



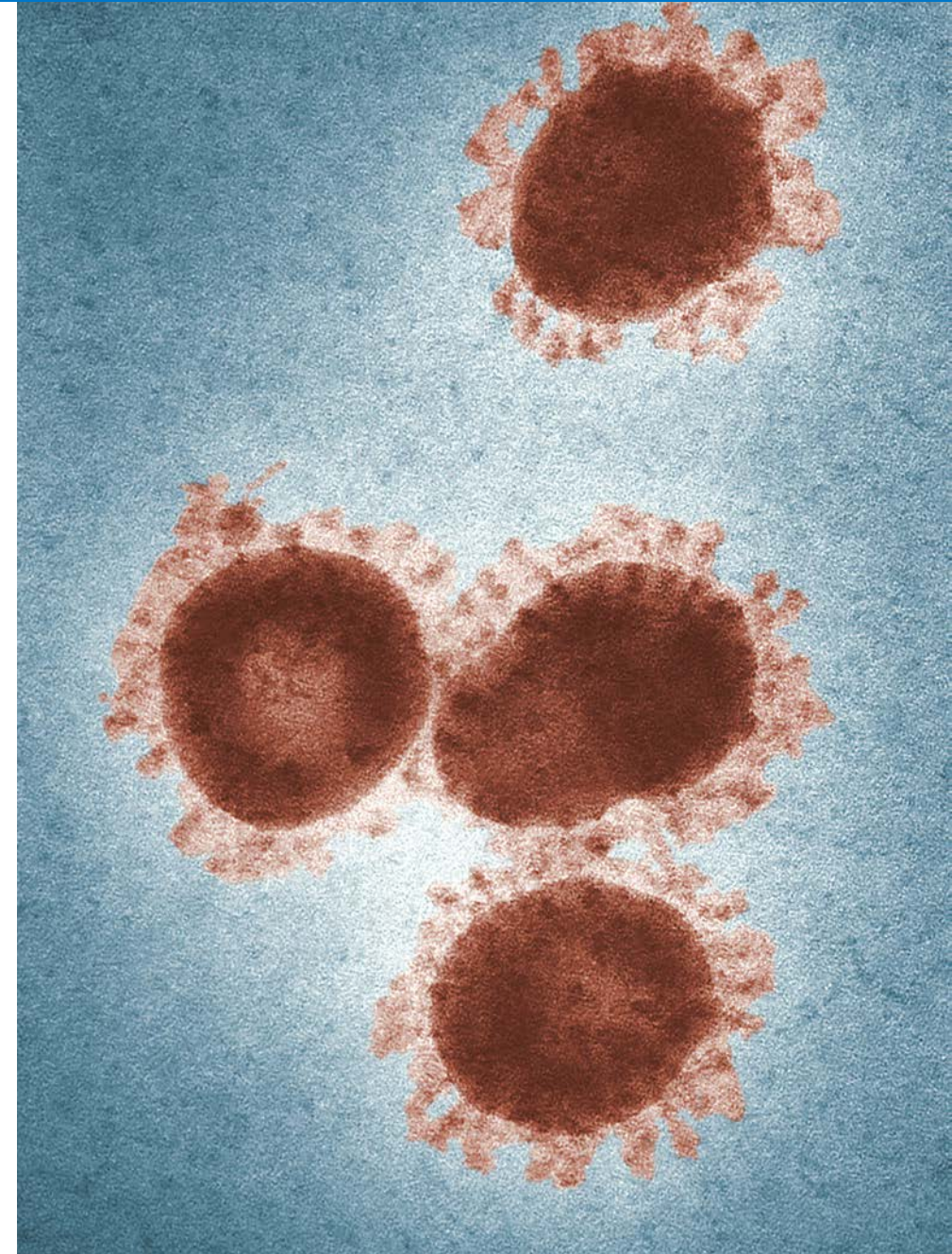
# Pandemics and Population





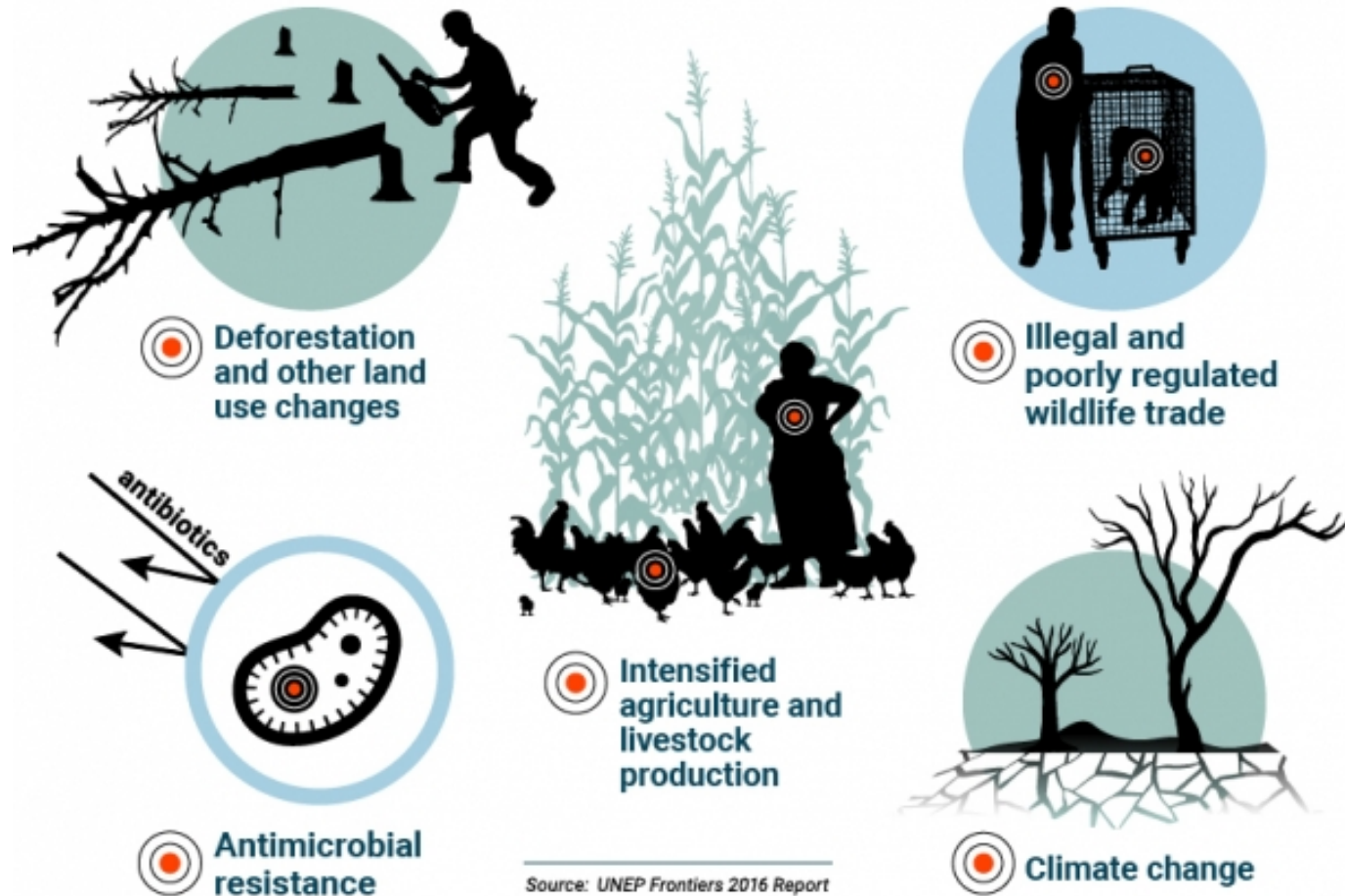
# Zoonotic Diseases

- COVID-19 is the latest of many zoonotic diseases, which are caused by animal-to-human contact.
- Viral animal-to-human spillovers are increasing, and are linked mainly to human encroachment onto animal habitats and ecosystem disruption.





# What factors are increasing zoonosis emergence? (Diseases transmitted from animals to humans)



- Population growth drives deforestation, intensified agriculture, and climate change.

# Zoonotic Diseases

- An estimated 75% of new infectious diseases are zoonotic, or a direct result of human-to-animal contact.
  - **Zika** - mosquitoes
  - **Ebola** - bats and/or nonhuman primates
  - **SARS** - bats
  - **AIDS** - chimpanzees
  - **Avian influenza** - poultry
  - **MERS** - bats
  - **Influenza A** - wild birds to pigs to humans
  - **COVID-19** - bats

