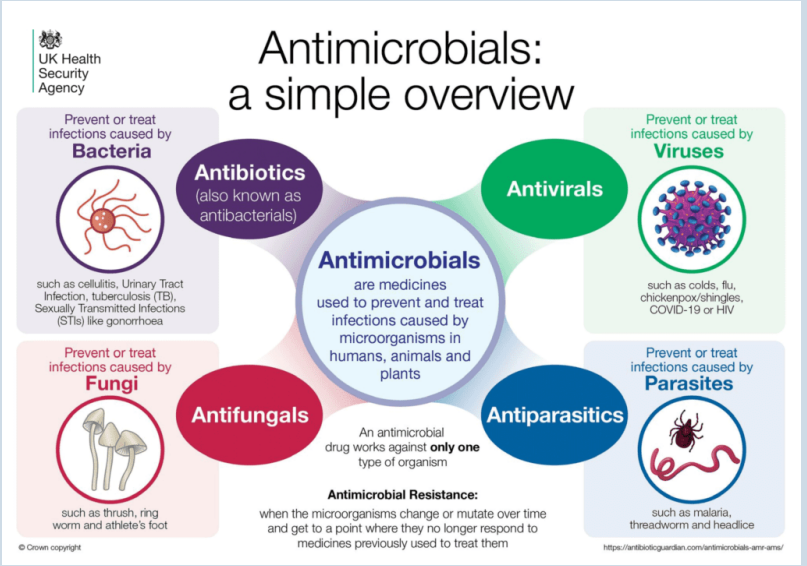
As forests fragment, Ebola outbreaks are more likely to occur.



Antimicrobial resistance

Through careless and widespread use of antibiotics, microbes are developing the ability to defeat drugs designed to kill them.

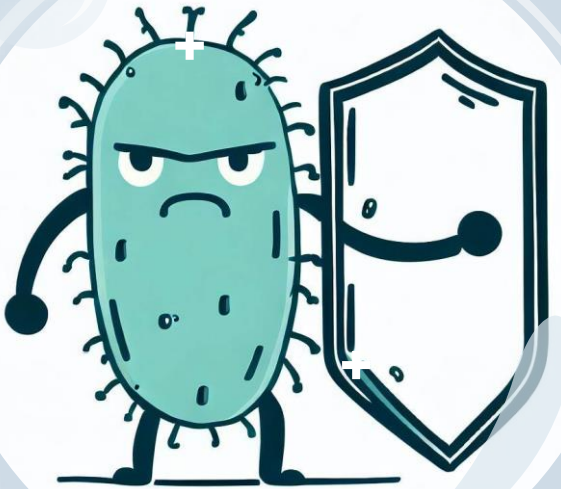
This is a major worldwide problem requiring global cooperation and stringent monitoring. The WHO has recently declared AMR as one of the top 10 global public health threats facing humanity.



Antimicrobial resistance

Dealing with this problem requires a transdisciplinary approach though veterinary, public health and clinical cooperation.

The cost of AMR is highly significant. Prolonged illness burden healthcare systems, require more expensive medicines, and may still lead to patient death.



Antimicrobial resistance

Emergence of Superbugs

Superbugs are strains of bacteria that have become resistant to known antibiotics.

According to the WHO there will be more deaths related to superbugs than cancer by 2050!

These could well be candidates for future pandemics, and virtually untreatable (as drugs take a long time to develop).

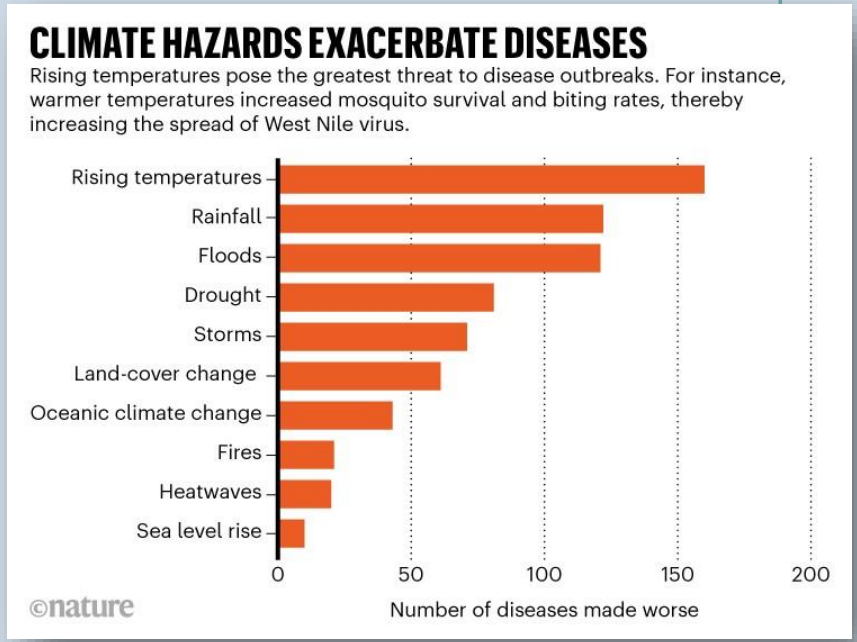
Emergence of Superbugs

How do we slow down the development of superbugs?

- Avoid self-medication, take only when necessary
- Doctors need to stop administering antibiotics for trivial infections
- Treatments must be completed, even when symptoms subside.

Climate Change and Pandemics

As climate change sets in, habitats change, and with it, the ecosystem. For example, previous areas too cold for certain vectors of disease (e.g. certain mosquito species) become suitable.



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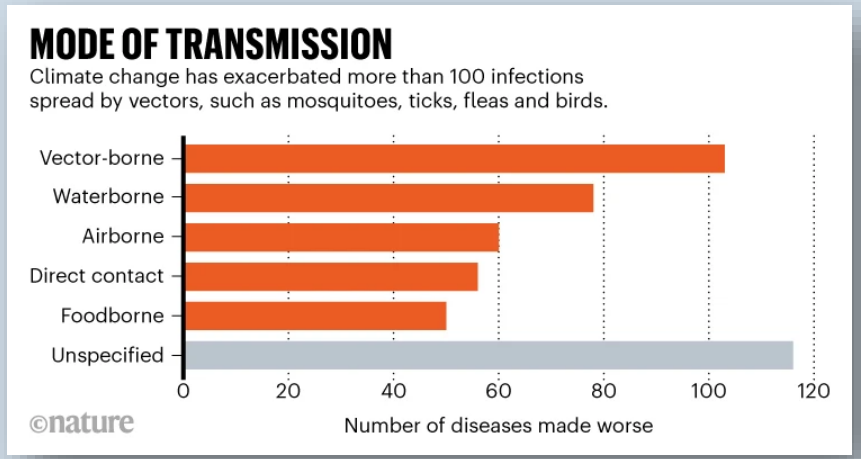
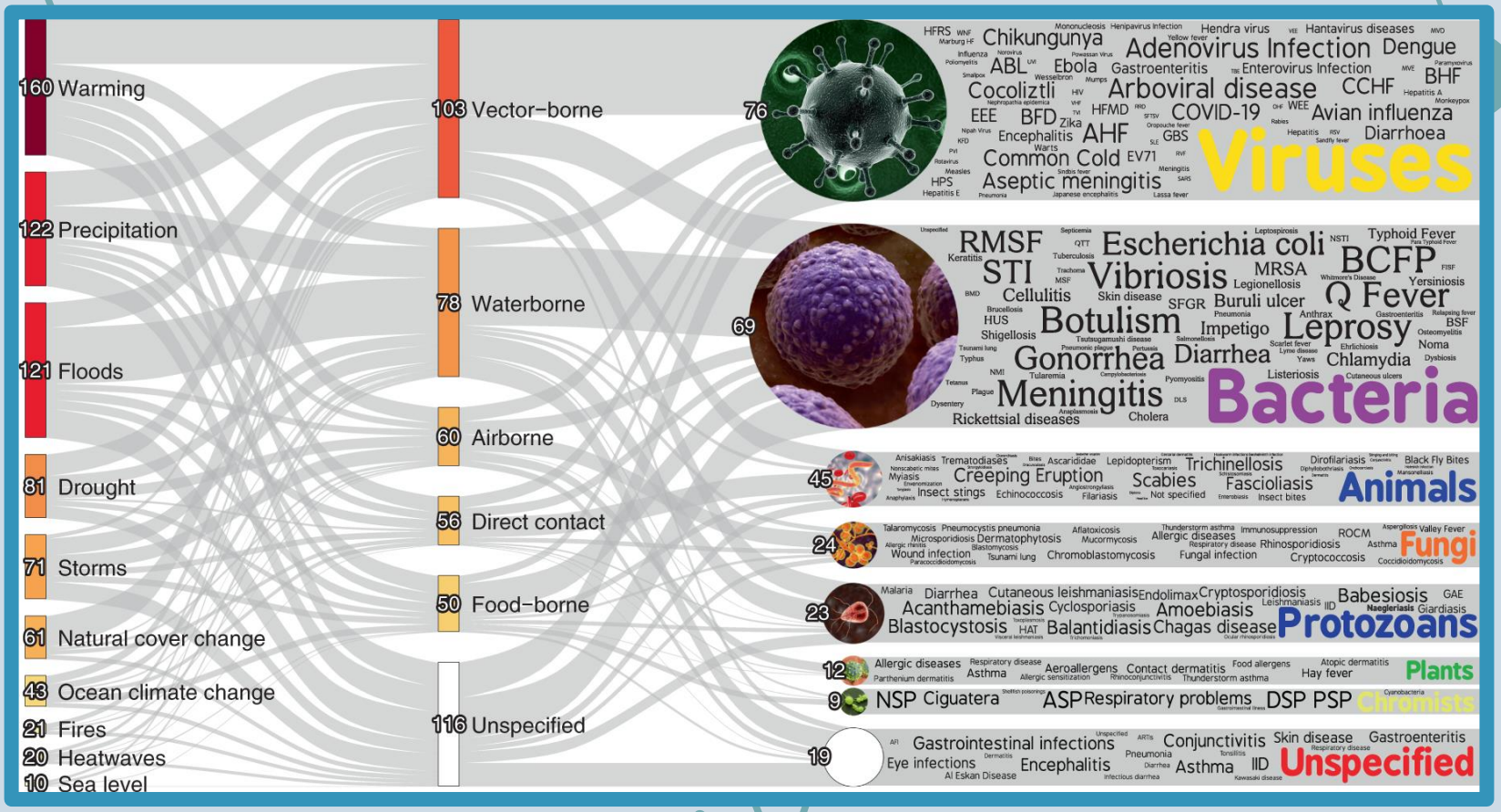


Climate Change and Pandemics

Changes in climate and associated effects lead to shifts in the geographical range of species.

Warming, precipitation changes especially are associated with a range of expansion of vectors including mosquitoes, ticks, fleas, birds and several mammals.


160 Warming
122 Precipitation
121 Floods
81 Drought
71 Storms
61 Natural cover change
43 Ocean climate change
21 Fires
20 Heatwaves
10 Sea level
103 Vector−borne
78 Waterborne
60 Airborne
56 Direct contact
50 Food−borne
116 Unspecified
76
Viruses
69
Bacteria
45
Animals
24
Fungi
23
Protozoans
12
Plants
9
Chromists
19
Unspecified

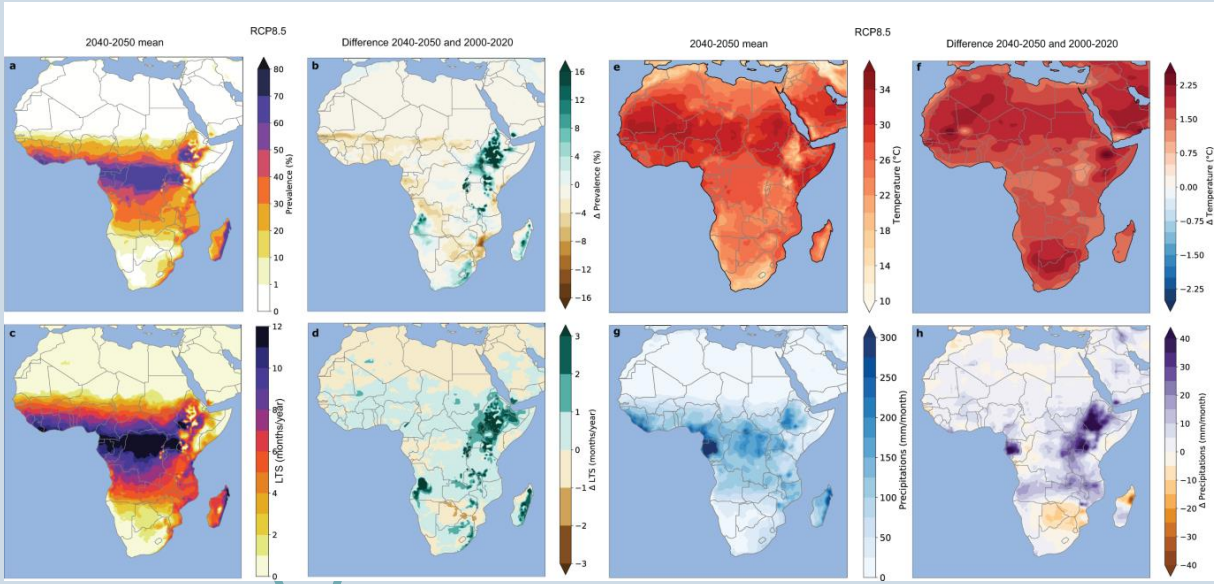
Climate Change and Pandemics

How are they linked?

