Biodiversité et santé

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KU
KASETSART
UNIVERSITY

Mahidol
University

News / Wuhan Coronavirus

11 January 2020, official announcement by WHO

Une personne est conduite à l'hôpital de Wuhan où des patients atteints d'une pneumonie inconnue sont traités, le 18 janvier 2019. STR / AFP

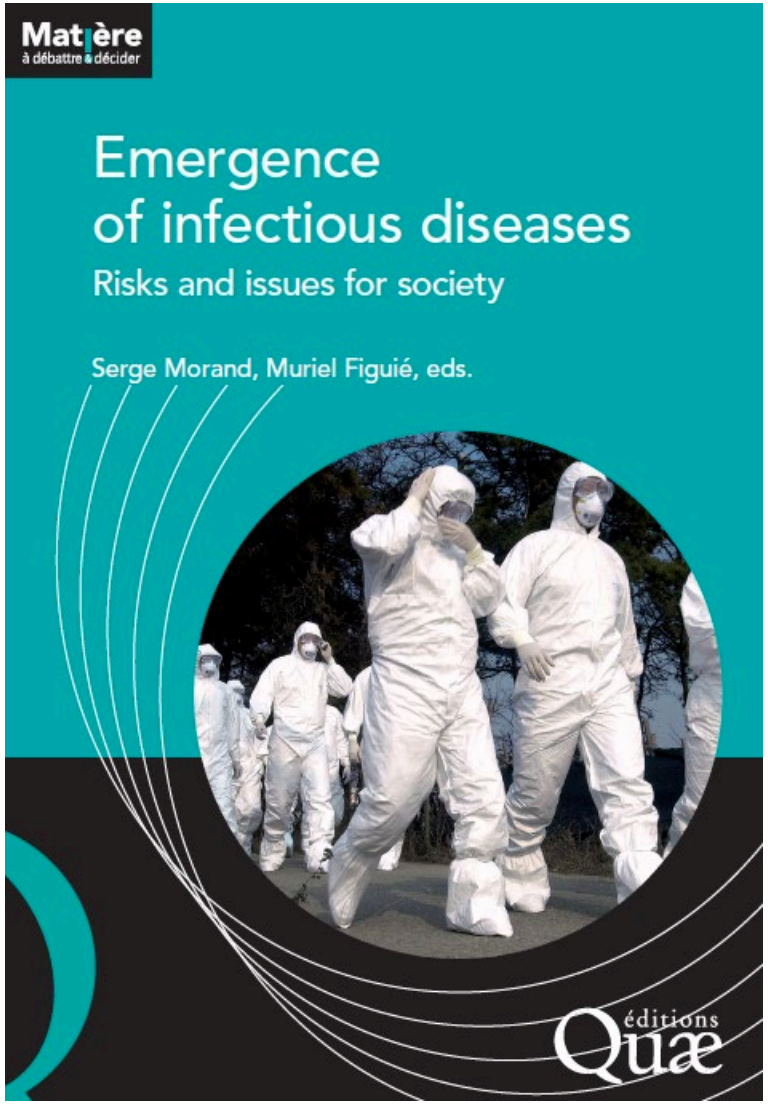
17 January 2020 - Imperial College London

Estimating the potential total number of novel Coronavirus (2019-nCoV) cases in Wuhan City, China

Estimation 1,723 cases of 2019-nCoV at Wuhan
(95% CI: 427 – 4,471)

China locking down cities with 18 million to stop virus

23 January 2020, by Ken M



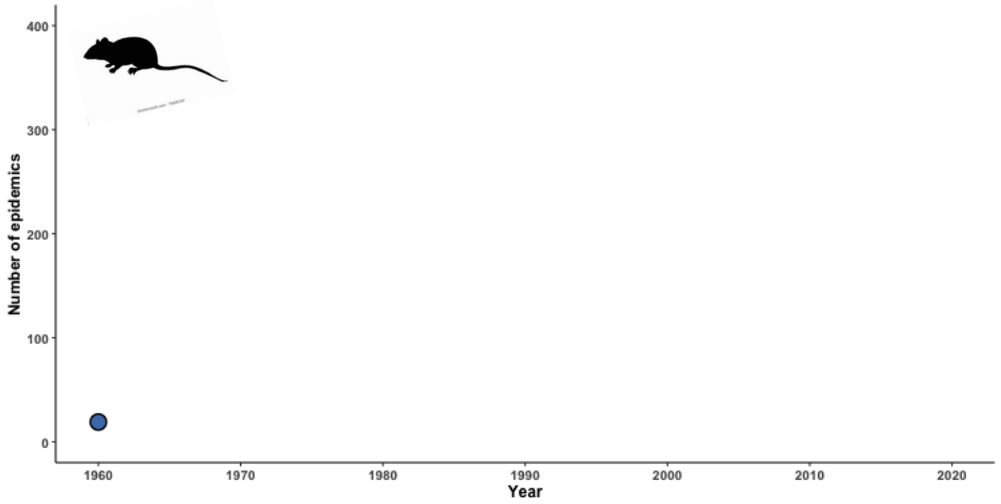
Une épidémie d'épidémies

An increasing number of outbreaks

Humans

Outbreaks of zoonotic diseases

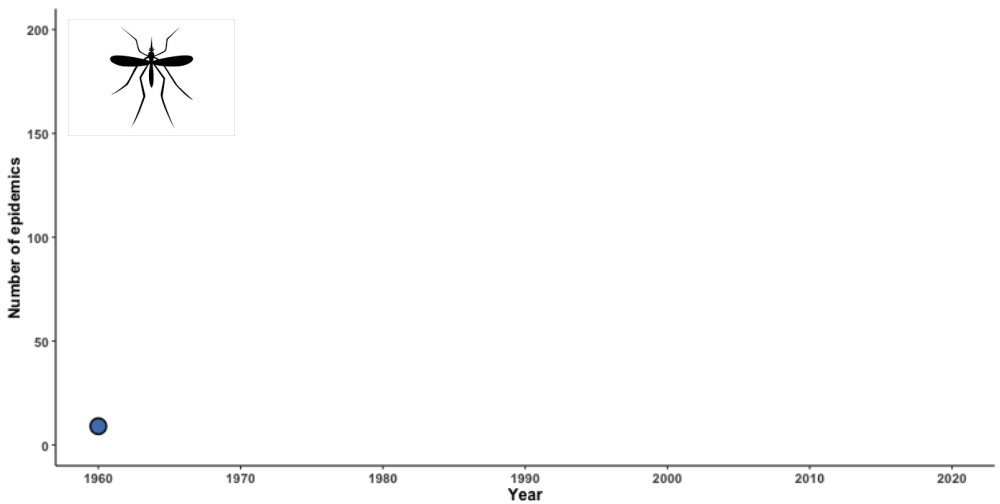
1960-2020



Data source: GIDEON

Outbreaks of vector-borne diseases

1960-2019



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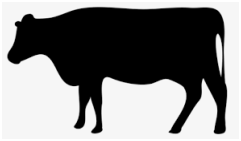
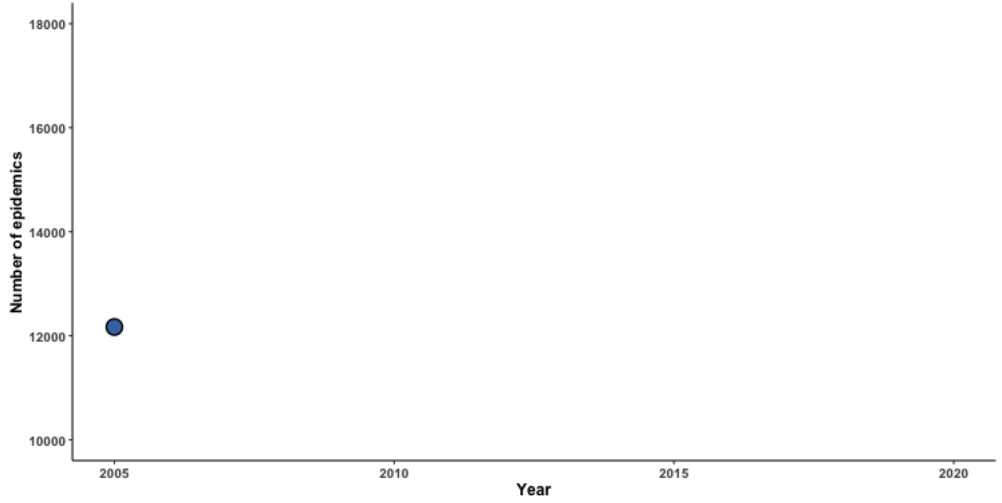