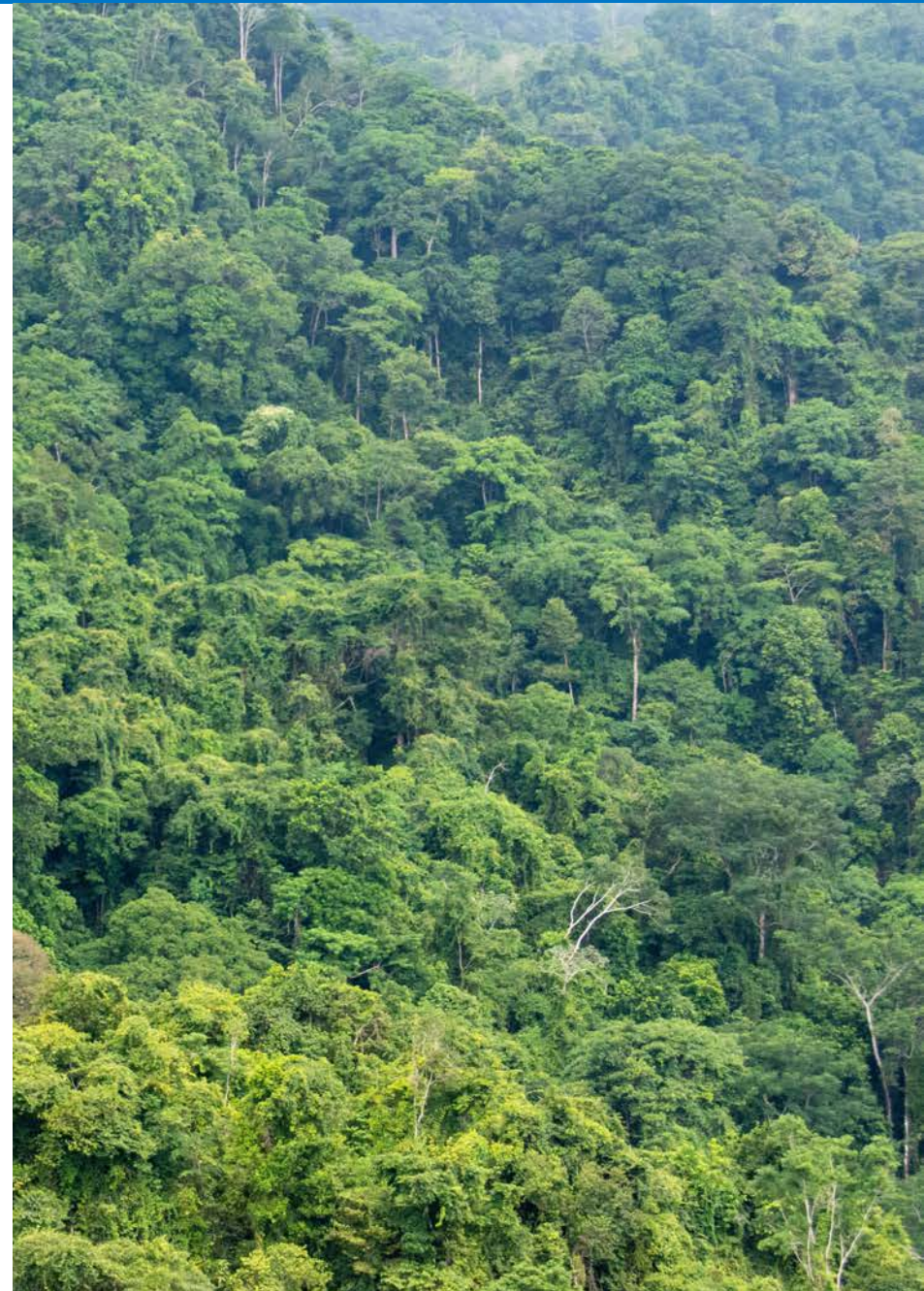






# Zoonotic Diseases

- Scientists maintain that there are likely about 1.7 million undiscovered infectious diseases that exist in wildlife.
- As researchers continue to search for the location of the next outbreak, the world's virus “hotspots” have three things in common:
  - High human population density
  - Diverse plants and animals (biodiversity)
  - Rapid environmental changes





# Zoonotic Diseases

- Virus “hotspots” include the native habitats of zoonotic disease hosts like rodents and bats.
- While the majority of the world’s mammals are rodents, bats make up about 50% of mammals in the most biodiverse tropical regions.
  - While bats are vital for sustaining ecosystem health, they also act as some of the world’s primary virus vessels, in part because of their strong immune systems.
  - Bats are carriers of many pathogens that don’t make them sick, but could be deadly if transferred to humans.
  - Humans are increasing the likelihood of this transfer, or “spillover.”



# Viral Spillover

- **Exotic wildlife trade** (for consumption, traditional medicine, and pets), especially at “wet markets,” increases the risk of animal-to-human spillover. Exotic meat sales are becoming more popular in the world’s quickly growing megacities (defined as a city with more than 10 million people).
- **Intensified agriculture** also increases this risk, as livestock are kept in crowded, often unsanitary spaces and fed antibiotics and hormones meant to help prevent sickness and promote fast growth. Increased pesticide use also contributes to biodiversity loss, which increases the chance of disease emergence.
- **Habitat destruction** - As the world’s population continues to grow, humans are coming into closer contact with vectors and pathogens by destroying wildlife habitats and reducing the number of predators. Without predators, the amount of rodents and other disease carriers quickly increases.



# Viral Spillover

- While much attention has been paid to “wet markets” as the culprit for zoonotic disease emergence, intensified agriculture is also very much to blame.
  - The heavy use of antibiotics for livestock results in microbial resistance, which allows for quicker disease transmission.
  - The practice of using fertilizers and pesticides on crops lowers disease resistance in farmers, farmworkers, and the people and animals that are exposed to them through dirt, air, and water.
  - Fertilizer use also results in heightened nutrient levels in the soil and water, which worsens the impact of infectious disease.
- Recent research indicates that since 1940, intensive agriculture has been linked to over 25% of all communicable diseases that infected humans, and over half of all infectious diseases that were transferred from animals to humans.





# Spillover Example: Nipah Virus

- In 1998, Nipah virus was discovered in Malaysia and has since spread throughout Asia, killing hundreds.
- Scientists believe that this virus was transferred to humans because of environmental change and agricultural intensification.
  - When rainforests were cleared and repurposed to produce palm oil, lumber, and livestock, native fruit bat populations were forced to relocate.
  - Some fled to areas surrounding pig farms, where mango and other fruit trees were prevalent.
  - Bat feces and saliva infected the pigs, and the pigs spread the virus to farm and industry workers.