E.g. Malaria

- Warmer temperatures expand vector habitats
- Increased/Decreased precipitation and humidity contribute to changes

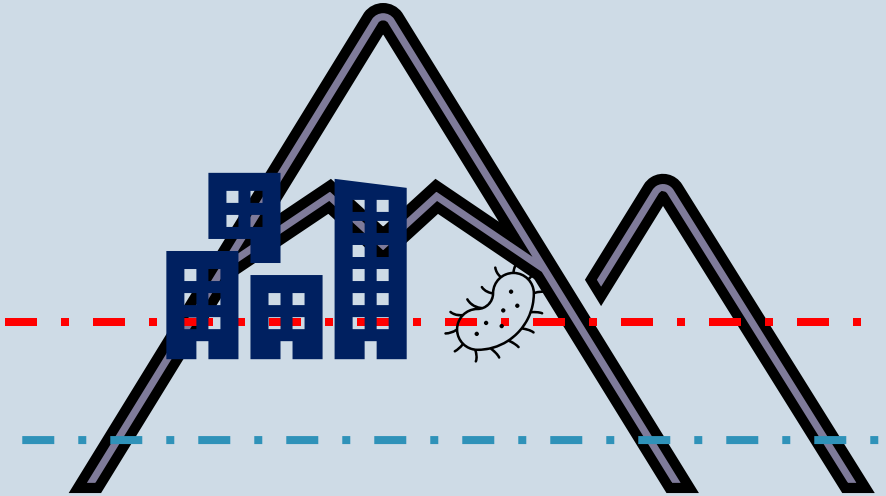
Mean and future changes in climate parameters and malaria risk based on the RCP 8.5 scenario.



Climate Change and Pandemics

Example: Malaria (spread by *Anopheles sp.*)

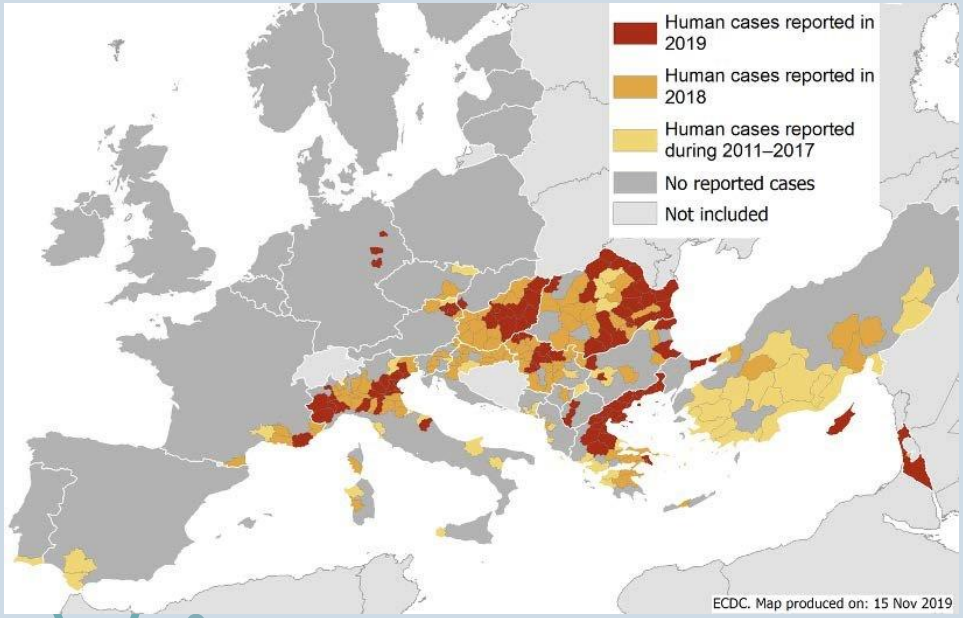
- City X was above the altitude comfortable for mosquitoes to survive
- Climate warms -> Mosquitoes survive higher up
- Malaria spreads in the city



Climate Change and Pandemics

West Nile Virus

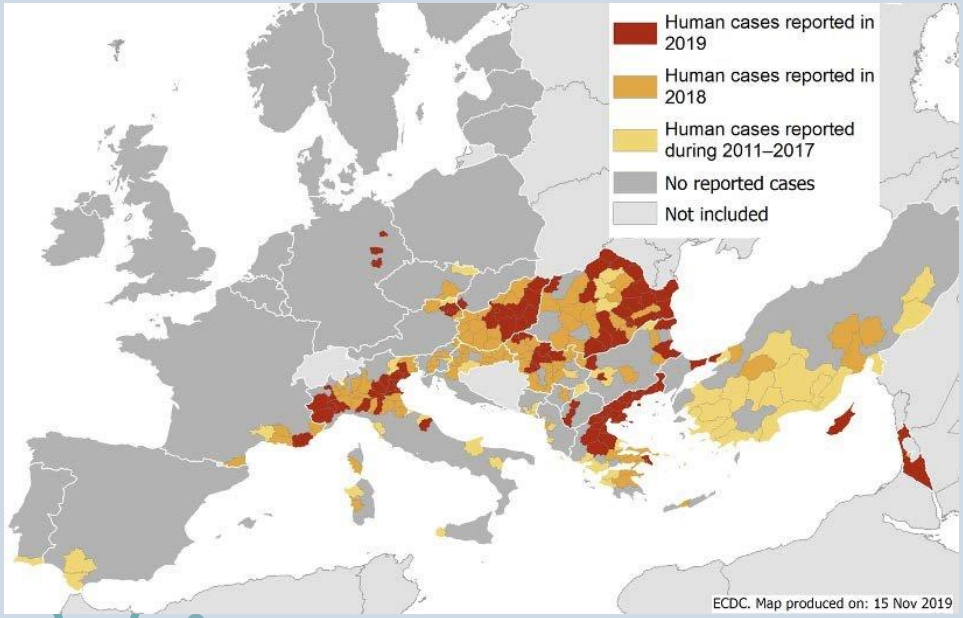
- Climate change increases the risk of human exposure to West Nile Virus.
- Warmer temperatures facilitate mosquito growth and spread, biting rates and incubation of the disease within the mosquito.



Climate Change and Pandemics

West Nile Virus

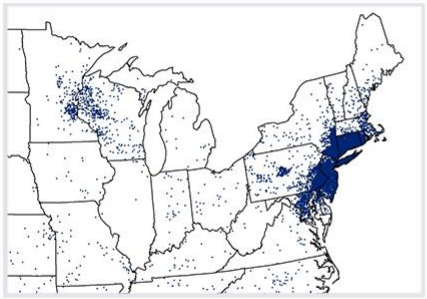
- The effect of climate change on the timing of bird migration and breeding patterns may also contribute to changes in long-range virus movement.
- Mild winters and drought have been associated with West Nile virus disease outbreaks



Climate Change and Pandemics

Lyme Disease

- Lyme disease is a bacterial illness that can cause fever, fatigue, joint pain, and skin rash, as well as more serious joint and nervous system complications.
- Lyme disease is the most common vector-borne disease (that is, a disease transmitted by mosquitoes, ticks, or fleas) in the United States



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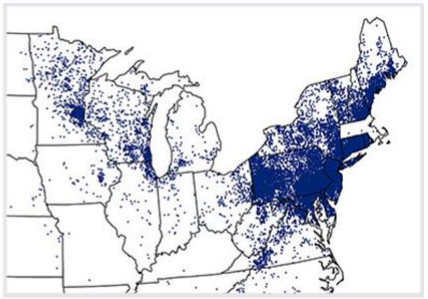
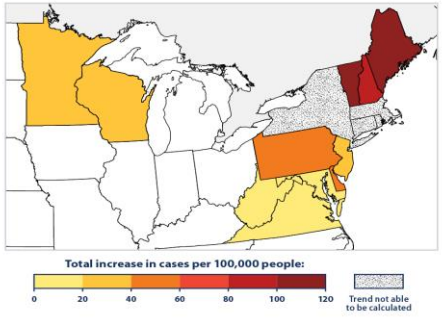


2018

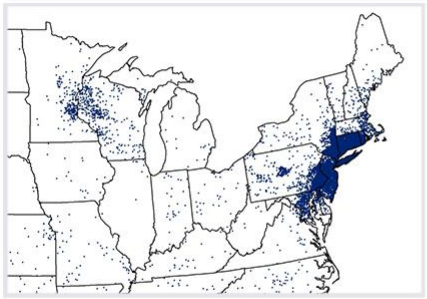


Climate Change and Pandemics

Lyme Disease

- The range for tick survivability has expanded, increasing the risk of transmissibility of Lyme disease.

- The life cycle and prevalence of Deer ticks is strongly influenced by temperature and humidity. A changing climate improves their odds of survival.



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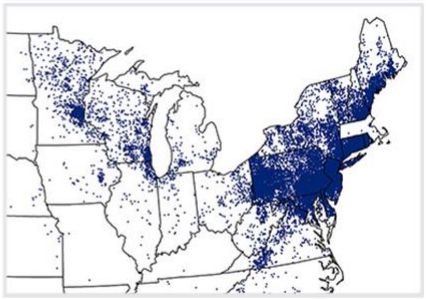

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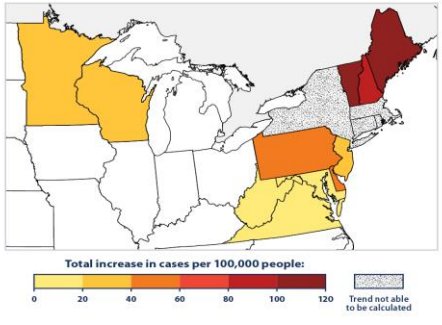
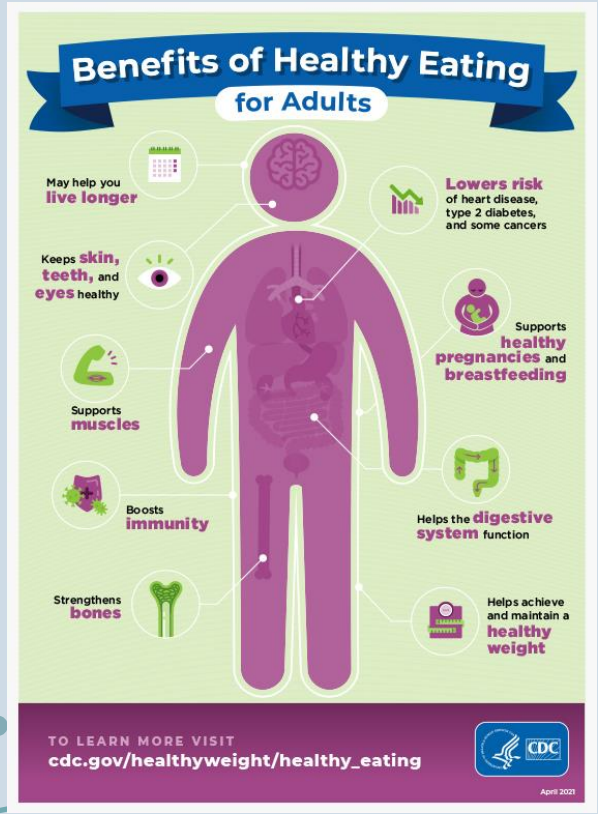


Climate Change and Pandemics

Other links: Food security & Immunity

- Food insecurity caused by climate change may force people to purchase low-quality food
- This may weaken their immune system, making them more susceptible to disease.
- This can make entire populations vulnerable to spread of disease



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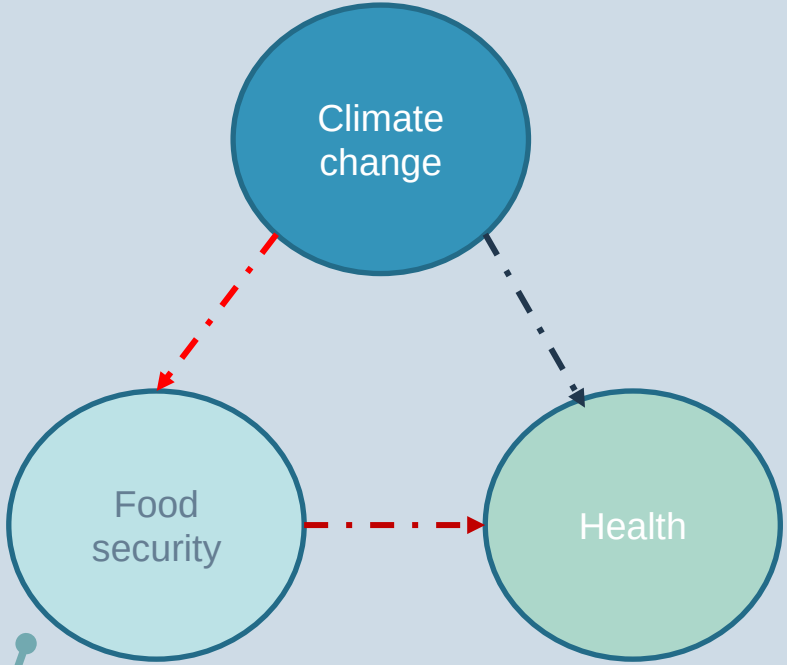


02

Pandemics and Healthcare

How are they related?