Livestock

Outbreaks of livestock - poultry diseases

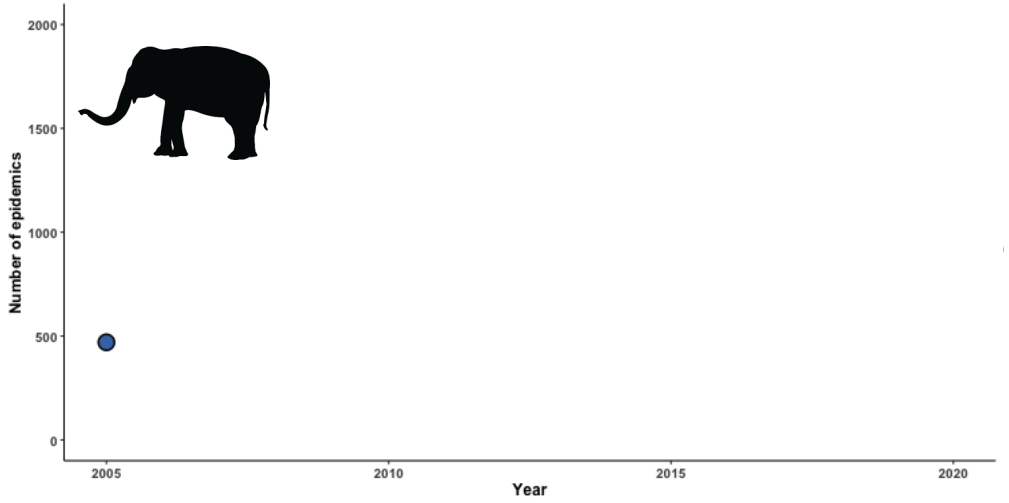
2005-2020



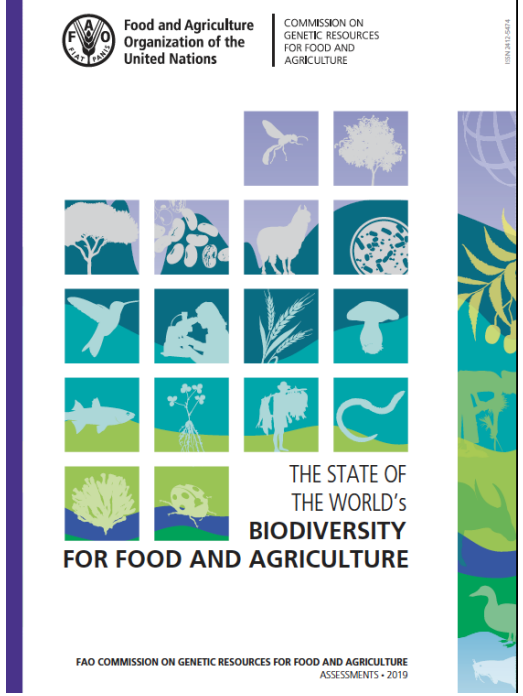
Data source: OIE-WAHIS

Outbreaks of wildlife diseases

2005-2020



Data source: OIE-WAHIS

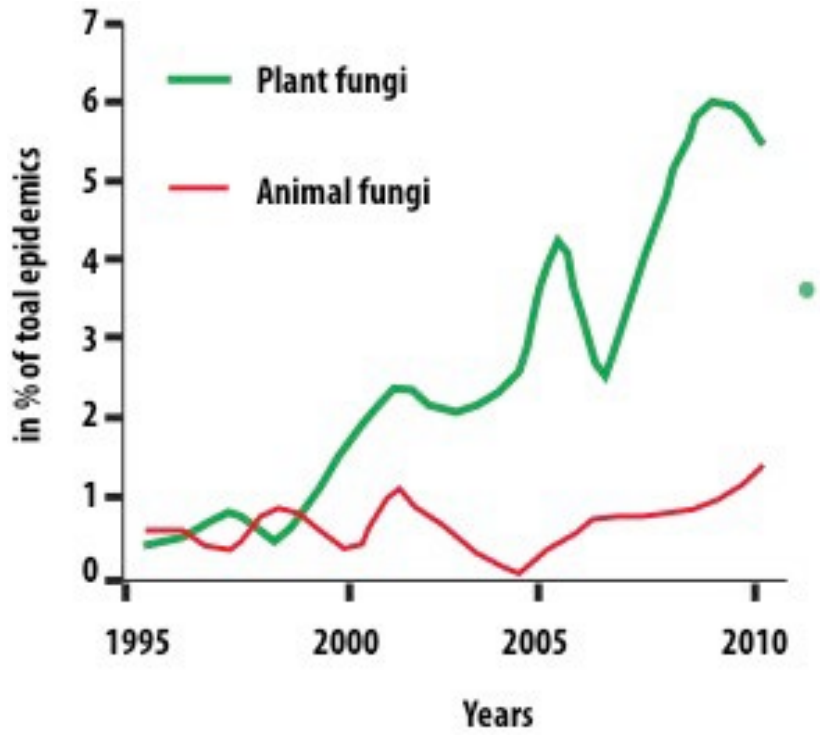


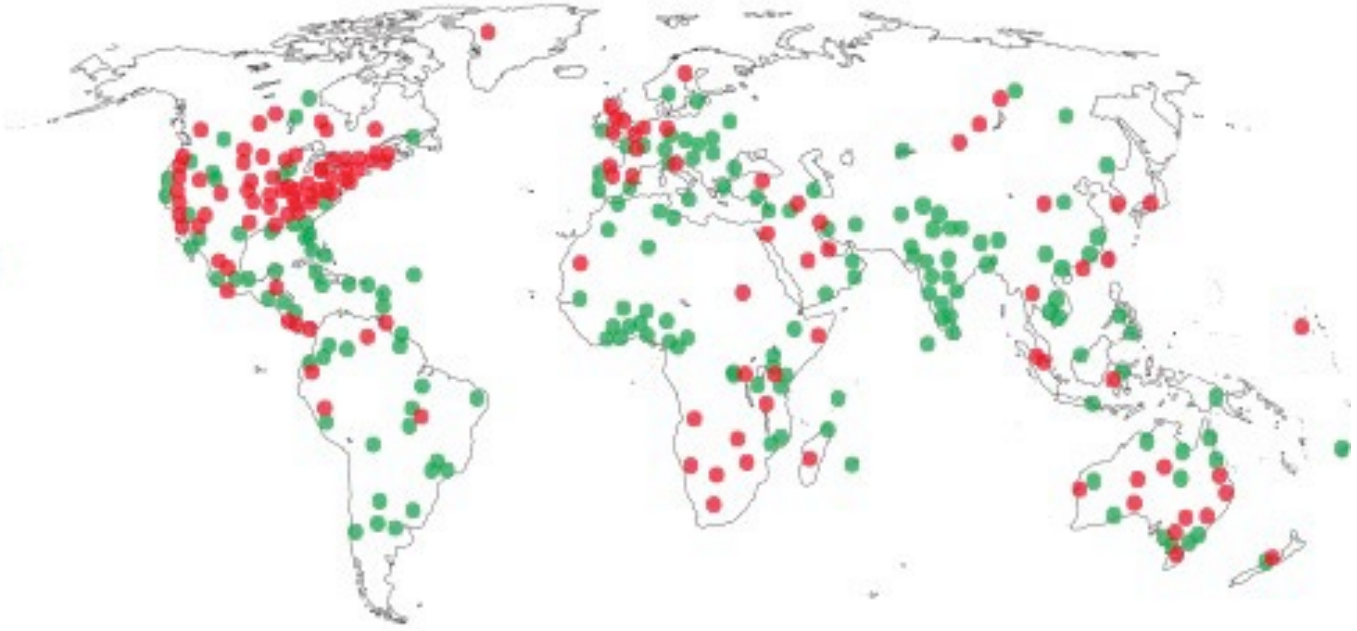
Increase of fungal diseases in plants and animals