# Pandemics and Population Growth

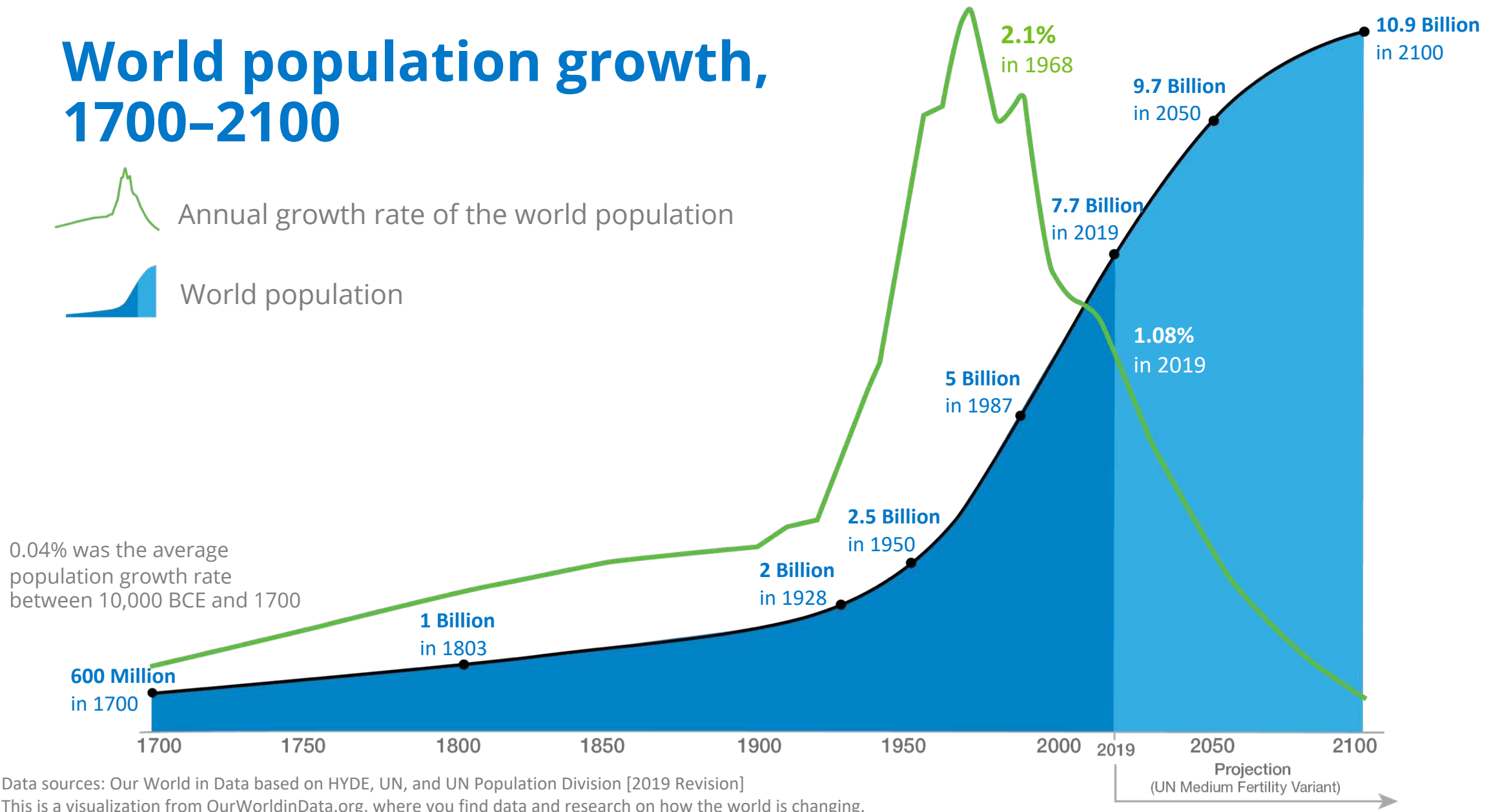
- The continued growth of the human population is worsening the threat of infectious disease outbreaks.
  - Scientists believe that animal-to-human interaction will continue to increase.
- The world population has increased from 1 billion in 1800 to 7.8 billion today.
- Although growth *rates* are falling, the world's population is projected to continue to grow into the next century.
  - The UN projects that the population will grow to around 8.5 billion in 2030, 9.7 billion in 2050, and 10.9 billion in 2100.







# World population growth, 1700–2100

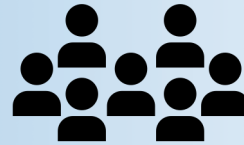




# The interconnected challenges facing the world today

## Population growth

**7.8bn** people today  
expect **9.8bn** by 2050



Demand for food and energy  
Pressure on scarce resources  
Negative environmental impact

Source: United Nations, 2020

## Climate change

Linked to fossil fuels and  
tropical deforestation



March 2020  
**414.5 ppm**

CO<sub>2</sub> rising 10 times faster than any sustained  
rise in **800,000** years  
Pushes planetary boundaries  
Accelerated biodiversity loss

Source: NASA, NOAA, IPCC, 2020\*

## Deforestation

**Four commodities:**  
Soy, palm oil, beef, lumber

**15,000** sq miles tropical land destroyed each year



Human intrusion biodiversity hotspots  
Disruption and disturbance  
Ecosystem degradation

Source: NASA, NOAA, IPCC, 2020\*

## Consumption and production

Increasing demand  
for animal protein



More than **50bn** animals consumed



**50bn**



**1.5bn**



**1.5bn**



**1.5bn**

Unsustainable production and consumption  
Reduce food waste, increase plant-based  
Tackle overuse and misuse of antibiotics

Source: World Economic Forum 2020

## Health and wellbeing

Ensure healthy lives  
Combat communicable disease



Emergence of infectious disease  
Underprepared health systems  
Dislodged viruses