Covid-19 Pandemic

The COVID-19 pandemic has shown us that the world was growly unprepared. The cost, measured in lives, mental health, economic costs and human suffering was immense.

Covid-19 Pandemic

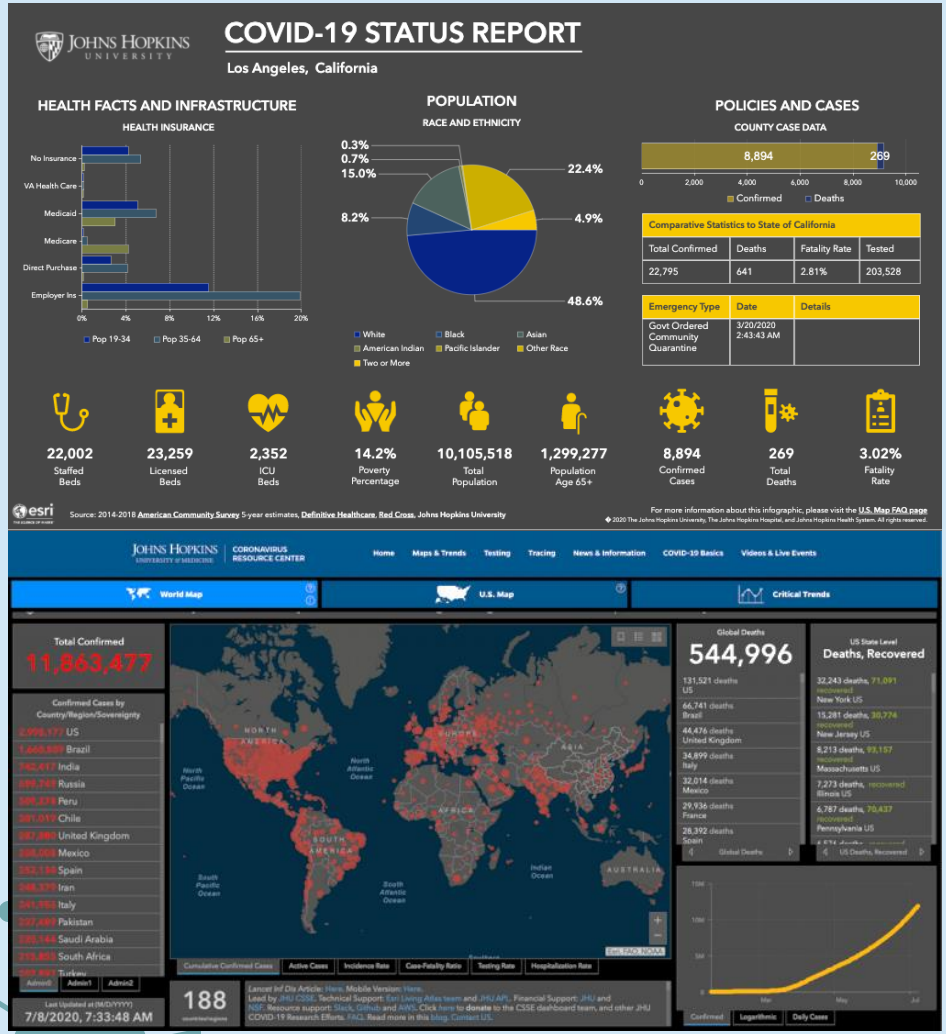
1. **Good science is not good enough**. Public participation and community acceptance is key. We need to engage with politics.

2. **Health inequities** are a huge problem. Social and environmental determinants of health are a real problem.

Covid-19 Pandemic

3. **National perspectives and border-ism are a problem.** Viruses don't care about borders. We need global cooperation and interlinked healthcare systems.

4. **Better data and health surveillance is key**. This allows real-time monitoring, coordinated policymaking and contact tracing capacity.



Covid-19 Pandemic

5. **Biomedical science is key.** Unprecedented efforts to produce vaccines that work, fast, have saved millions of lives and billions in economic costs.

6. **Misinformation is big challenge**. The pandemic showed us how misinformation, empowered through social media, spreads and endangers global efforts.

Healthcare systems

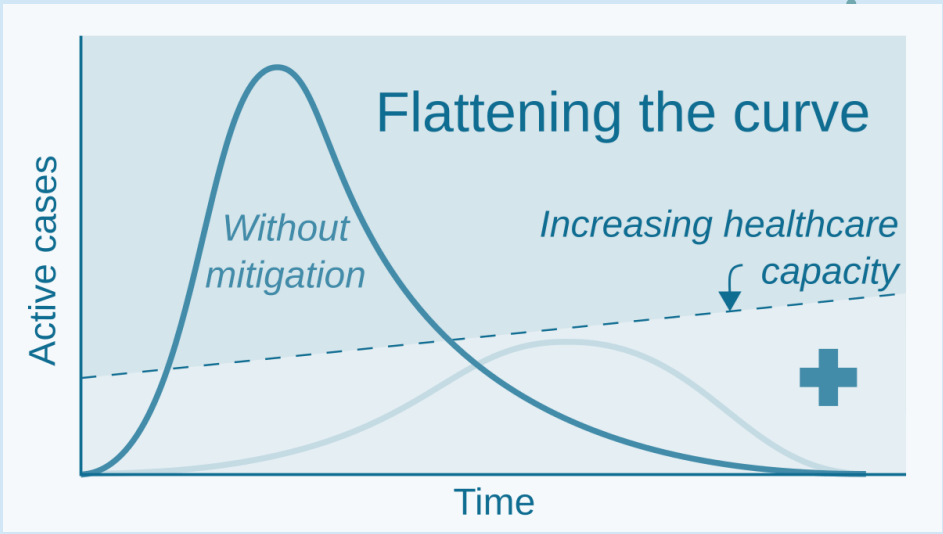
Healthcare systems play a crucial role in controlling and managing pandemics.

Essential components include:

- Surveillance
- Research
- Treatment
- Prevention

Healthcare systems

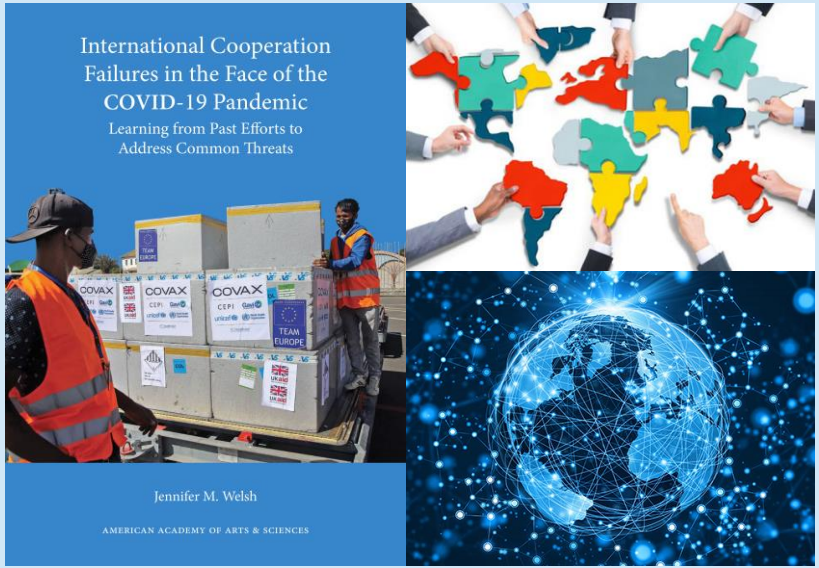
Ensuring healthcare systems continue functioning is essential to prevent burnout, dealing with patient influx and to ensure resource allocation.



Global cooperation

Global cooperation and trust during pandemics is key. Pandemics in the past decades has showed us the importance of collaboration, especially in our interconnected world.

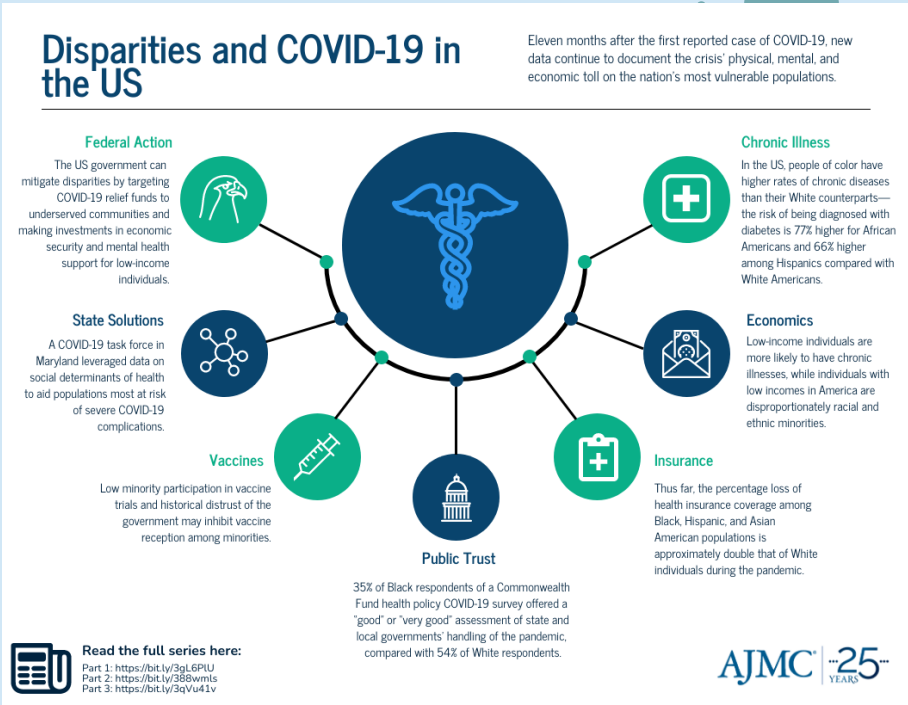
While there is much progress in sharing of science and knowledge, there is much more to be done in sharing of resources, especially with countries with buckling healthcare systems.



Health Disparities

Health disparities increase the risk of pandemics. For example: We will never know the true impact of Covid-19 in many countries and within many countries precisely because health systems are not as equipped, or equally accessible.

The US is a case in point! Their healthcare system actually allows chronic diseases in the least advantaged members of society to go unchecked, leading to higher risk of disease/pandemic spread.