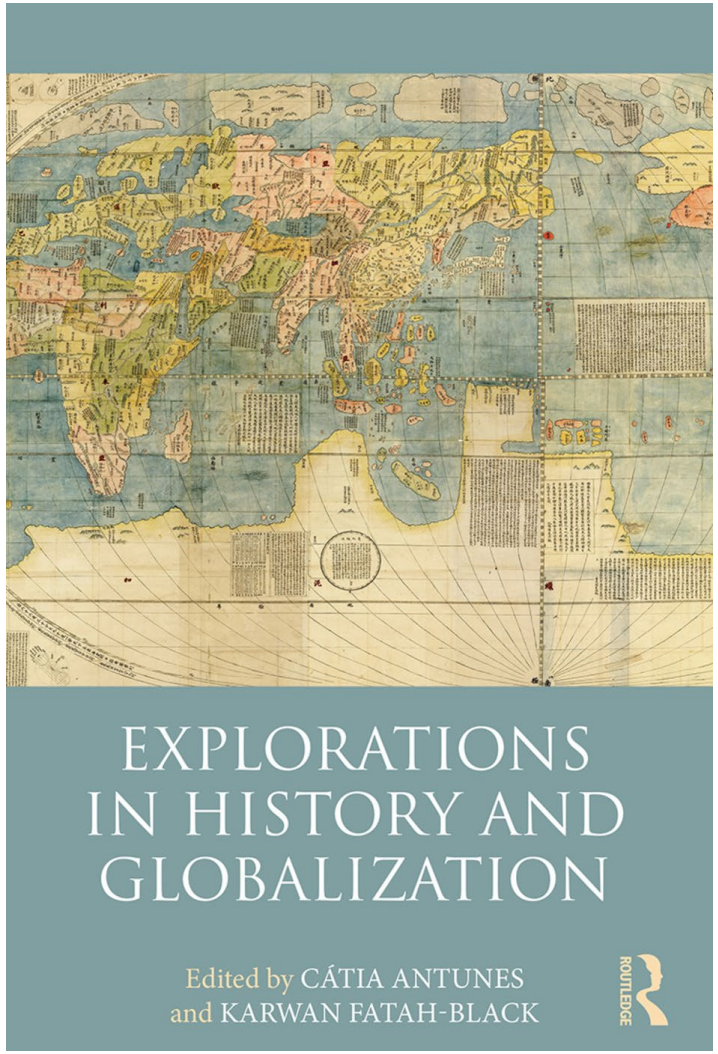
Bat white-nose syndrome

Amphibian cythrid

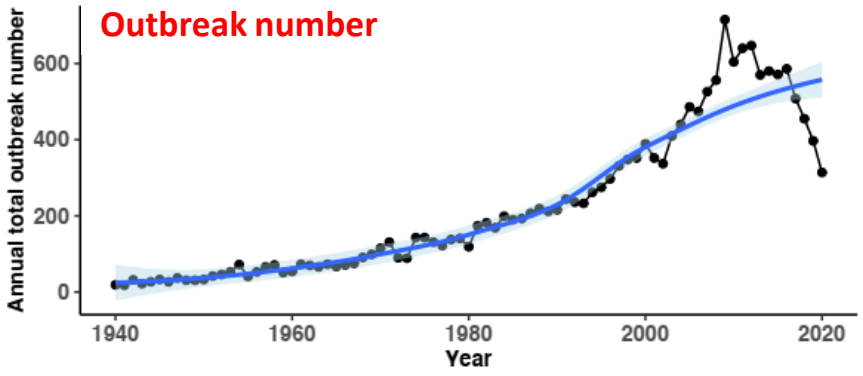
Plant fungal diseases



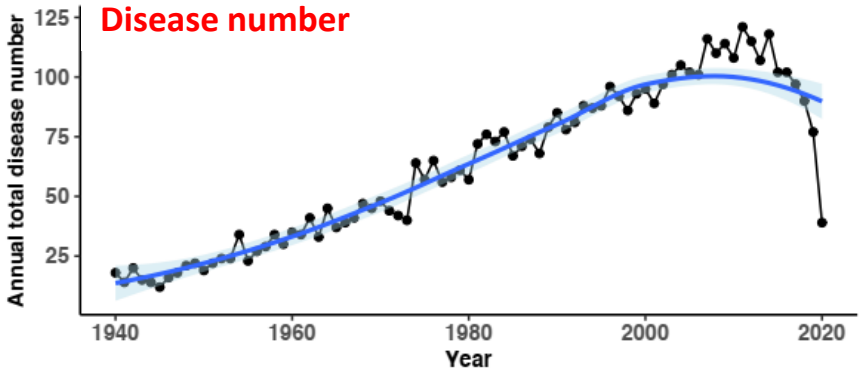




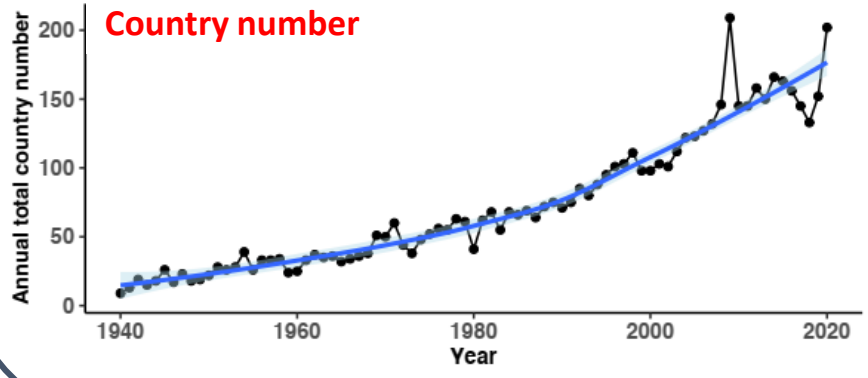
Une planète globalisée



Data source: Gideon



Data source: Gideon

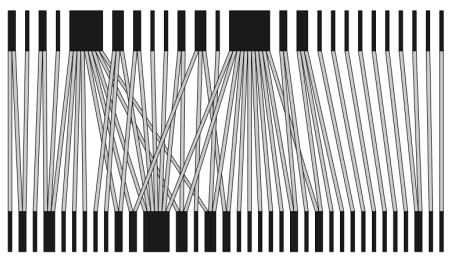


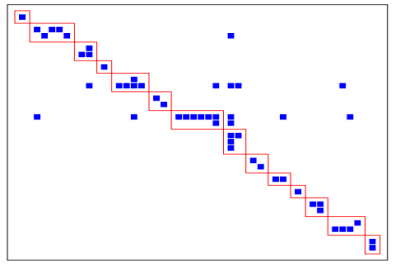
Bipartite network

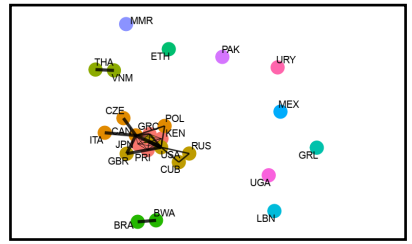
Bipartite modules

Unipartite network

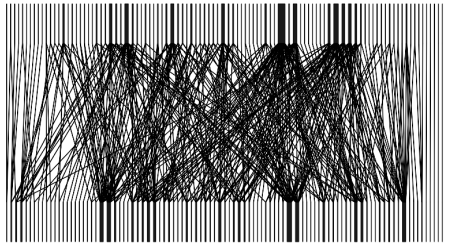
1960

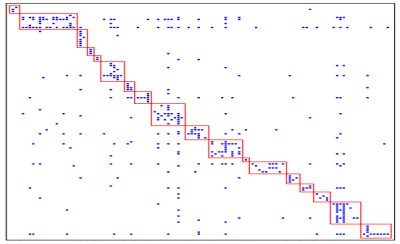


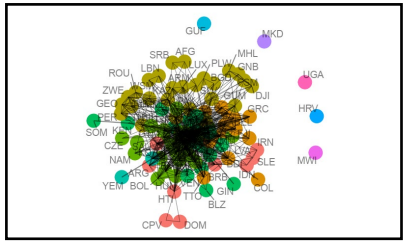




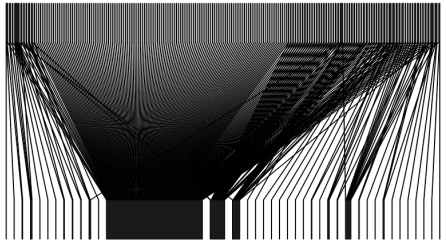
2000

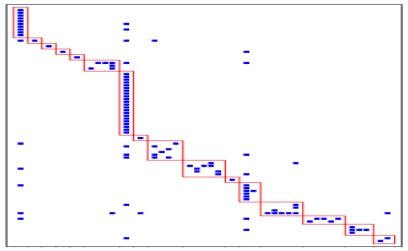


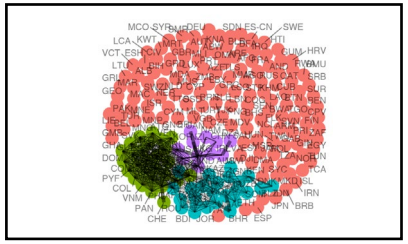




2020

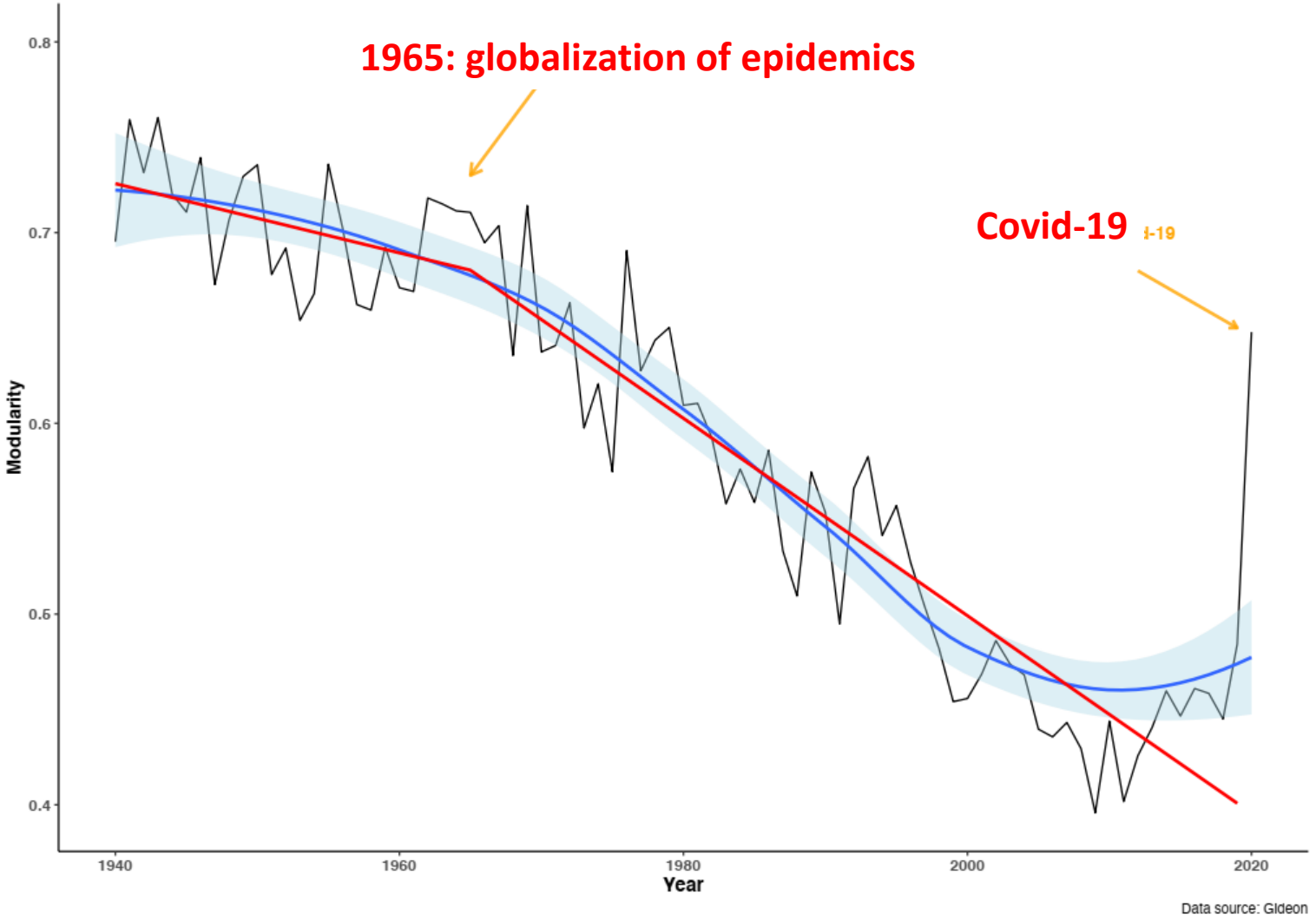






Globalization of epidemics

Modularity
network of outbreaks



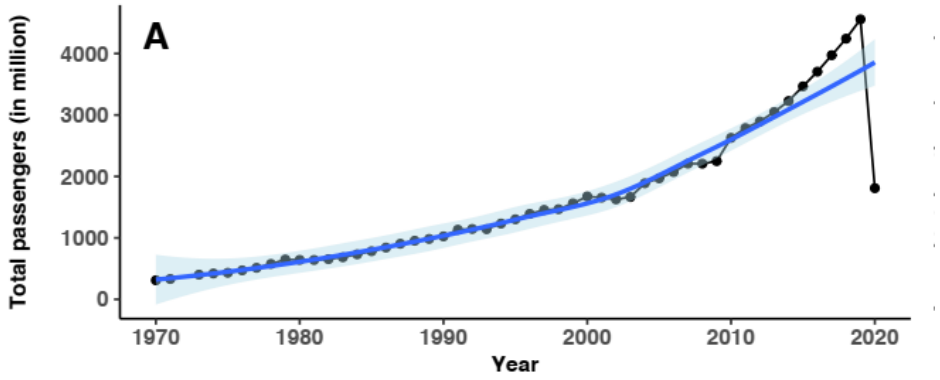
Year

(Morand & Walter, resubm)