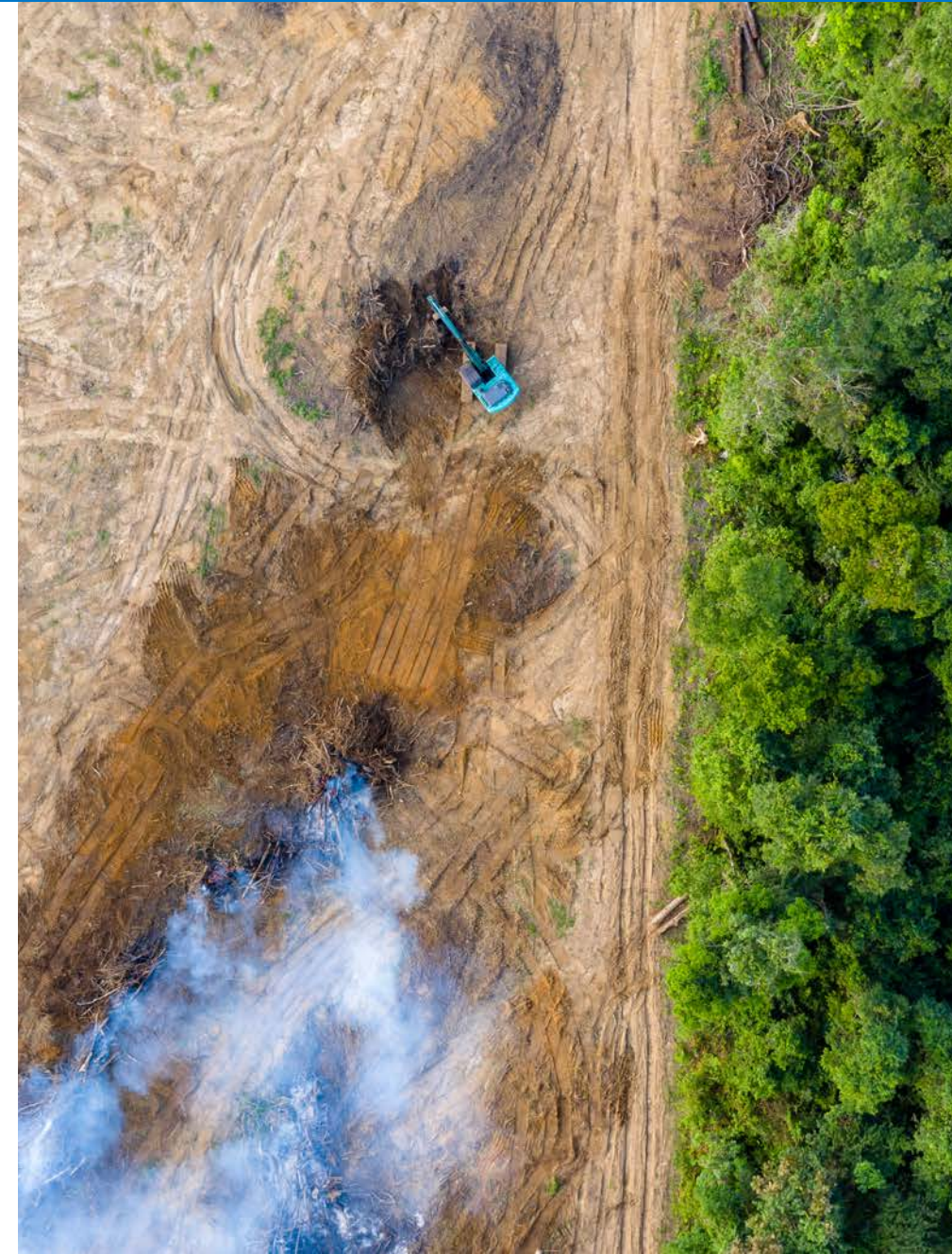
# Case Study: Brazilian Amazon

Brazil's Amazon rainforest has been described as a "perfect storm" of deforestation, coronavirus, and wildfire.



# Case Study: Brazilian Amazon

- Deforestation in the Brazilian Amazon is increasing substantially. Since 2019, the rainforest has opened for loggers, ranchers, and miners, which has caused a spike in forest clearance.
  - From January to March of 2020, deforestation rose by 51% compared to 2019 levels.
- Forest clearance and low rainfall during dry seasons creates conditions for large wildfires.







## Case Study: Brazilian Amazon

- Even during the COVID-19 lockdown, many believe illegal loggers and miners have continued to work in the Amazon with little to no regulation.
- As the exploitation of the Amazon's natural resources continues, COVID-19 is spreading to indigenous communities throughout the region.
  - Smoke from wildfires increases the mortality risk, as it contains pollutants that have been linked to increased risk of dying from the virus.
  - Both smoke from forest fires and COVID-19 attack the respiratory system.