03

Pandemics throughout history

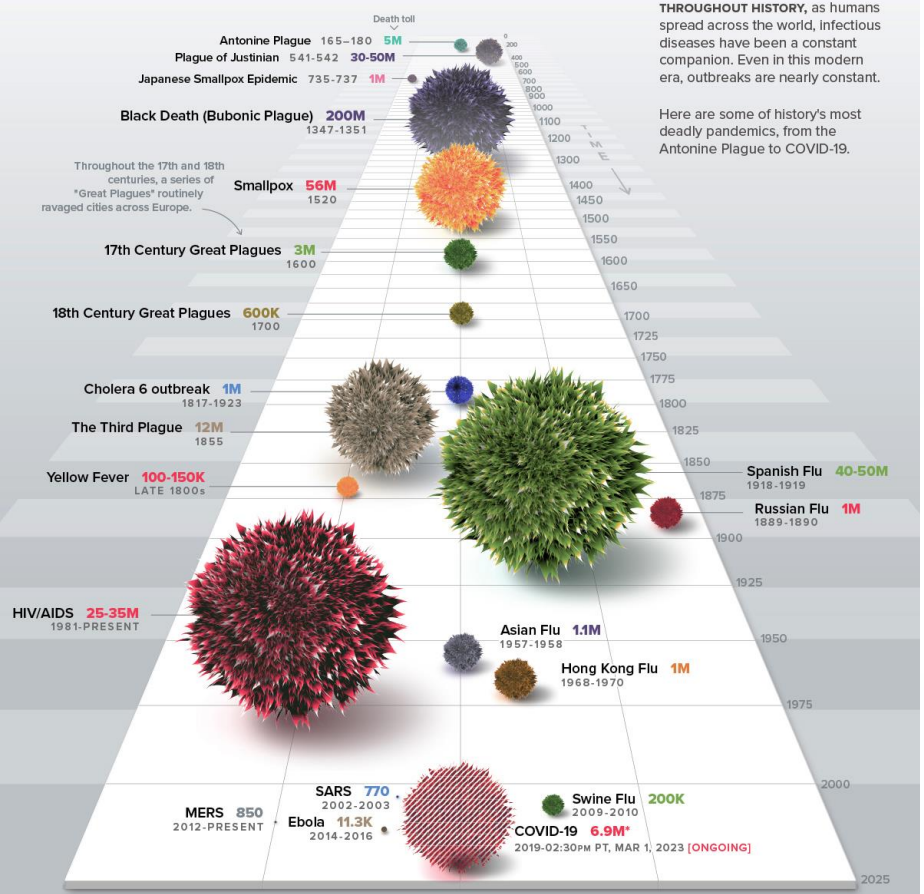
Shedding light on how
pandemics have shaped history

HISTORY OF **PANDEMICS**

PAN·DEM·IC (of a disease) prevalent over a whole country or the world.

THROUGHOUT HISTORY, as humans spread across the world, infectious diseases have been a constant companion. Even in this modern era, outbreaks are nearly constant.

Here are some of history's most deadly pandemics, from the Antonine Plague to COVID-19.

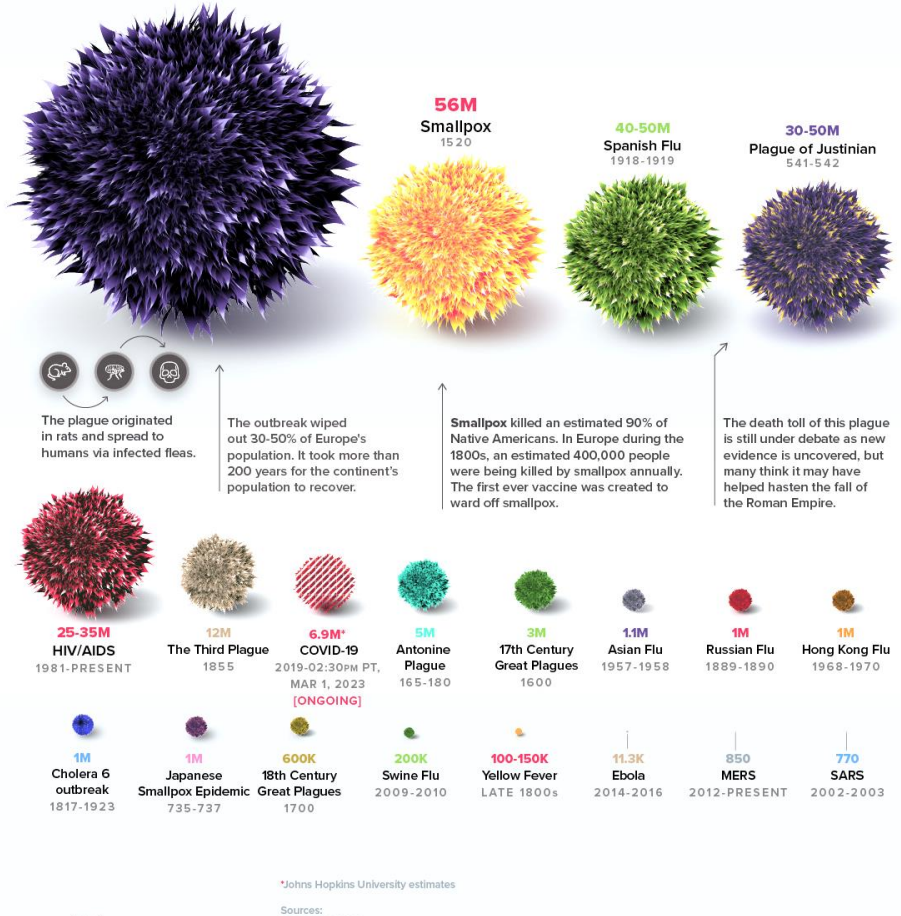


WHO officially declared COVID-19

DEATH TOLL
[HIGHEST TO LOWEST]

the impact of COVID-19 because the disease is new to medicine, and data is still coming in.

*Johns Hopkins University estimates



*Johns Hopkins University estimates

Sources: CDC, WHO, BBC, Wikipedia,

VISUAL CAPITALIST

/visualcapitalist @visualcap visualcapitalist.com

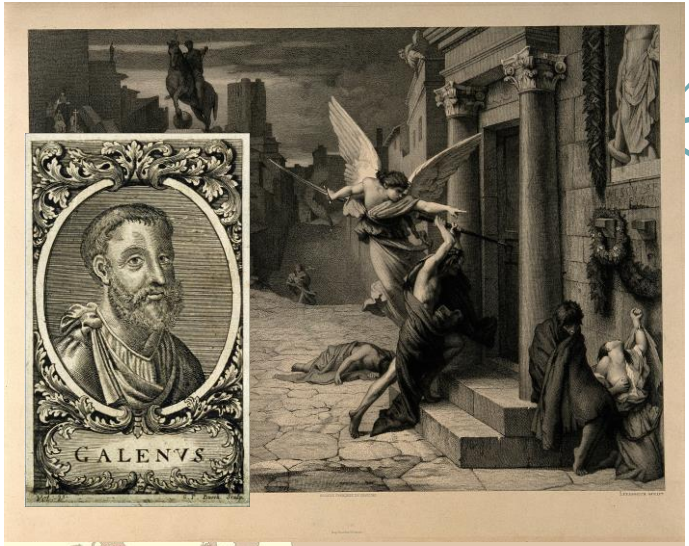
Antonine Plague (160 CE)

Estimated deaths: 5 – 10 million
Fatality rate: 25%
Culprit: Unknown. Possibly Smallpox (debated)

Brought to the Roman Empire at its zenith from the Near East, probably during the siege of the Mesopotamian city of Seleucia. It spread throughout legions and over 15 years led to the death of 10% of the empire's population.

While the extent of its impact is debated by historians, it coincides with a turning point in the fate of the Roman Empire.

Documented by Galen, the Greek Physician and writer. Symptoms included fever, diarrhea, pharyngitis and pustular skin eruptions on the 9th day of infection.

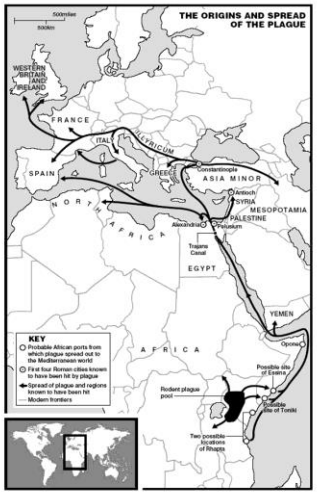


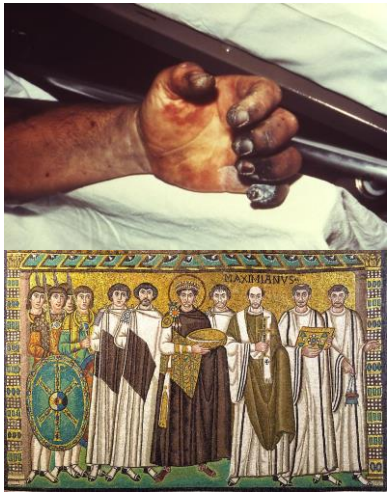
Plague of Justinian (541-542 CE)

Estimated deaths: 30 – 50 million (~1/3rd of European population)
Fatality rate: 40%?
Culprit: *Yersinia Pestis* carried via fleas on rodents

Brought to the Byzantine Empire through traders from the Kingdom of Aksum in East Africa via Egypt. Up to 5,000 people per day were dying in Constantinople at its peak. Around 25% of the population in the Mediterranean basin died over this period.

This had a tremendous economic impact on the Byzantine empire, leading to famines and loss of craftmanship. Military campaigns faltered, and the size of military reduced, with Byzantium unable to retain recaptured land in Italy.





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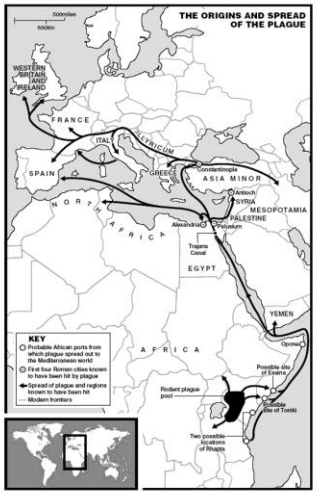
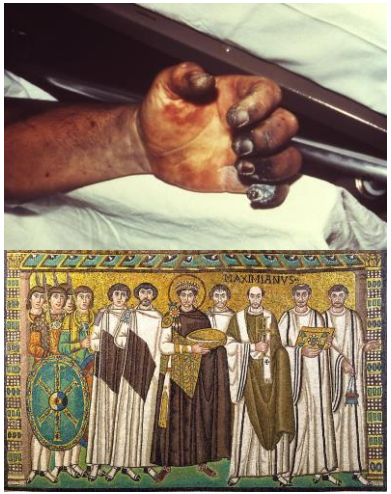
Culprit: *Yersinia Pestis* carried via fleas on rodents

A “sudden fever…but the body showed no change in its original color, neither was it as hot as expected when struck by a fever, nor did any inflammation occur…but the fever was of such a lethargic kind….[within a couple of days] a bubonic swelling developed there in the groin of the body, which is below the abdomen, but also in the armpit, and also behind the ear and at different places on the thighs… Up to this point, then, everything occurred in the same way all who had taken the disease.”

Procopius, contemporary historian



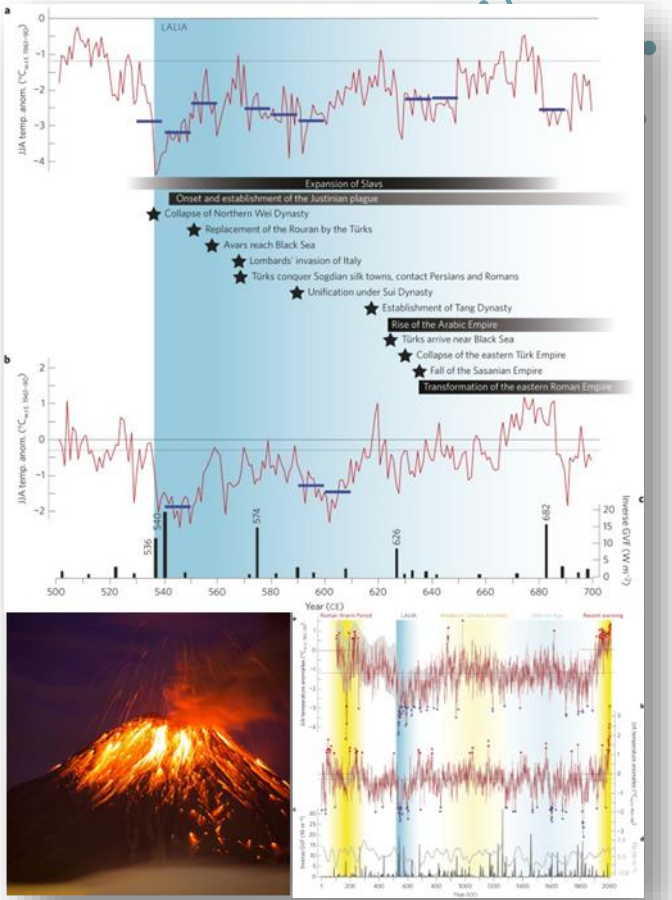


Plague of Justinian (541-542 CE)

Estimated deaths: 30 – 50 million (~1/3rd of European population)
Fatality rate: 40%?
Culprit: *Yersinia Pestis* carried via fleas on rodents

There are debates around association with a possible “Cold event” in 536 CE. Volcanic eruptions that year led to a period of protracted cooling, documented worldwide. The lingering effects were accentuated in 541CE with another eruption. Possible links with crop failures and lowering immunity, predisposing populations to disease and pandemics. Rodents were more likely to survive the usually hot journey to Egypt.