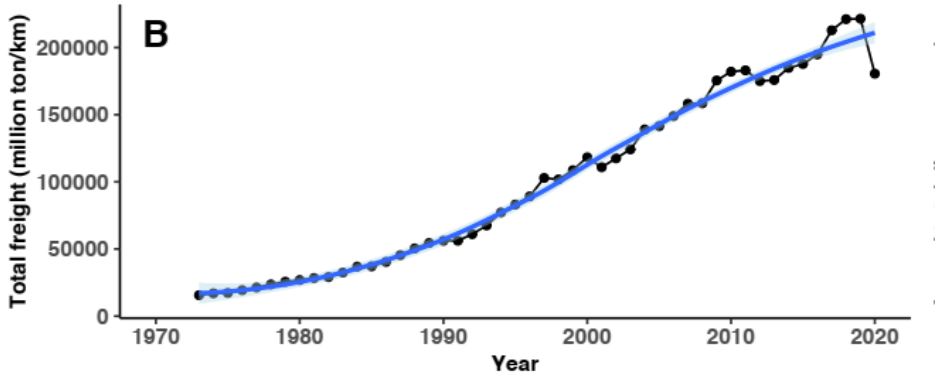
Global trade and travels

Globalization of epidemics

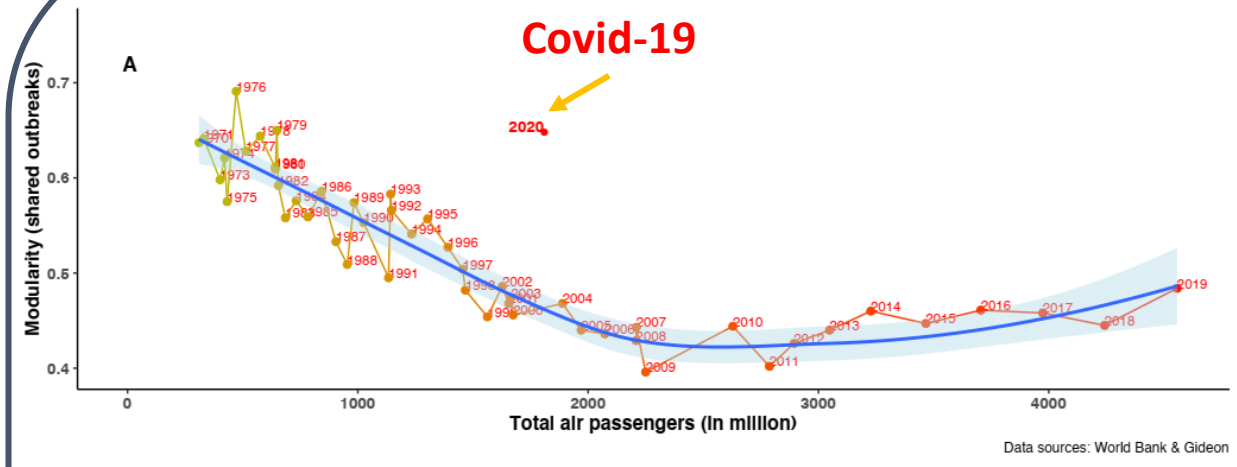
1,300 % increase 1970-2019



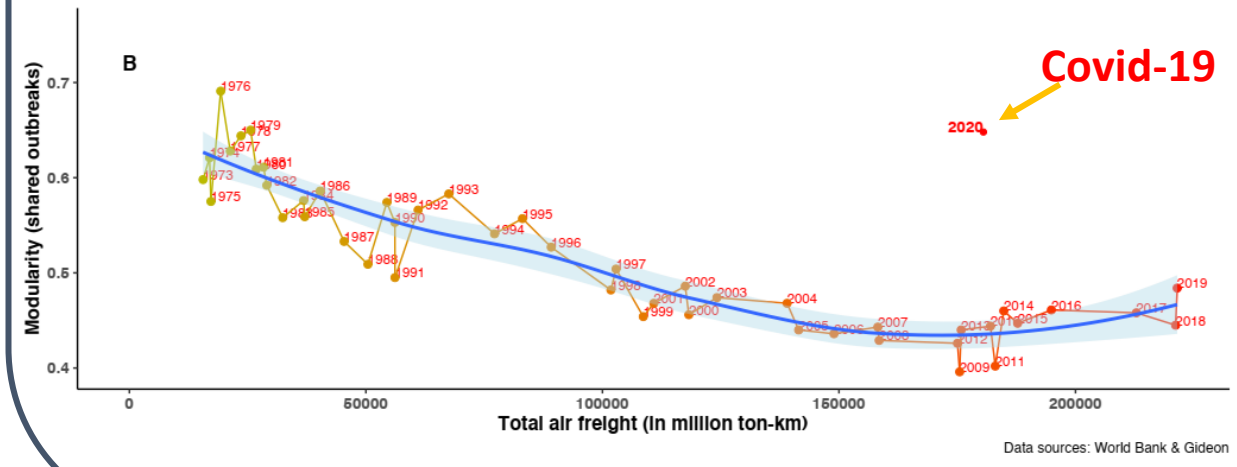
Data source: World Bank



Data source: World Bank

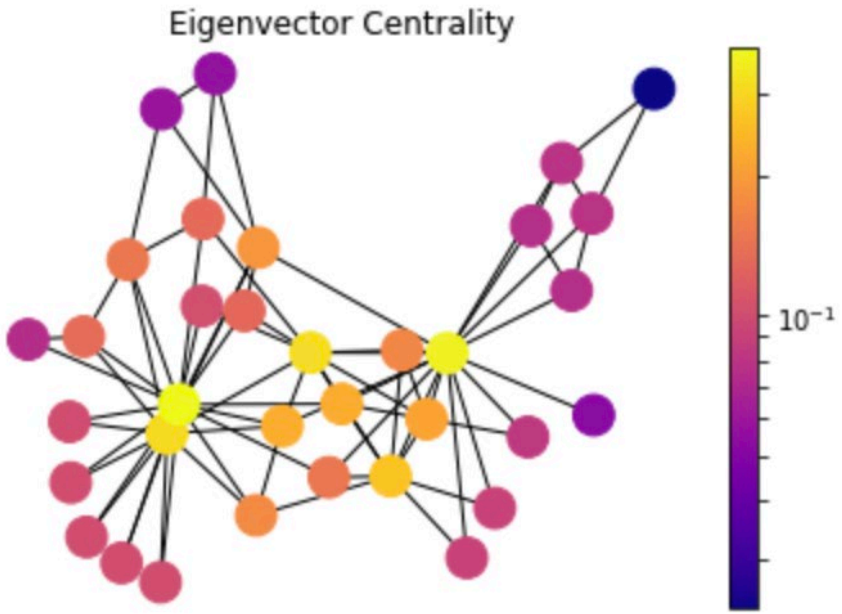


Data sources: World Bank & Gideon

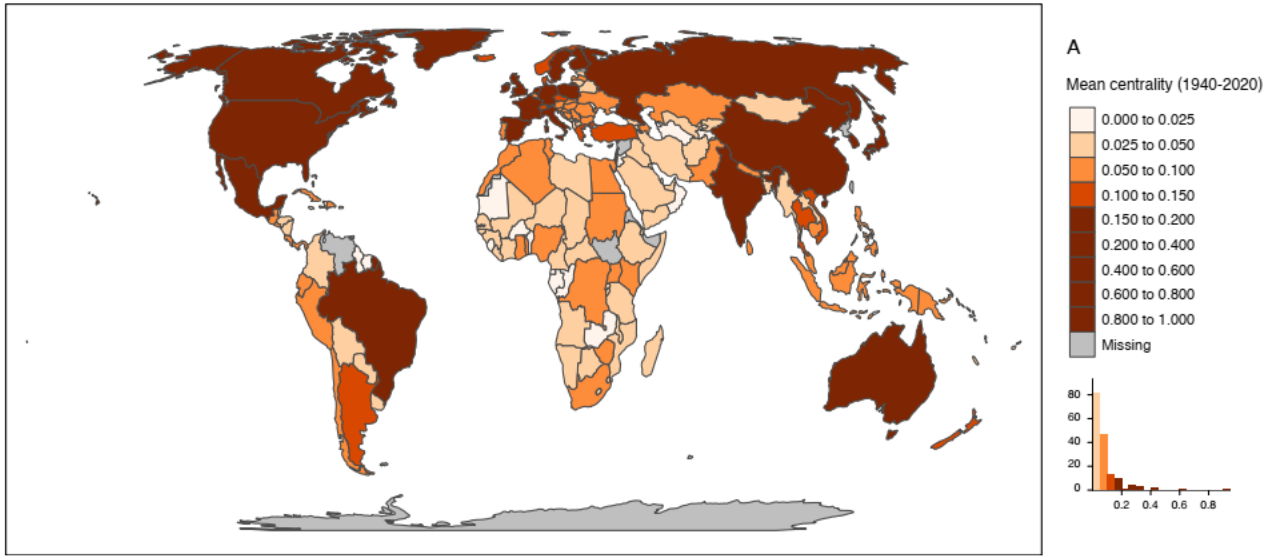