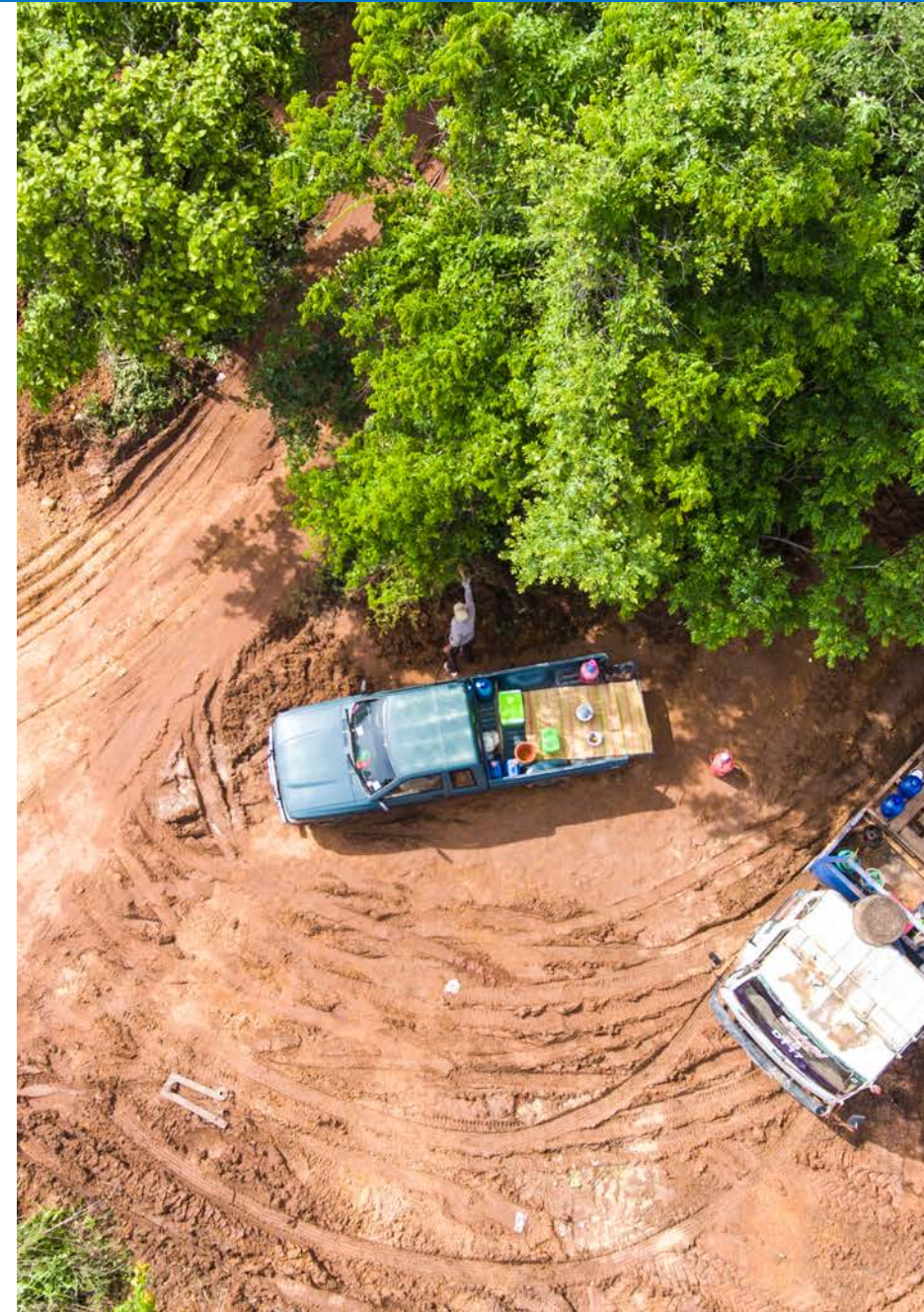


## Case Study: Brazilian Amazon

“Today, with this new scourge spreading rapidly throughout Brazil, native communities, some living in isolation in the Amazon Basin, could be completely eliminated, without any defense against the coronavirus.”

“Without any protection against this highly contagious virus, the Indians face a real risk of genocide, through contamination caused by illegal invaders on their lands.”

- *Sebastião Salgado, Brazilian photojournalist, and Lélia Wanick Salgado, Brazilian author, film producer, and environmentalist*







## Case Study: Brazilian Amazon

- Although Brazil has deployed armed forces to combat deforestation and fires in the rainforest, many activists worry that the plan will not be effective in the long term.
  - At the same time, Brazilian President Jair Bolsonaro has continued to weaken or eliminate environmental regulations and the organizations enforcing them.
  - Many have pointed to the fact that military enforcement is expensive in a time when resources are already being used to fight the coronavirus pandemic.
  - President Bolsonaro's administration is also creating laws that would allow for the ownership of illegally deforested land occupied before 2018, effectively promoting continued invasion into the Amazon region.

## Case Study: Brazilian Amazon

- Deforestation is increasing in much of the Amazon's public areas that are not officially protected or marked as indigenous land.
- In the first quarter of 2020, unprotected forests accounted for 46% of registered deforestation—an increase of 30% from 2019.
- Without further protections, the Amazon rainforest and its inhabitants—both human and animal—will be more exposed to large-scale forest clearing and subsequent wildfires.
  - With less rain and drier grasslands, fires can spread quickly and are largely impossible to control.





## Case Study: Brazilian Amazon

- Deforestation is also a major contributor to climate change, because forests store large amounts of carbon dioxide (CO<sub>2</sub>) from the atmosphere as they grow.
- When forests are cleared or burned, the carbon that was once stored in branches, leaves, trunks, and soil is released into the atmosphere, mainly in the form of CO<sub>2</sub>.
  - Carbon emissions from human processes are one of the primary greenhouse gases accelerating climate change.
  - From 2015-2017, the global loss of tropical forests released about 4.8 billion tonnes of CO<sub>2</sub> per year.
    - This accounted for 8-10% of annual human emissions of CO<sub>2</sub>.