This period of cooling (536 – 660 CE) is often called the “Late Antique Little Ice Age”



Black Death(1347 - 1351 CE)

Estimated deaths: 200 million (30-60% of European population!)
Fatality rate: 30-60%
Culprit: *Yersinia Pestis* carried via fleas on rodents

Arrived from China in the 1340s, reached Europe during the siege of Kaffa (Crimea) in the summer of 1347 with Genoa as an epicentre, spreading via trade routes.

Devastating to European society. Population levels would not recover until the mid-1500s. However it also brought about changes that set the foundation for the Renaissance over the following decades.

Sidenote: “Crow face” to the right was a beak filled with herbs and sweet flowers as belief at the time was that disease was spread through bad smells..!

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Interestingly, it seems to have followed the “Great Famine” of 1315-1317, which killed around 15-20% of the European population. It is possible that a weakened population with lower immunity was predisposed to higher mortality rates within a generation of this event.

This also coincided with the “Dantean Anomaly” of the 1310s, where cold/wet cycles of rainfall and rapid climate change may have precipitated the Great Famine.

This perhaps demonstrates how climate, food security and health are linked, in ways that are complicated but historically relevant.

Black Death(1347 - 1351 CE)

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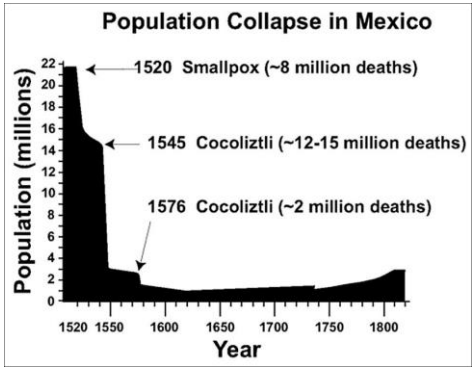
Culprit: *Yersinia Pestis* carried via fleas on rodents

A shock, but it brought about immense changes to society!

Smallpox and others (16th Century)

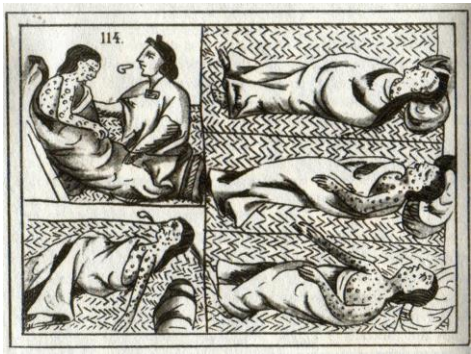
Estimated deaths: 50 million? (90-95% of Americas!)
Fatality rate: 95%
Culprit: *Smallpox, Typhus, Measles*



The Spanish Franciscan Motolinia left this description:

"As the Indians did not know the remedy of the disease…they died in heaps, like bedbugs. In many places it happened that everyone in a house died and, as it was impossible to bury the great number of dead, they pulled down the houses over them so that their homes become their tombs."

Effectively biological warfare.
Pandemics as weapons.



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This is characteristic of new diseases. It is why COVID-19 spread so fast – our bodies had not previously encountered it, and immunologically we were not prepared for it. This is why disease surveillance, monitoring and mitigation is an essential trifecta in our scientifically-informed age.

Lakota winter count showing smallpox events

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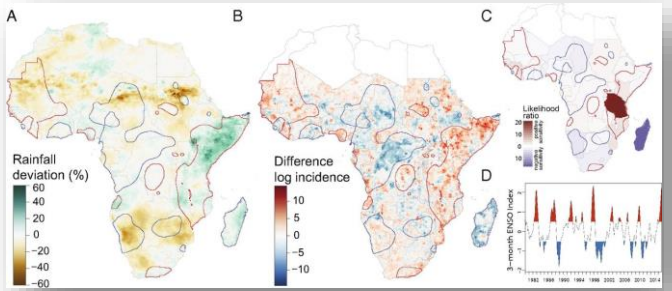
Cholera Epidemics & El Nino

In the wake of the 2015–2016 El Niño, multiple cholera epidemics occurred in East Africa, including the largest outbreak since the 1997–1998 El Niño in Tanzania, suggesting a link between El Niño and cholera in Africa.

High-resolution mapping techniques found the cholera burden shifts to East Africa during and following El Niño events.

Throughout Africa, cholera incidence increased three-fold in El Niño-sensitive regions, and 177 million people experienced an increase in cholera incidence.

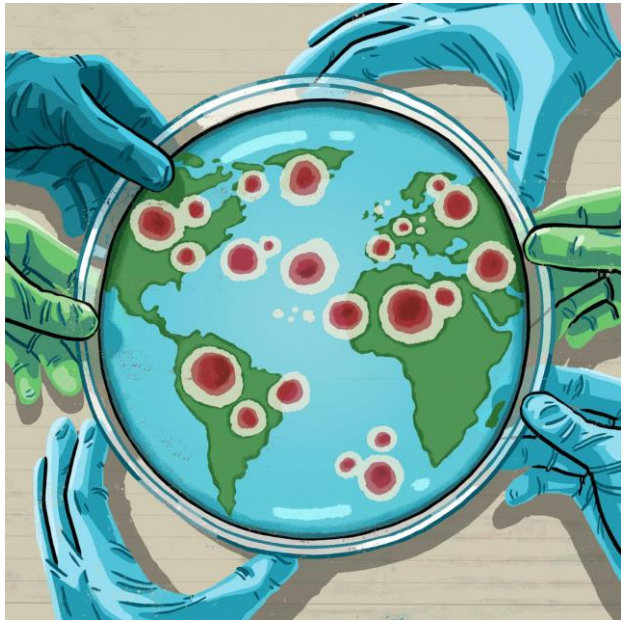
Without treatment, the case fatality rate can reach 50%, but accessible, appropriate care nearly eliminates mortality. Climatic forecasts predicting El Niño events 6–12 months in advance could trigger public health preparations and save lives.



Geographical distribution of cholera in El Niño and non-El Niño years.

What can we learn from history?

- NOT preparing for pandemics in our time is both irresponsible and risky.
- We live in an interconnected globe with fast means of travel – pandemics are not only likely, but inevitable.
- We need to have global cooperation and collaboration to fight off the next pandemic – one hopes we have learnt some lessons from COVID-19, which could have been much worse.
- Mitigating climate change and environmental degradation is essential. Historical associations of climatic events and pandemics are highly debated, but accepted as real and explainable.



04

Preparing for Pandemics

Strategies to prepare for future, inevitable pandemics

Key Lessons learnt from covid-19

- Importance of early detection and rapid response
- The critical role of robust healthcare systems
- The value of science and transparent communication in controlling misinformation
- The need for global cooperation and collective action

1. Early Detection and Response

Disease Surveillance systems are crucial here.
These systems involve the:

- Collection
- Analysis
- Interpretation

Of data from a variety of sources

1. Early Detection and Response

Data sources may include

- Syndromic data (e.g. fever, etc)
- Laboratory data
- Demographics
- Socioeconomic data
- Location data

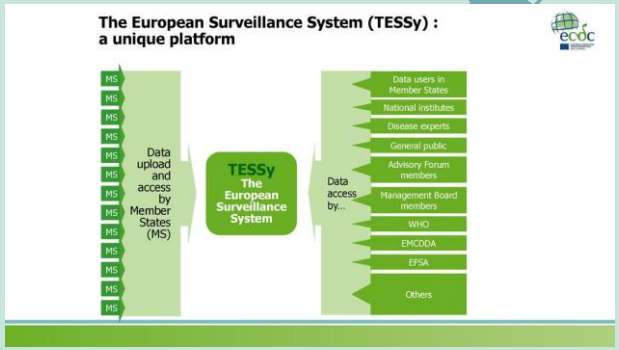
These data need to be cleaned, transformed into something understandable, and visualised.

1. Early Detection and Response

National reports (including real-time updates!) can be generated which are important tools for health policy decision making.

These datasets can then be pooled together with other countries to map what, where and how diseases are spreading, and what their characteristics may be.

In Europe, such a system exists and is called TESSy (The European Surveillance SYstem)



ecdc

EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

2. The Critical role of robust healthcare systems

A robust healthcare system is key to a nation’s resilience. The WHO lists the following priorities:

- Investing in public health functions
- Building strong primary healthcare systems
- Creating and promoting environments for research, innovation and learning
- Increasing investment in health systems and emergency response management
- Address preexisting inequities

3. The value of science and transparent communication

Without addressing communication and scientific information pitfalls, healthcare systems lose the trust of the public.

This was amply demonstrated during COVID-19 when scientific misinformation caused immense harm, especially due to misinformation spread through social media.

This will be an ongoing challenge in every sphere,

4. The need for global cooperation and response

Importantly, as aforementioned, in our interconnected world we cannot afford to silo ourselves. Resources, knowledge and technical information needs to be shared to deal with emerging diseases as quickly and efficiently as possible…

Ideally before they become a pandemic!

World Health Organization

05

What is the role of Environmental Health in all this?

Environmental Health: Tracking change

As we have seen, Environmental health plays a key and growing role in dealing with the threat of pandemics. Without a healthy environment, we cannot have healthy societies.

We need a “HEALTH IN ALL” approach, where health is at the core of all our human systems. This goes from personal exposures, to external and biological responses (The ‘Exposome’)

There is a need to **TRACK** change, and prepare for possible outcomes, including pandemics

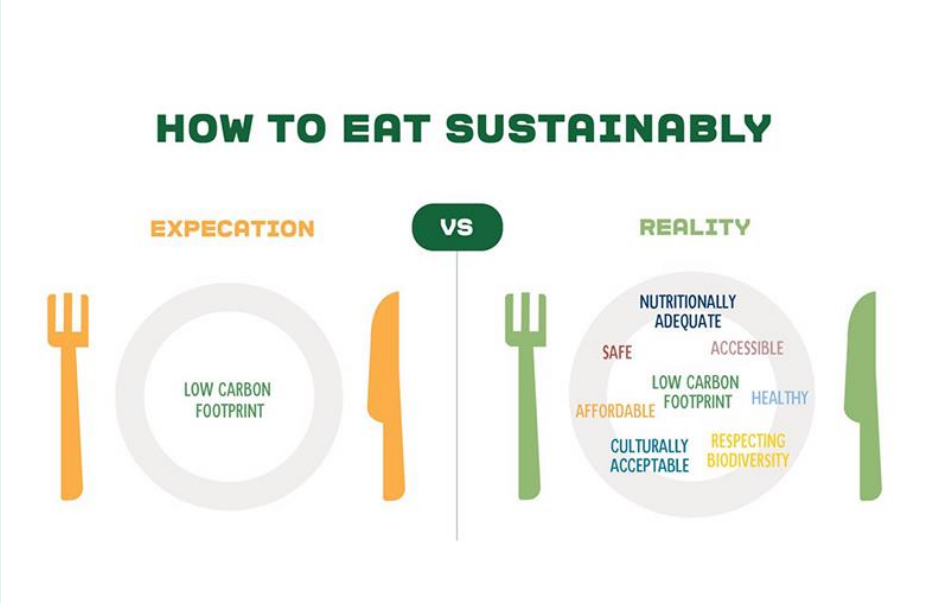
Environmental Health: Promoting sustainable practice

Implementing environmentally sustainable practices can reduce the chance of zoonotic disease.

This can happen in any sphere, especially in food systems where animal livestock are involved.

This will require a change in diet, but it will be a healthy, positive change.

Environmental Health: Promoting sustainable practice



FOOD / Greenhouse gas emissions across the supply chain

Original graphic by Our World in Data

There is a vast difference in greenhouse gases (GHG) that are produced across various food types.