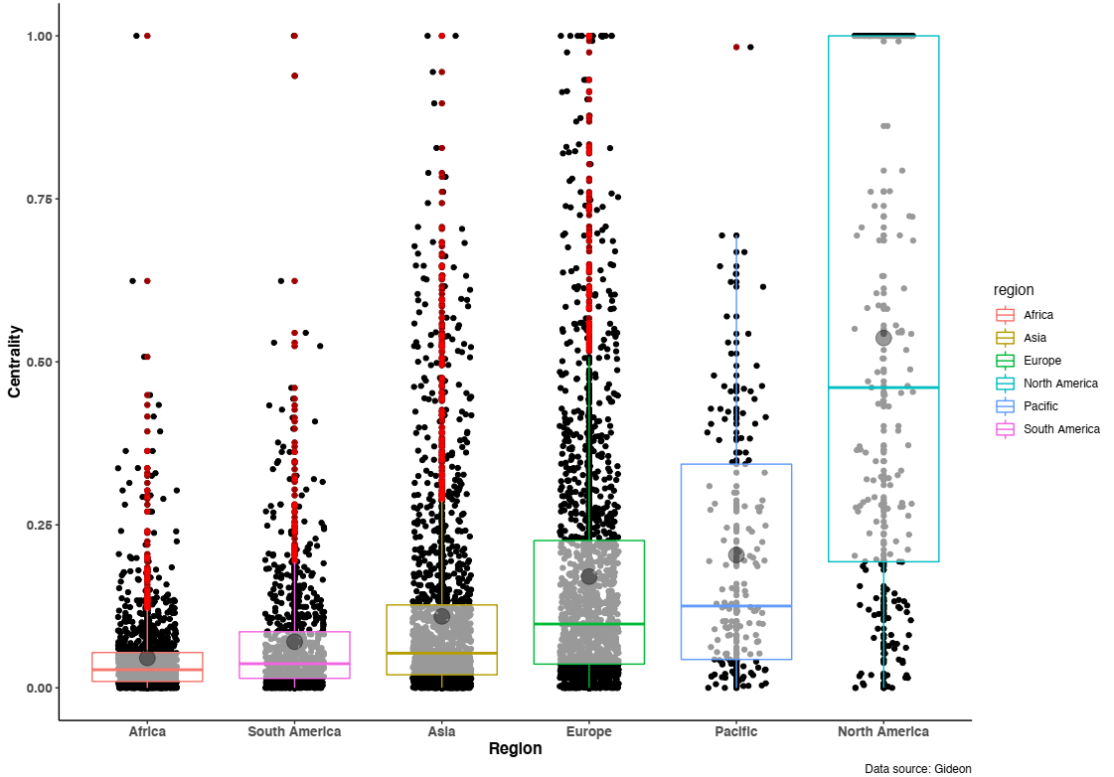
Data sources: World Bank & Gideon

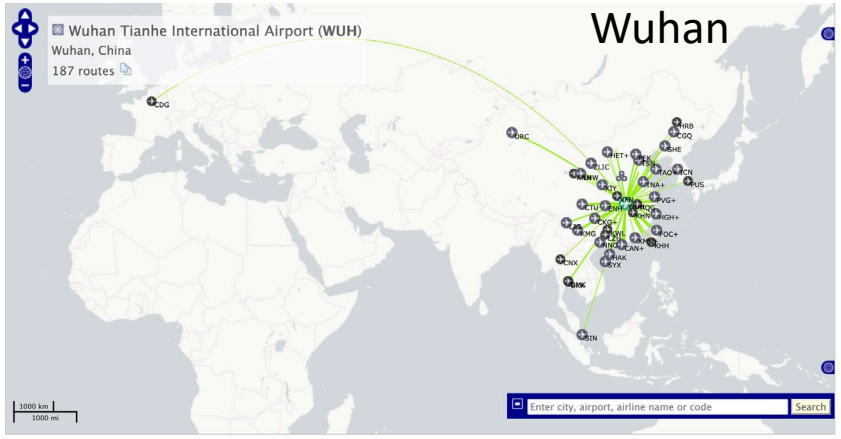
Centrality in outbreak sharing

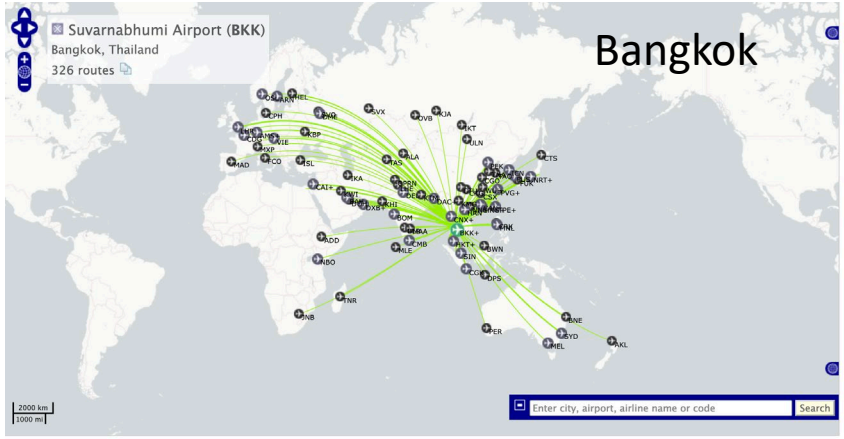


Eigenvector centrality is a basic extension of *degree centrality*, which defines centrality of a node as proportional to its neighbors' importance.