# Political Economy of Pandemics

- Deforestation, along with intensive farming and climate change, is among the main drivers of increased virus transmission from animals to humans.
- Studies have shown that the global approach to the production of goods causes a higher level of resource depletion in low-income countries than in higher-income countries. This includes the production of key agricultural products like:
  - Beef
  - Palm oil
  - Coffee
  - Cocoa



Source: Scientific American 2020

Large scale deforestation in the rainforest of Borneo to make way for palm oil plantations. Adobe Photos





# Political Economy of Pandemics

- The production of cash crops (produced for commercial sale rather than personal consumption) typically involves deforestation and causes biodiversity loss. Both processes drastically increase the risk of viral spillover.
- Globally, some of the main regions where key agricultural products like beef, coffee, cocoa, and palm oil are produced include sub-Saharan Africa, Southeast Asia, and Latin America.
  - The economies of these regions are largely export-led: The overwhelming majority of cash crops produced in low-income regions are shipped and sold to high-income regions.
    - For example, over 95% of the coffee and cocoa produced in developing regions is exported to affluent regions throughout North America and Europe.

# Political Economy of Pandemics

- The agricultural sector is one of the most important sectors of Brazil's economy.
  - Ag makes up 4.4% of Brazil's annual GDP.
  - About 10% of Brazil's workforce is employed in the agriculture industry.
- Brazil is a leading producer of coffee, sugar, soybeans, and beef.
- Agriculture and deforestation account for about 70% of Brazil's greenhouse gas emissions.







# Political Economy of Pandemics

- The environmental degradation caused by intensified agriculture and the production of cash crops leads to the loss of large, predatory animals first.
  - Without predators, the world's most common vectors, including bats, rats, and mosquitoes, are left to multiply.
  - Natural resource depletion increases the competition for dwindling resources.
  - As a result, vectors are pushed further and further into communities and urban areas in search of food and shelter.
  - This forces animals to come into closer contact with humans.



# Political Economy of Pandemics

- The populations of sub-Saharan Africa, Southeast Asia, and Latin America are increasing.
  - Sub-Saharan Africa currently has the highest rate of population growth of any world region and is projected to double in population by 2050, adding 1 billion people between 2020 and 2050 and continuing to grow beyond the end of the century.







# Political Economy of Pandemics

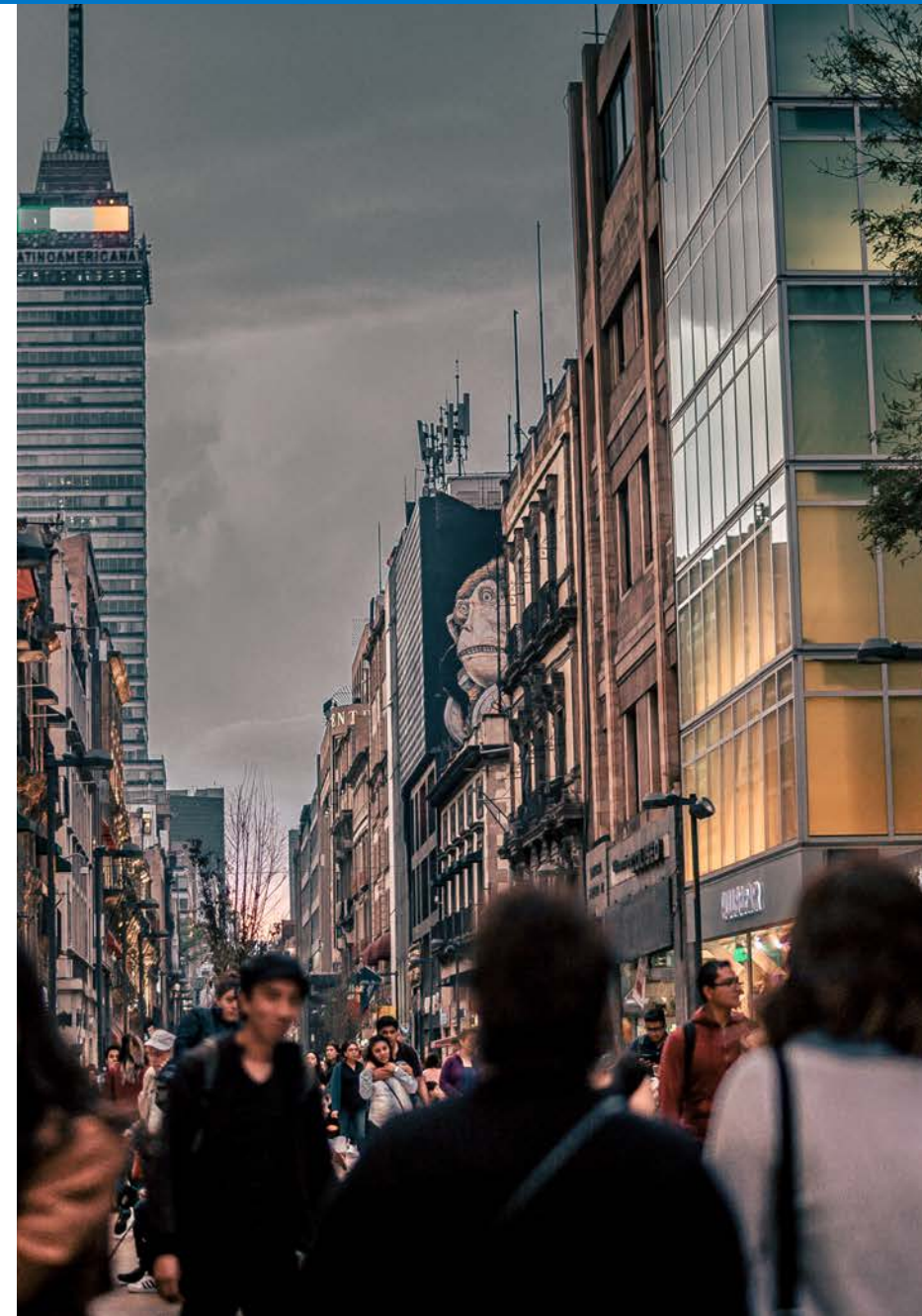
- At around 668 million people, Southeast Asia is the world's third most populous geographical region. Its urban population is expected to reach 56% of its total population by 2030.
  - Indonesia is expected to experience a baby boom because of the coronavirus lockdown. The Indonesia National Population and Family Planning Agency, BKKBN, estimates that there could be 370,000 to 500,000 extra births early next year.