Land Use Change
Aboveground changes in biomass from deforestation, and below ground changes in soil carbon

Farm
Methane emissions from cows, methane from rice, emissions from fertilizers, manure, and farm machinery

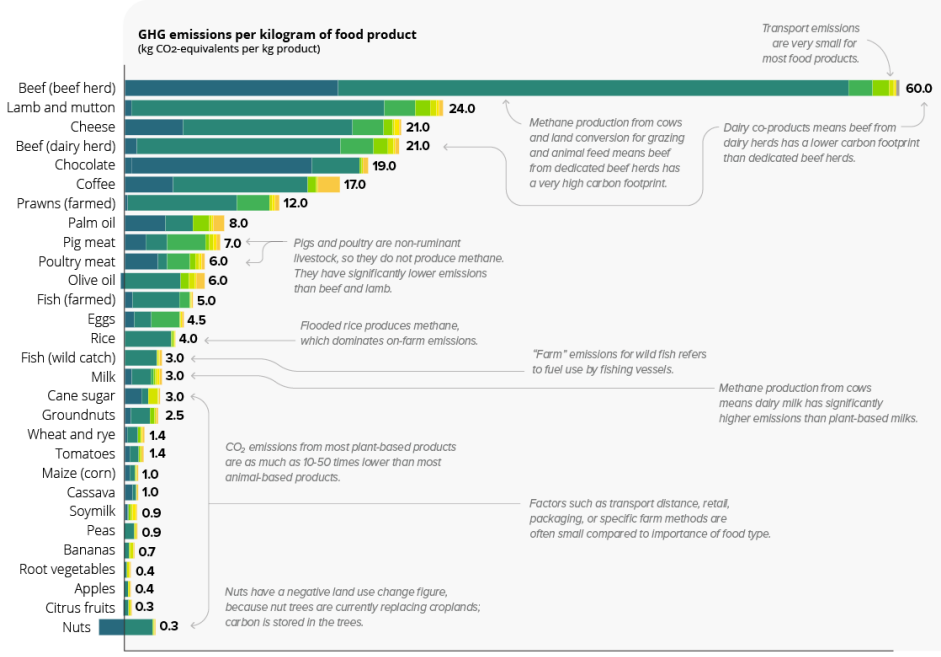
Animal Feed
On farm emissions from crop production and its processing into feed for livestock

Processing
Emissions from energy use in the process of converting raw agricultural products into final food items

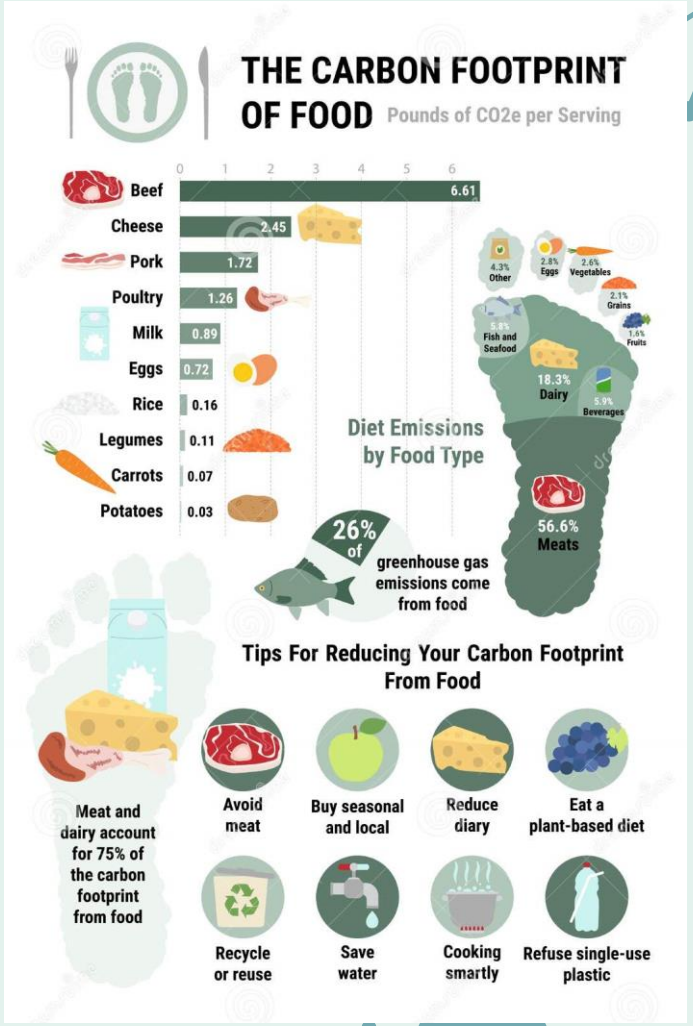
Transport
Emissions from energy use in the transport of food items in country and internationally

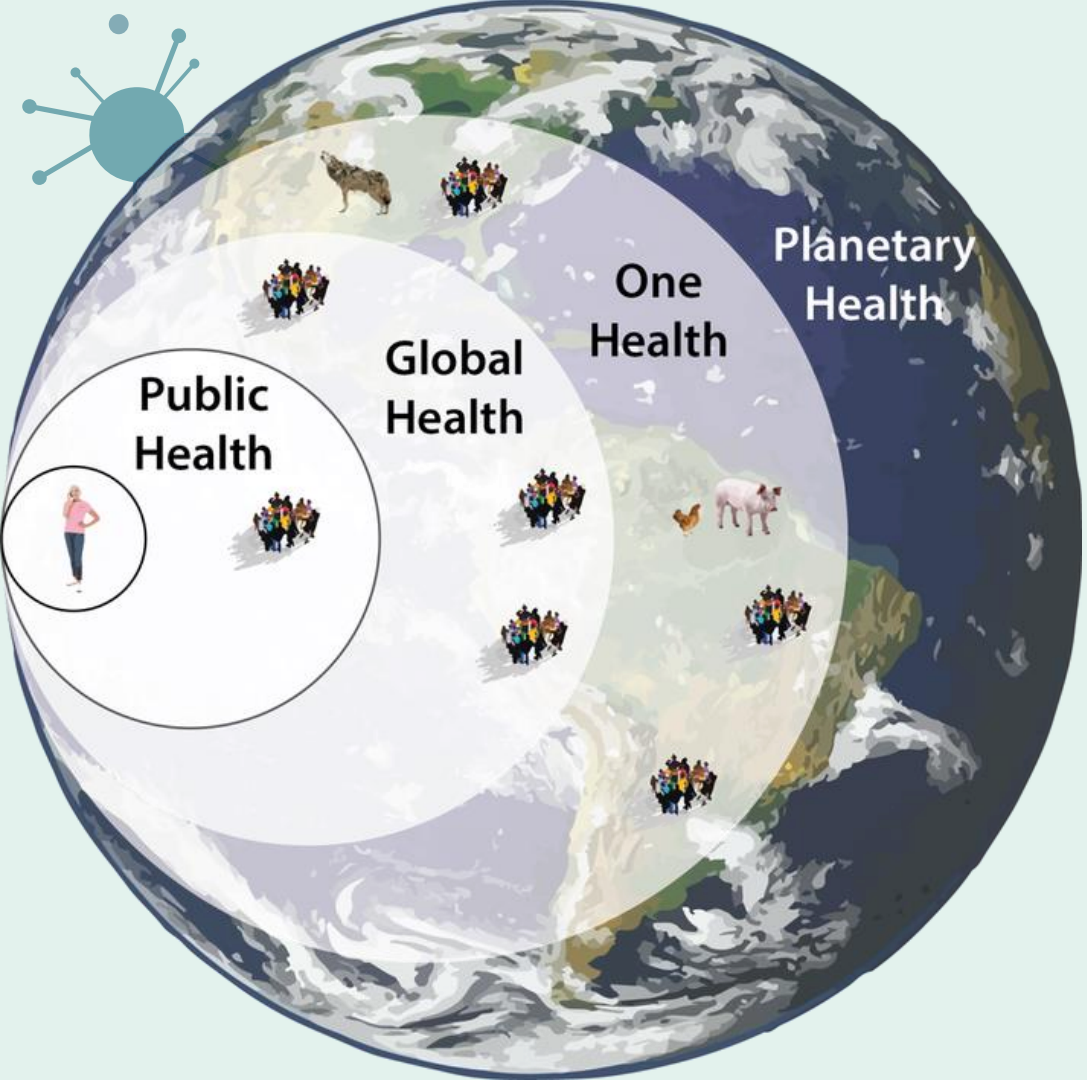
Retail
Emissions from energy use in refrigeration and other retail processes

Packaging
Emissions from the production of packaging materials, material transport and end-of-life disposal



Note: Greenhouse gas emissions are given as global average values based on data across 38,700 commercially viable farms in 119 countries.
Data source: Poore and Nemecek (2018). Reducing food's environmental impacts through producers and consumers. Science. Images sourced from the Noun Project. OurWorldInData.org - Research and data to make progress against the world's largest problems.