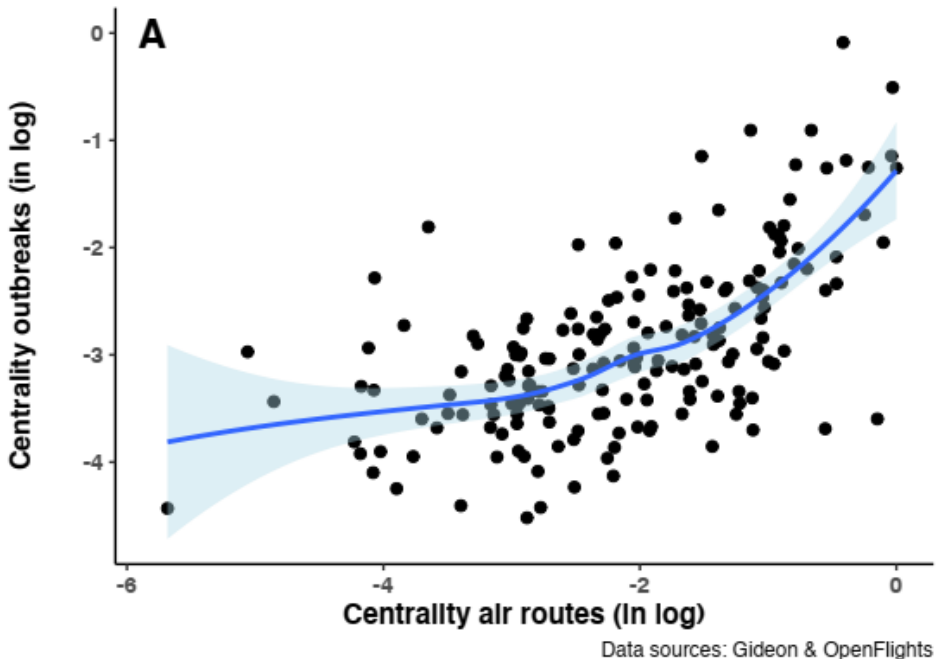


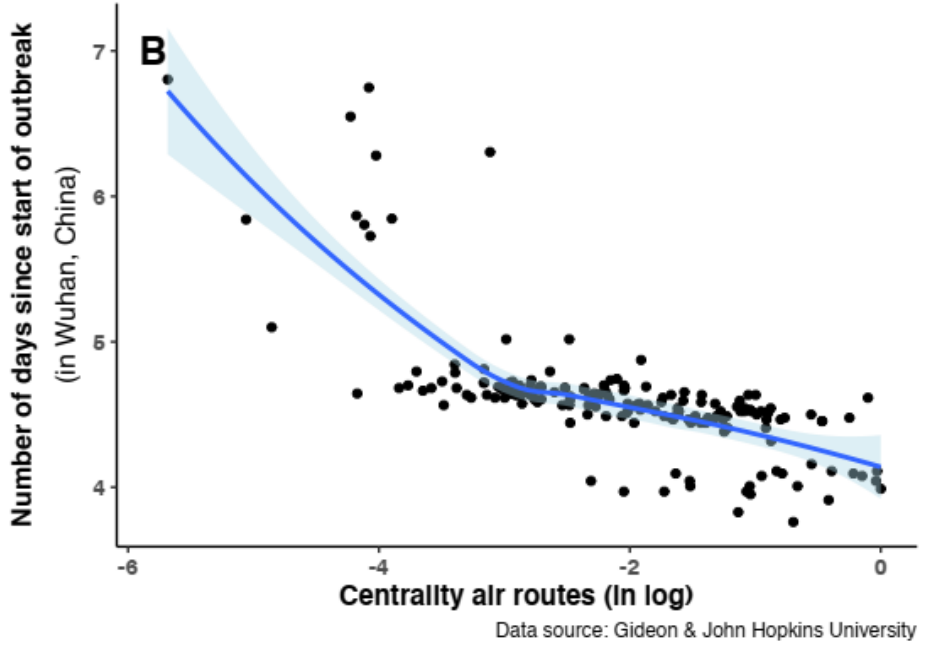






OpenFlights.org





Centrality in outbreaks vs centrality in air routes

First cases of Covid-19 vs centrality in air routes

Mpox (Monkeypox)

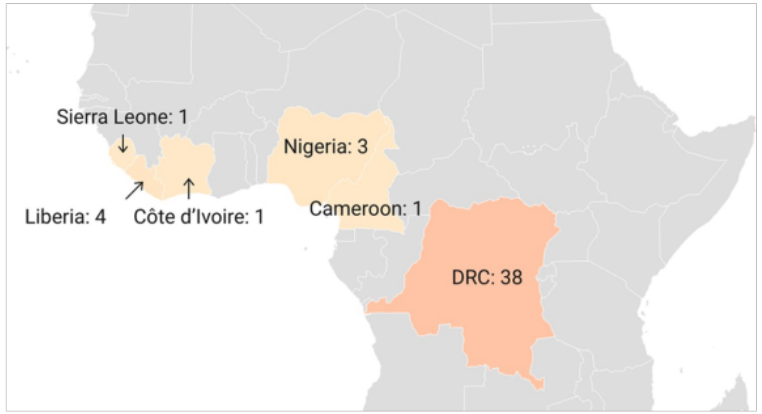
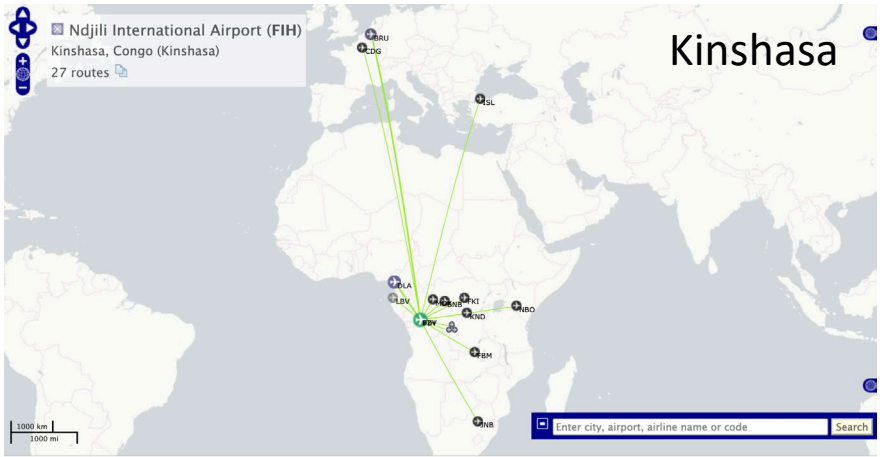
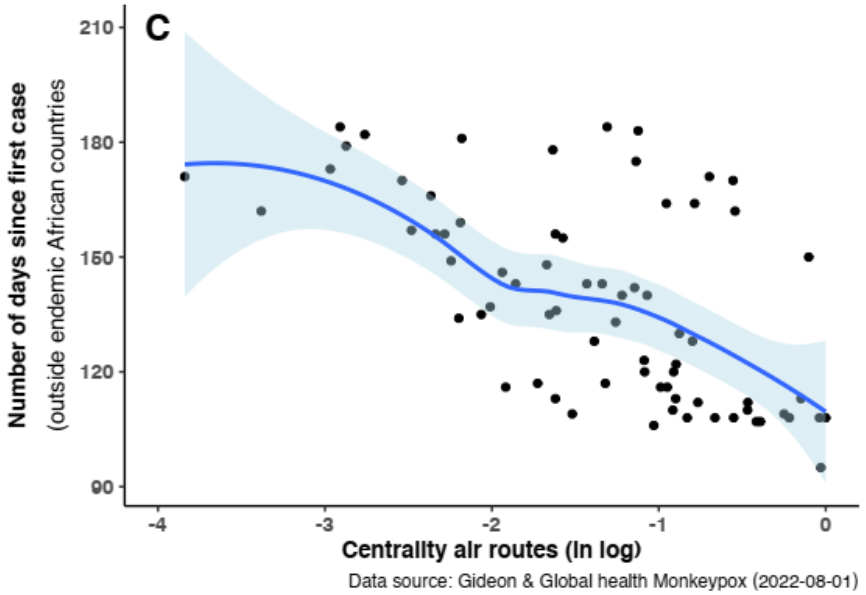
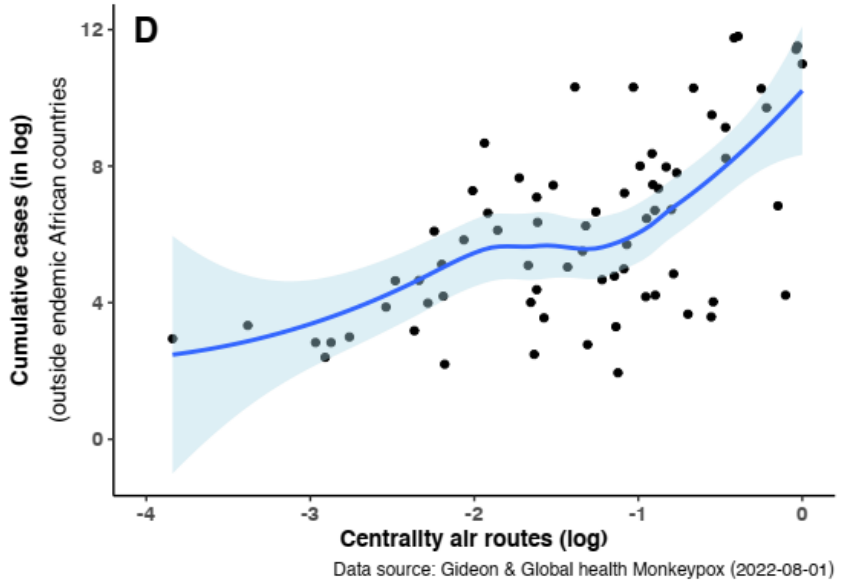


Fig 2. Number of confirmed, probable, and/or possible monkeypox cases between 1970–1979.

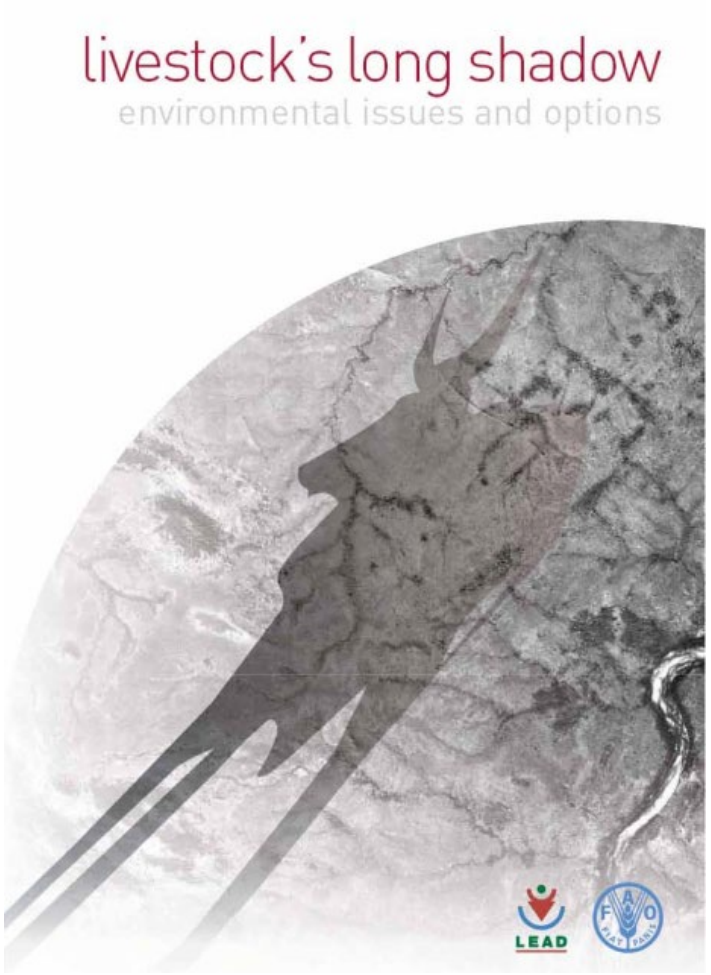




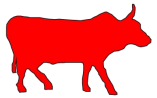
First cases of monkeypox vs centrality in air routes