# Political Economy of Pandemics

The population of Latin America and the Caribbean tripled between 1950 and 2019. The region's population growth is expected to peak in 2058 at 768 million.







# Political Economy of Pandemics

“It is time to connect the dots. Global infectious disease pandemics like COVID-19 and others are the indirect result of a global economic order that depends on unequal access to power and resources. While environmental harm is localized and thus out of sight for most consumers, the consequences are not. They are far-reaching and, as we now know, potentially deadly.”

- Kelly Austin, Associate Professor, Department of Sociology and Anthropology, Lehigh University





# Zoonotic Diseases

“The risk of disease emergence and amplification increases with the intensification of human activities surrounding and encroaching into wildlife habitats, enabling pathogens in wildlife reservoirs to spill over to livestock and humans.”

“There’s a [c]ritical relationship between a healthy environment and healthy people, and how human activities often undermine the long-term health and ability of ecosystems to support human well-being.”

—UN Environment Programme





“Nature sustains us. It’s where we originated. The lesson from this pandemic is not to be afraid of nature, but rather to restore it, embrace it, and understand how to live with and benefit from it.”

*– Thomas Lovejoy, Professor of Environmental Science and Policy, George Mason University*





# One Health Solutions

- The One Health approach recognizes that the health of humans is intimately tied to the health of other living things and the global environment.
  - This approach is collaborative and comprehensive. It works across disciplines and at the local, regional, national, and global levels.
- The goal of One Health is to increase health outcomes by better understanding the interconnections between humans, animals, plants, and their shared environment.







**One Health** is the idea that the Health of people is connected to the health of animals and our shared environment.

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When we protect **one**,  
We help protect **all**.



# ONE HEALTH TO PREVENT



**ONE HEALTH** is an approach that recognizes that the **health of people** is closely connected to the **health of animals** and our **shared environment**.

**ONE HEALTH**  
Is not new, but it has become more important in recent years. This is because many factors have changed interactions between people, animals, plants, and our environment.

## pandemics

- Human populations are growing and expanding into new geographic areas. As a result, more people live in close contact with wild and domestic animals, both livestock and pets. Animals play an important role in our lives, whether for food, fiber, livelihoods, travel, sport, education, or companionship. Close contact with animals and their environments provides more opportunities for diseases to pass between animals and people.
- The earth has experienced changes in climate and land use, such as deforestation and intensive farming practices. Disruptions in environmental conditions and habitats can provide new opportunities for diseases to pass to animals.
- The movement of people, animals, and animal products has increased from international travel and trade. As a result, diseases can spread quickly across borders and around the globe.

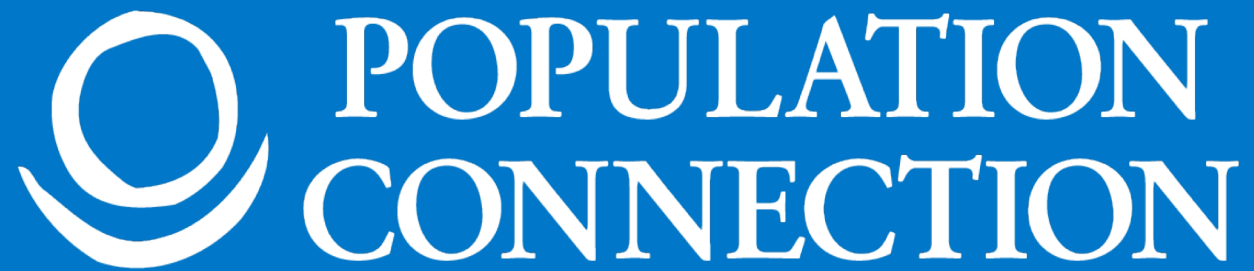






# Final Thoughts

- Zoonotic disease emergence is linked to human population growth, habitat destruction, wildlife trade, agriculture, antimicrobial resistance, and deforestation.
- In order to prevent the next pandemic, humans must reduce our impact on plants, animals, and the living environment. A greater understanding of the interconnections between human health and ecosystem health must be integrated into our social, political, and economic systems.



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