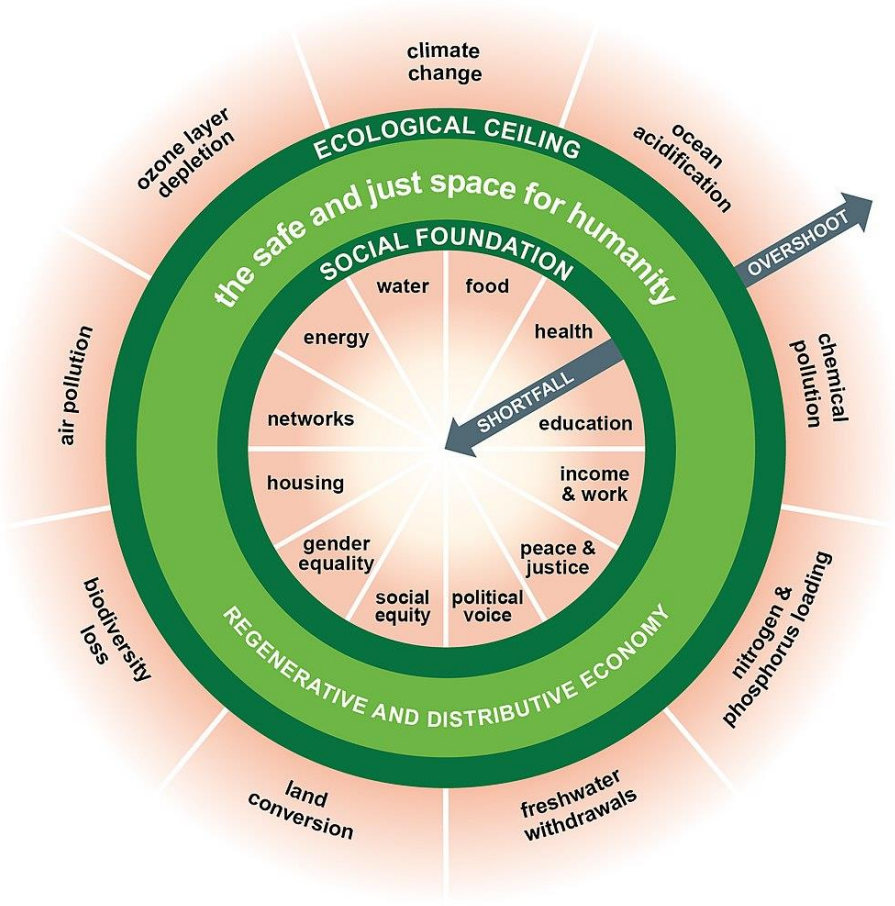




Planetary Health

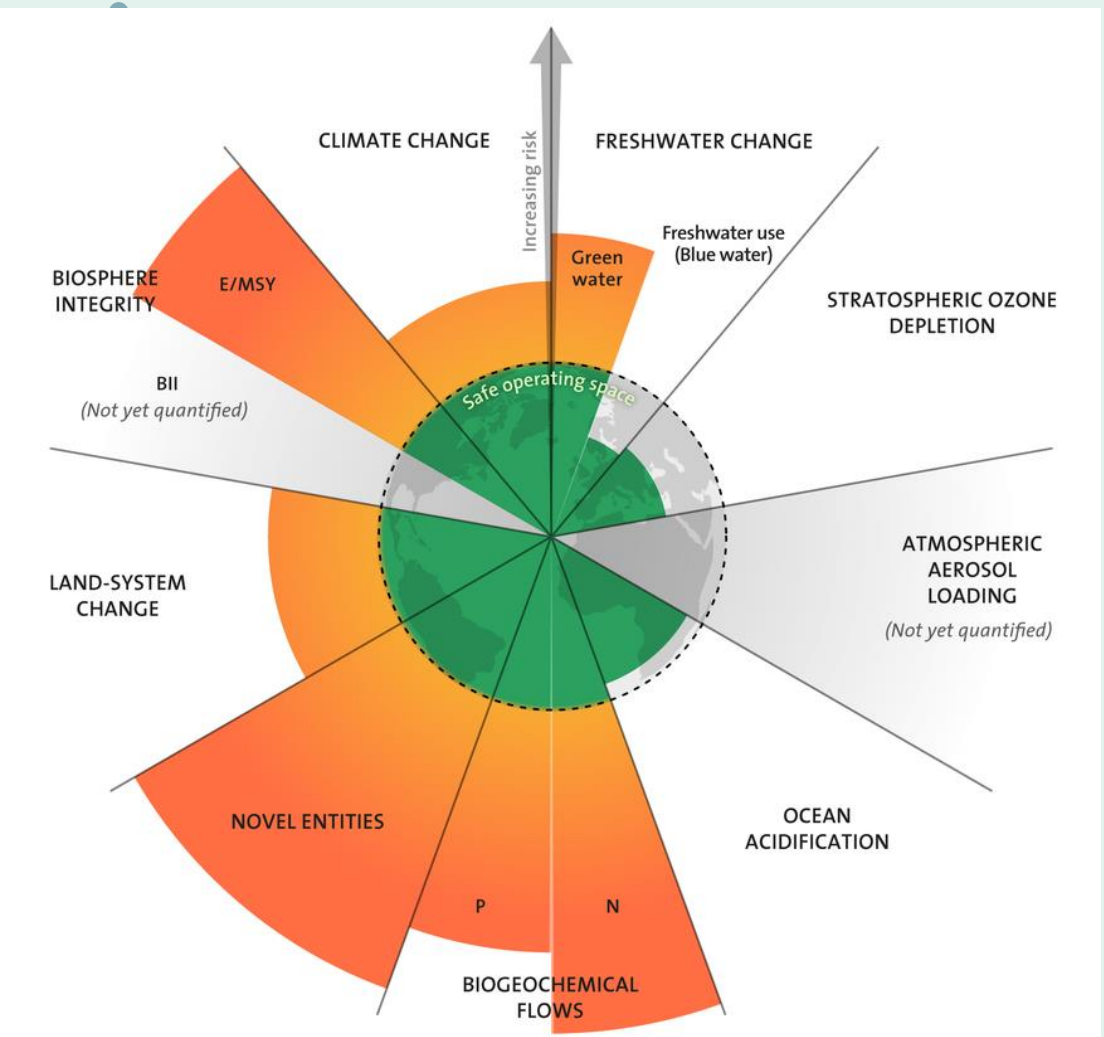
We need to start thinking in terms of systems and health being an interlinked system, where the environment, life and human life on our planet is one interdependent whole (which it is!).

Health plays a key role here, and we need this shift in thought to ensure sustainable futures as part of a global, collective, (healthy!) civilization.



Planetary Health

This also needs to be reflected in our (currently, very broken) economic system, which should ensure that while basic human needs are met, environmental thresholds are respected.



Planetary Health

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There are Planetary boundaries, and we are bursting through them in ways that cause long-term, irreversible harm.

Planetary Health: Better cities, homes and living spaces

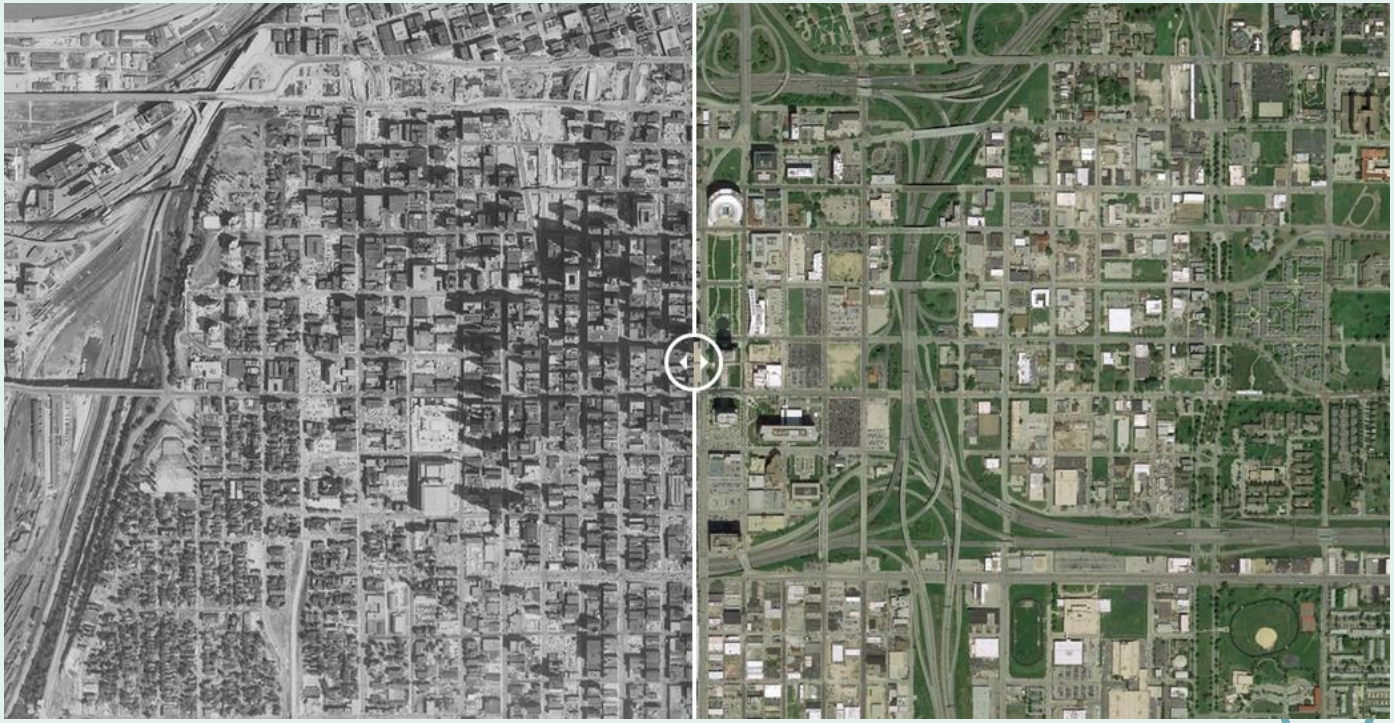
Designing better environments, from our cities to the places that we work, our commutes, our homes, will go a long way at ensuring a better quality of life, environment and health.

Planetary Health: Better cities, homes and living spaces

Example: the 15 minute city

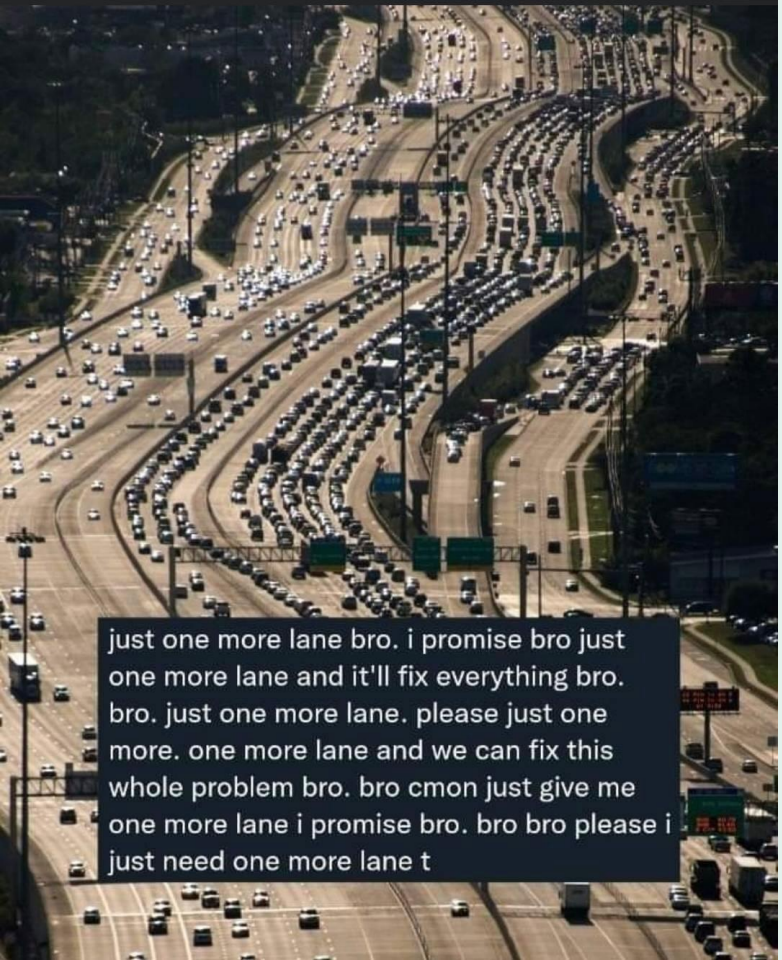
- Better commuting
- Less stress
- No need for cars
- Fewer carbon emissions
- More greenery
- Better communities!

Planetary Health: Better cities, homes and living spaces



Planetary Health: Better cities, homes and living spaces

Anything except a solution that actually makes sense.

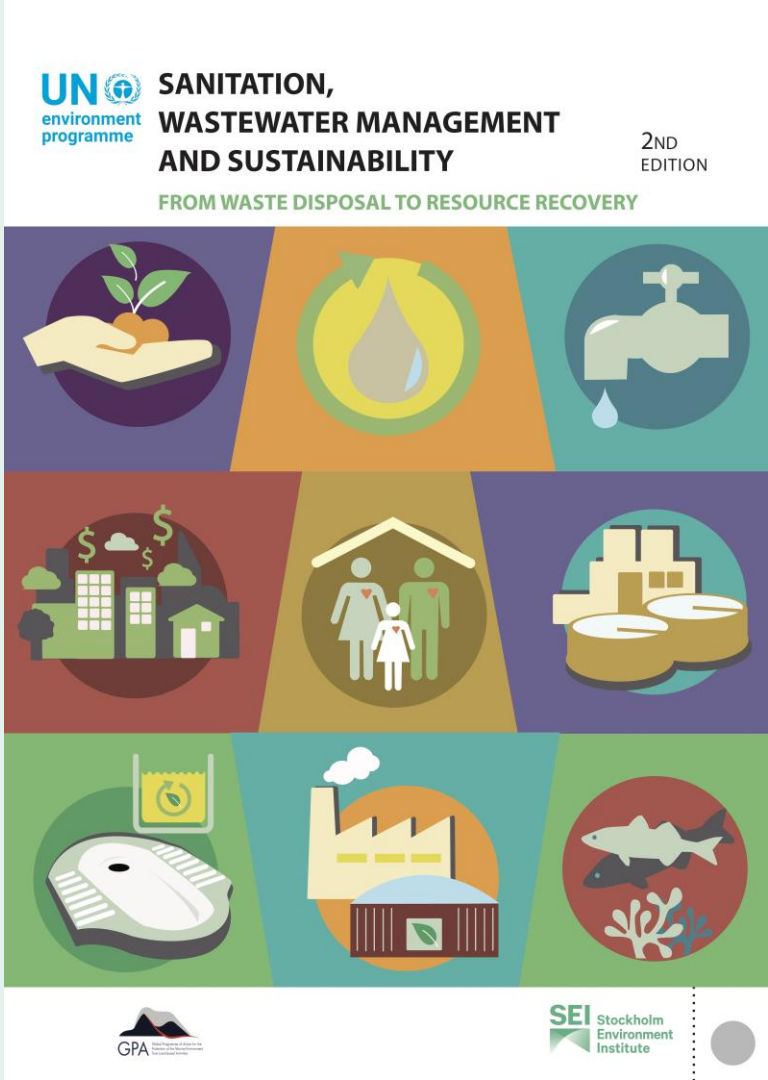


Planetary Health: Water Management

Better water management is key to a sustainable world and environmental health goals.

This also ensures that our water is safe to drink and utilise.

Access to water needs to be equitable and safe.