Number of cases of monkeypox vs centrality in air routes

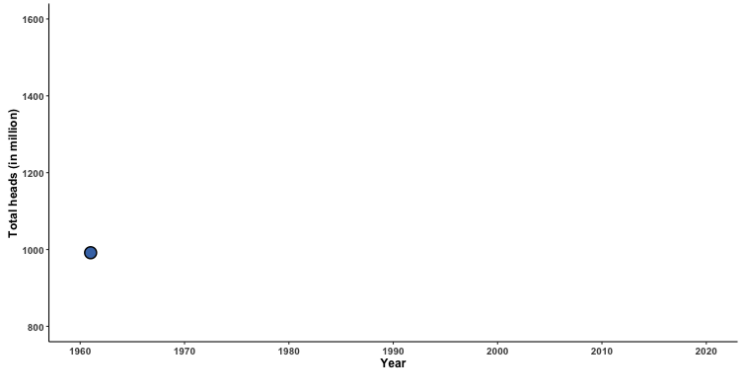


Un élevage en croissance

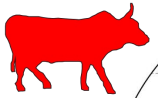


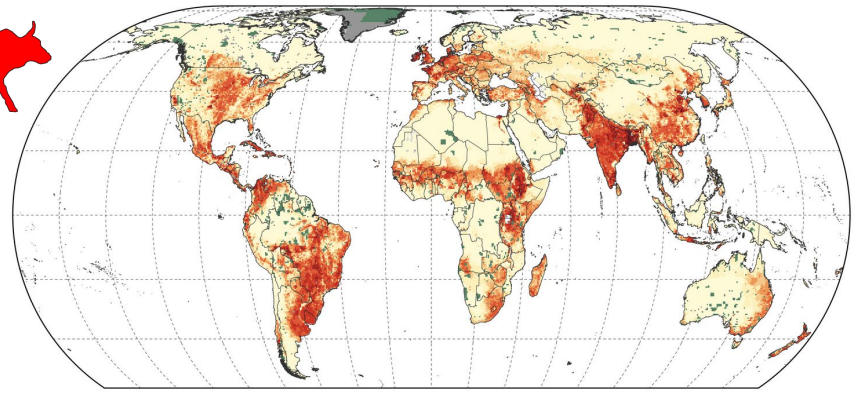
Total heads of cattle (in million)

1960-2020



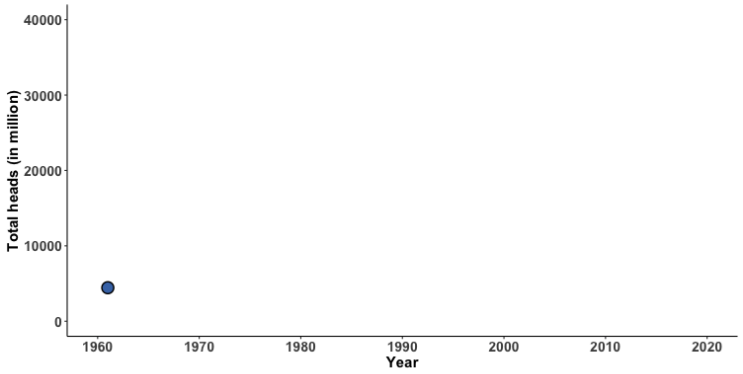
Data source: FAO





Total heads of chickens (in million)

1960-2020



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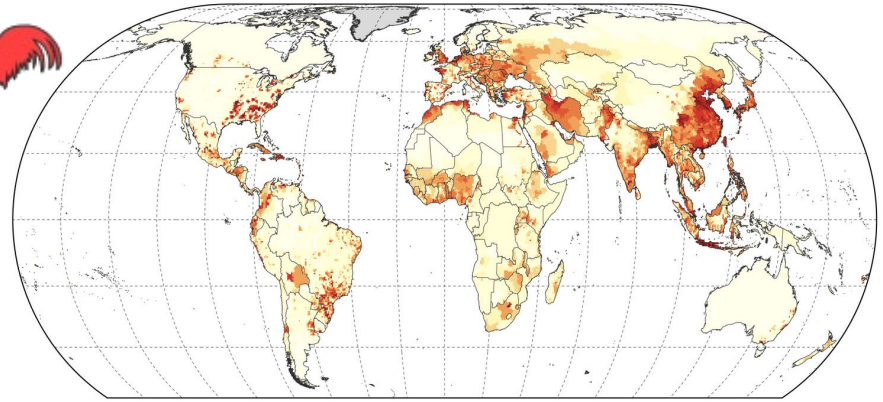
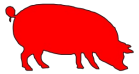
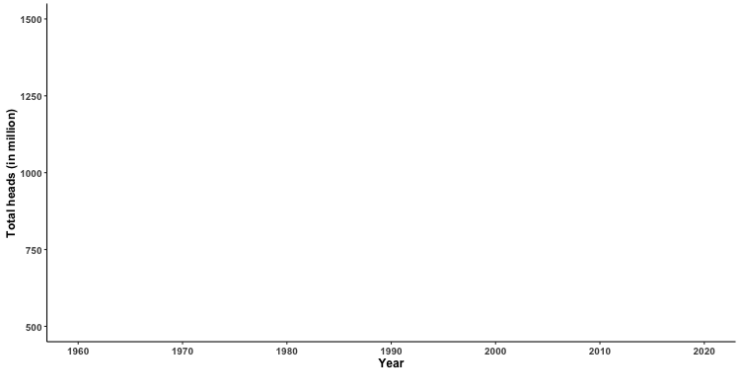




Total heads of pigs (in million)

1960-2020



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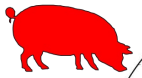
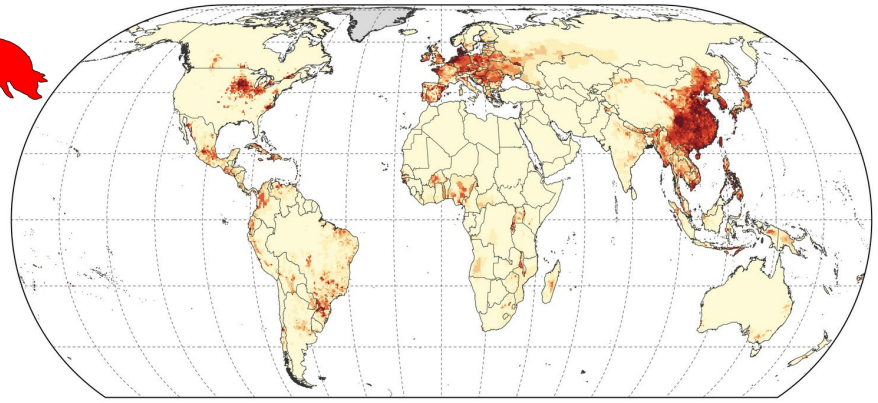
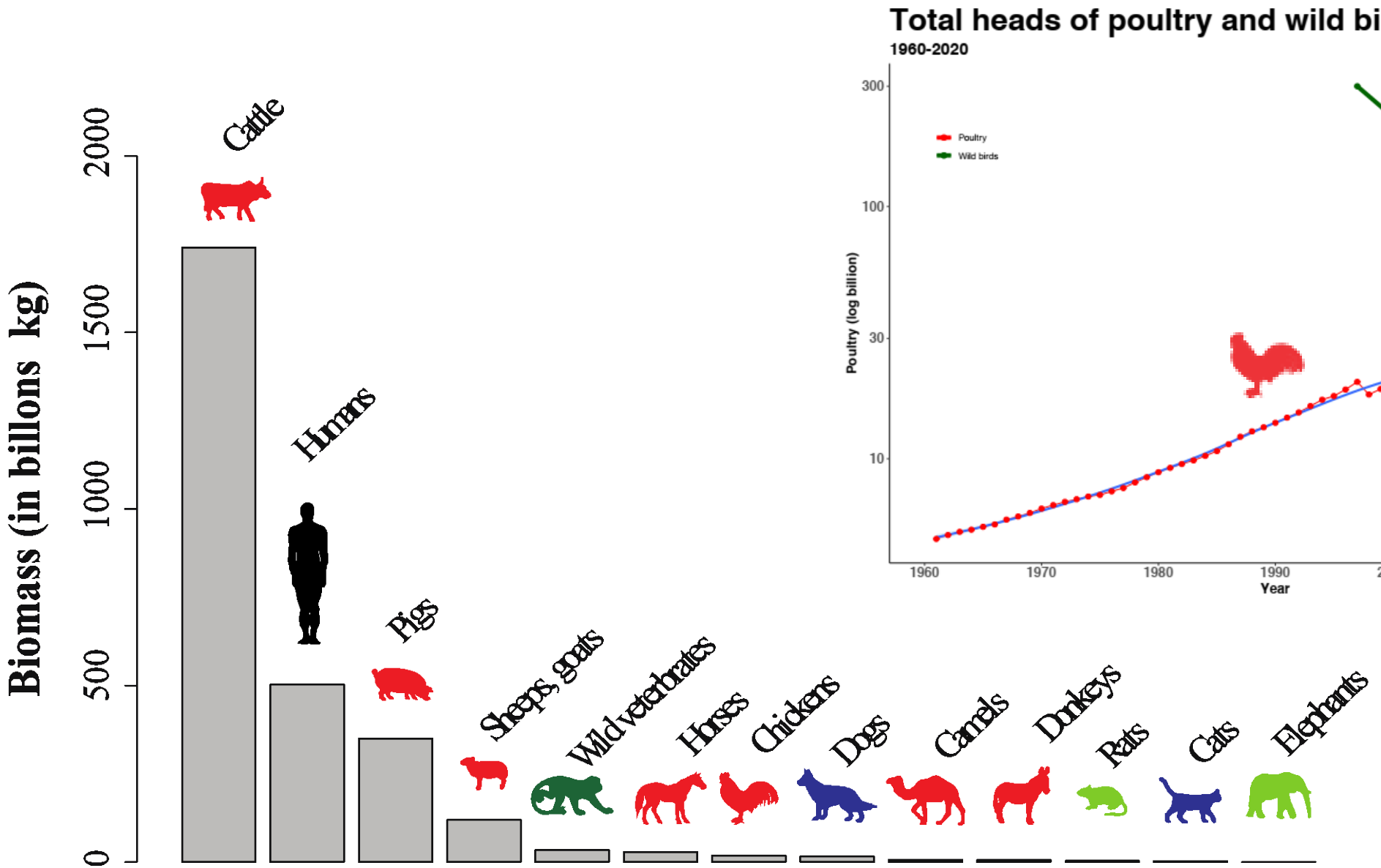
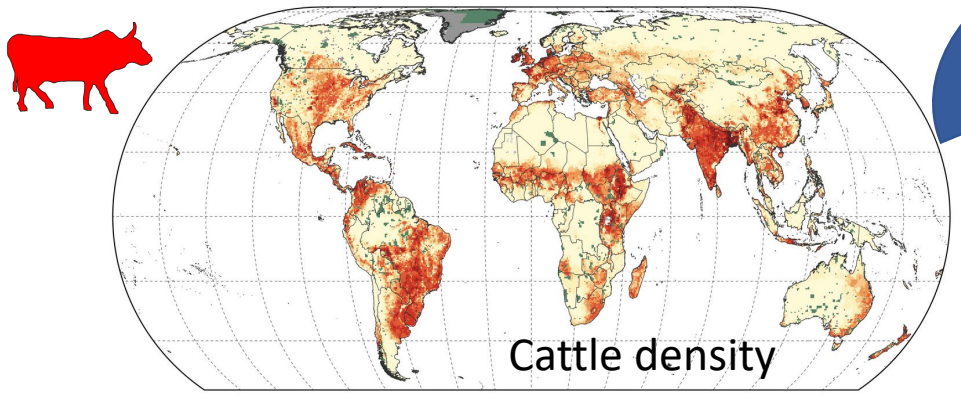