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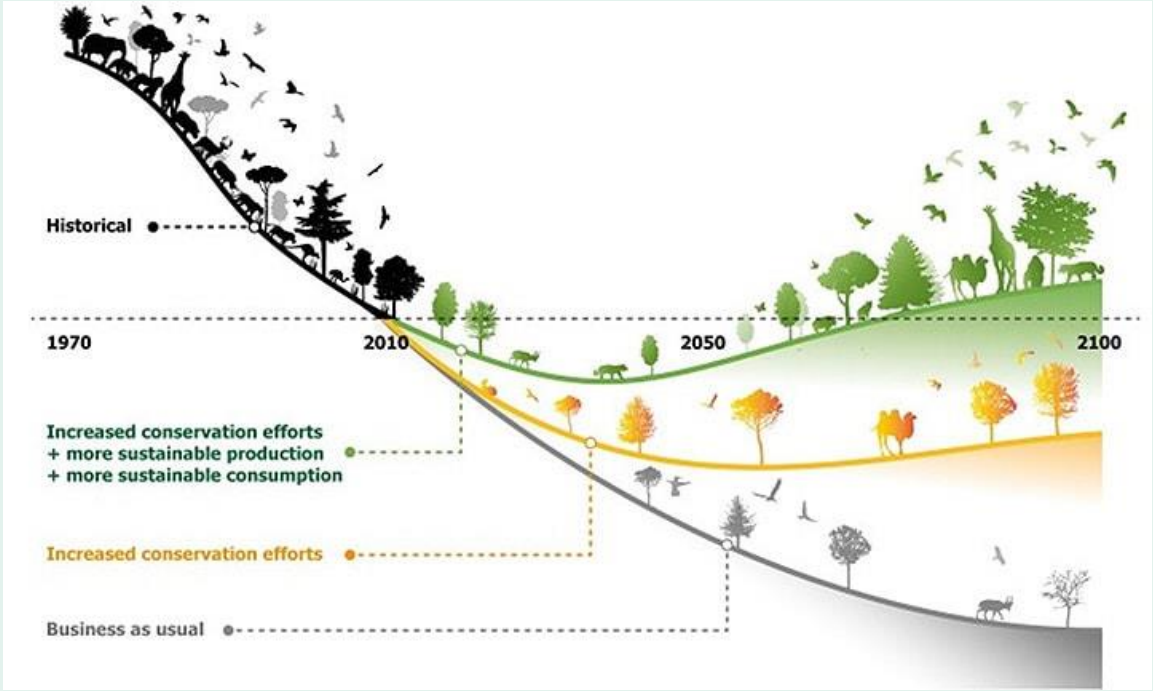
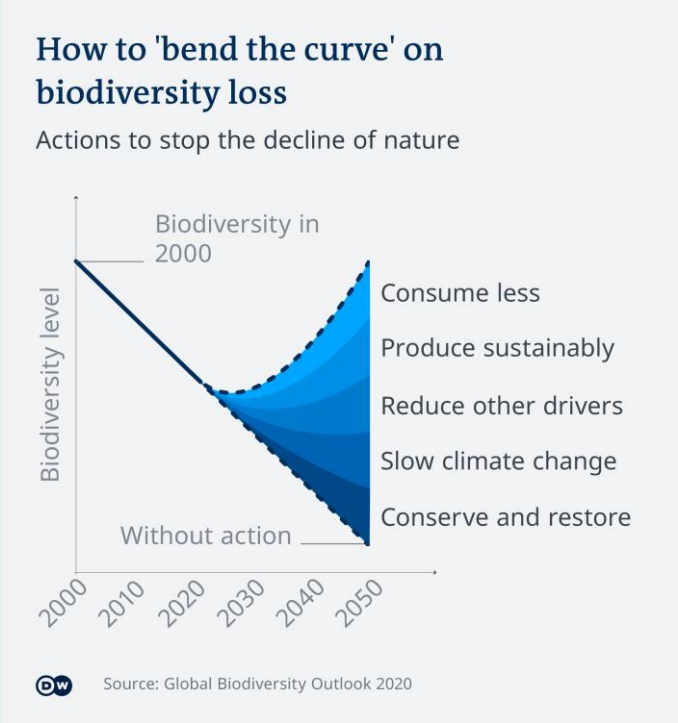
Habitat loss reversal



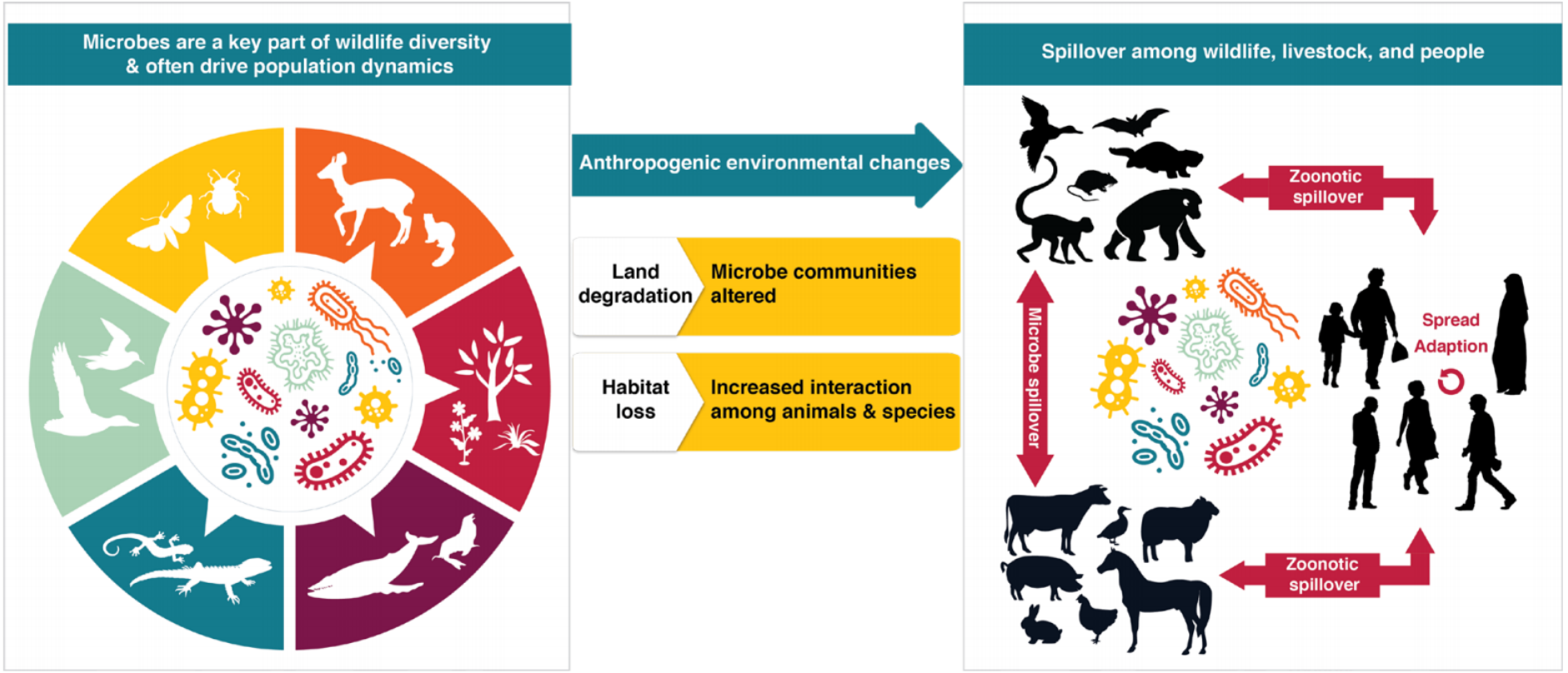


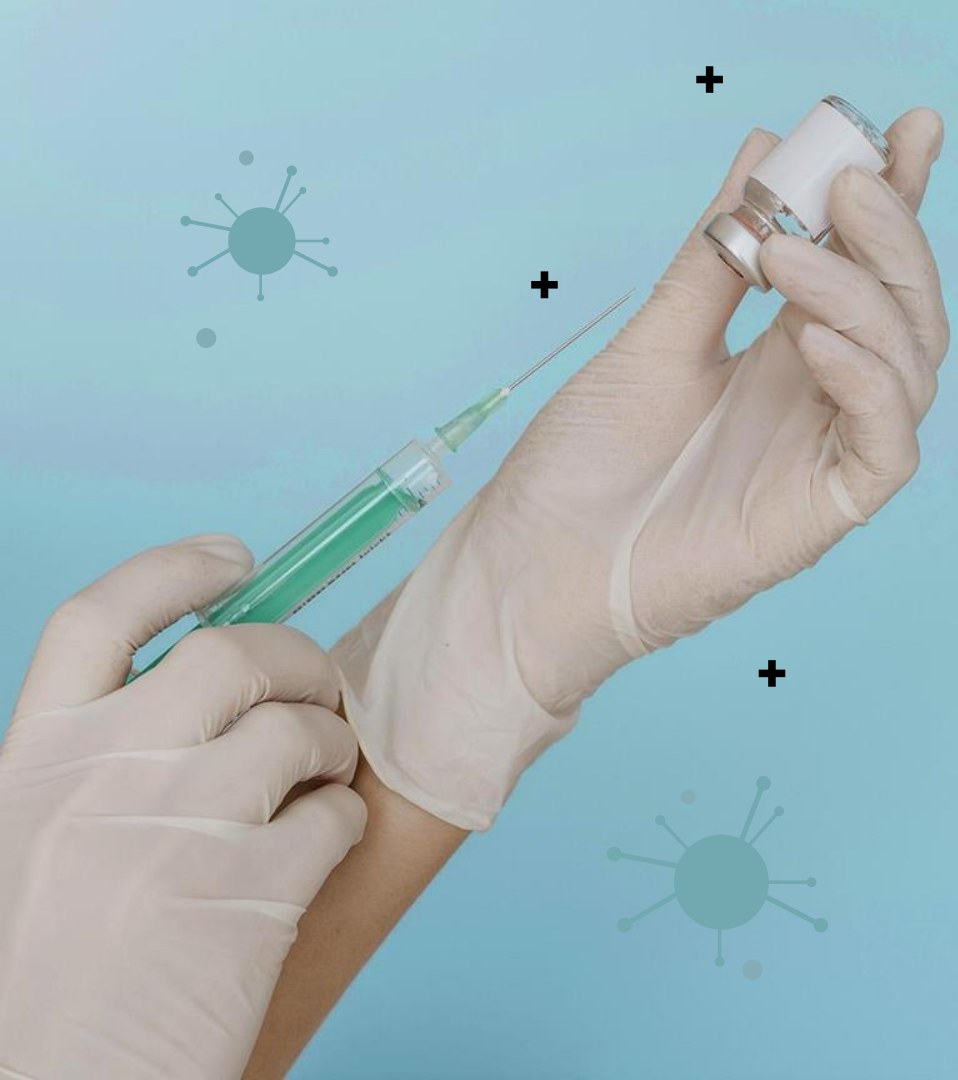
Habitat loss reversal: Biodiversity prevents pandemics!

Biodiversity plays a critical role in preventing pandemics by maintaining the balance of natural ecosystems and preventing the spillover of diseases from animals to humans.

In diverse ecosystems, diverse species can act as a buffer and inhibit pathogens from spreading, a concept known as the "dilution effect". Preserving different species is key.

Human-induced changes such as deforestation and urbanisation disrupt these natural systems, leading to closer contact between wildlife and human populations, increasing the risk of zoonotic disease transmission, and potential pandemics. These need to be stopped and reversed where possible.


Microbes are a key part of wildlife diversity & often drive population dynamics
Anthropogenic environmental changes
Land degradation
Microbe communities altered
Habitat loss
Increased interaction among animals & species
Spillover among wildlife, livestock, and people
Zoonotic spillover
Microbe spillover
Spread
Adaption
Zoonotic spillover



CONCLUSIONS

Placing Environmental Health principles at the heart of all policies ensures that we can fight off the next pandemic heading our way, while improving our quality of life and wellbeing.

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Placing Environmental Health principles at the heart of all policies ensures that we can fight off the next pandemic heading our way, while improving our quality of life and wellbeing.

Pandemics are a symptom of poor human management of their environment and surroundings.

Bad news: We have a lot of work to do
Good news: We can change that system!

References

- CDC (2023), *One Health.* Available from: https://www.cdc.gov/onehealth/index.html
- Morgan, O. W., Abdelmalik, P., Perez-Gutierrez, E., Fall, I. S., Kato, M., Hamblion, E., ... & Ihekweazu, C. (2022). How better pandemic and epidemic intelligence will prepare the world for future threats. *Nature Medicine*, *28*(8), 1526-1528.
- Bayulken, B., Huisingh, D., & Fisher, P. M. (2021). How are nature based solutions helping in the greening of cities in the context of crises such as climate change and pandemics? A comprehensive review. *Journal of Cleaner Production*, *288*, 125569.
- Moraci, F., Errigo, M. F., Fazia, C., Campisi, T., & Castelli, F. (2020). Cities under pressure: Strategies and tools to face climate change and pandemic. *Sustainability*, *12*(18), 7743.
- McMichael, A. J. (2015). Extreme weather events and infectious disease outbreaks. *Virulence*, *6*(6), 543-547.
- Ljungqvist, F. C., Seim, A., & Huhtamaa, H. (2021). Climate and society in European history. *Wiley Interdisciplinary Reviews: Climate Change*, *12*(2), e691.
- WHO (2023). *Environmental Health*. Available from: https://www.who.int/health-topics/environmental-health

THANKS!

Do you have any questions?

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Credits: SlidesGo, Bing AI image creator