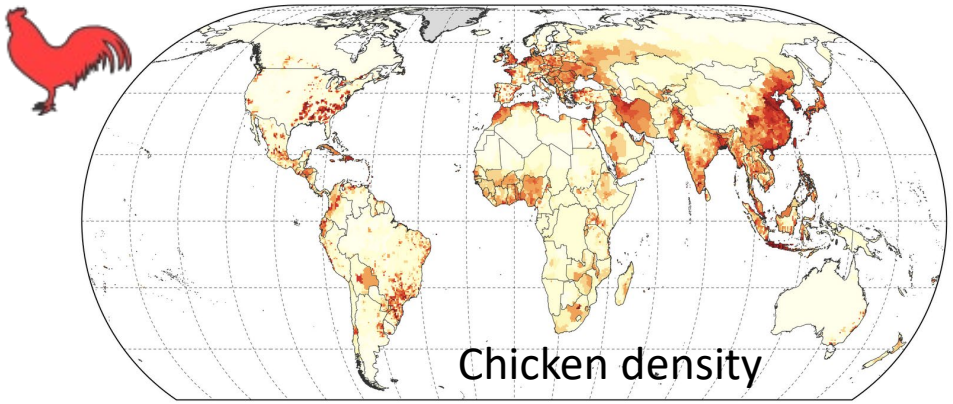


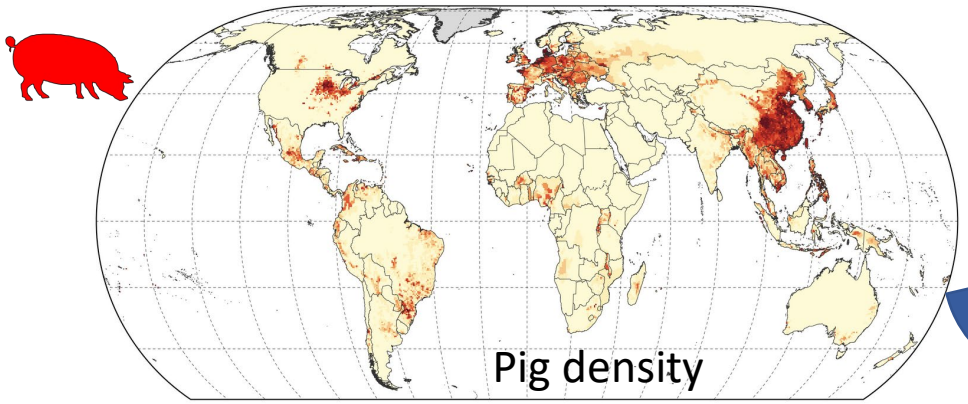
A planet dominated by livestock and poultry



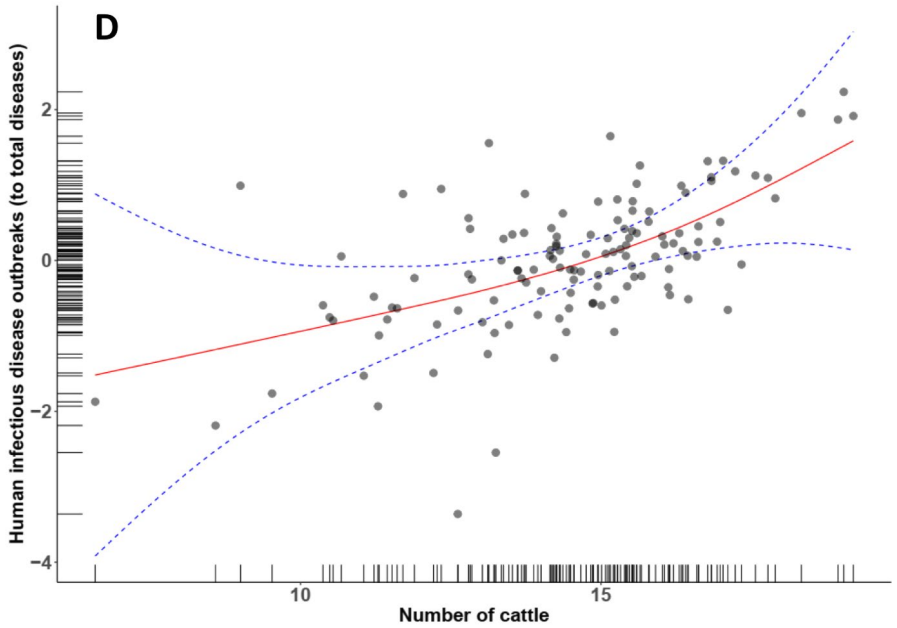
(Morand & Lajaunie, 2017; données de Vaclav Smill, 2002)

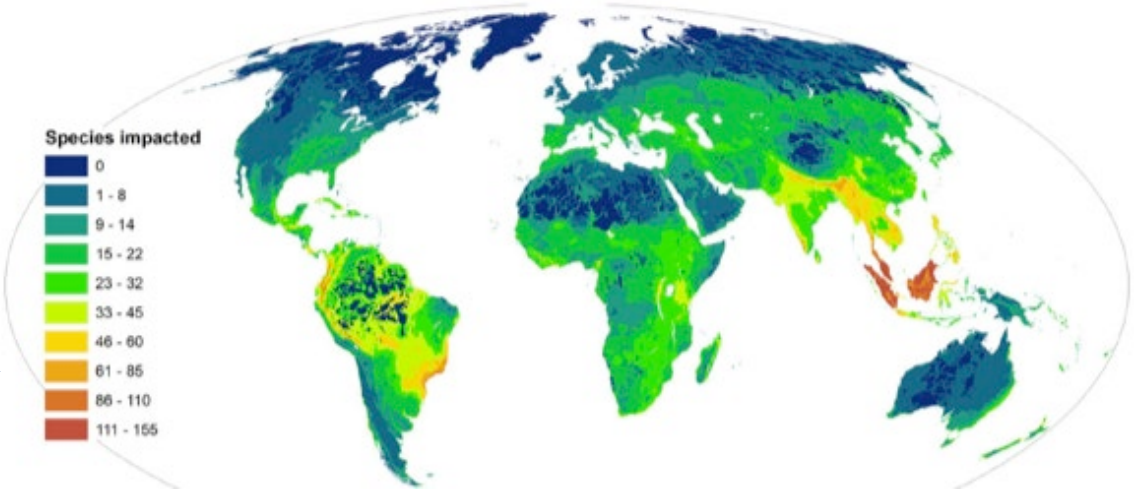






Oubreaks of zoonoses





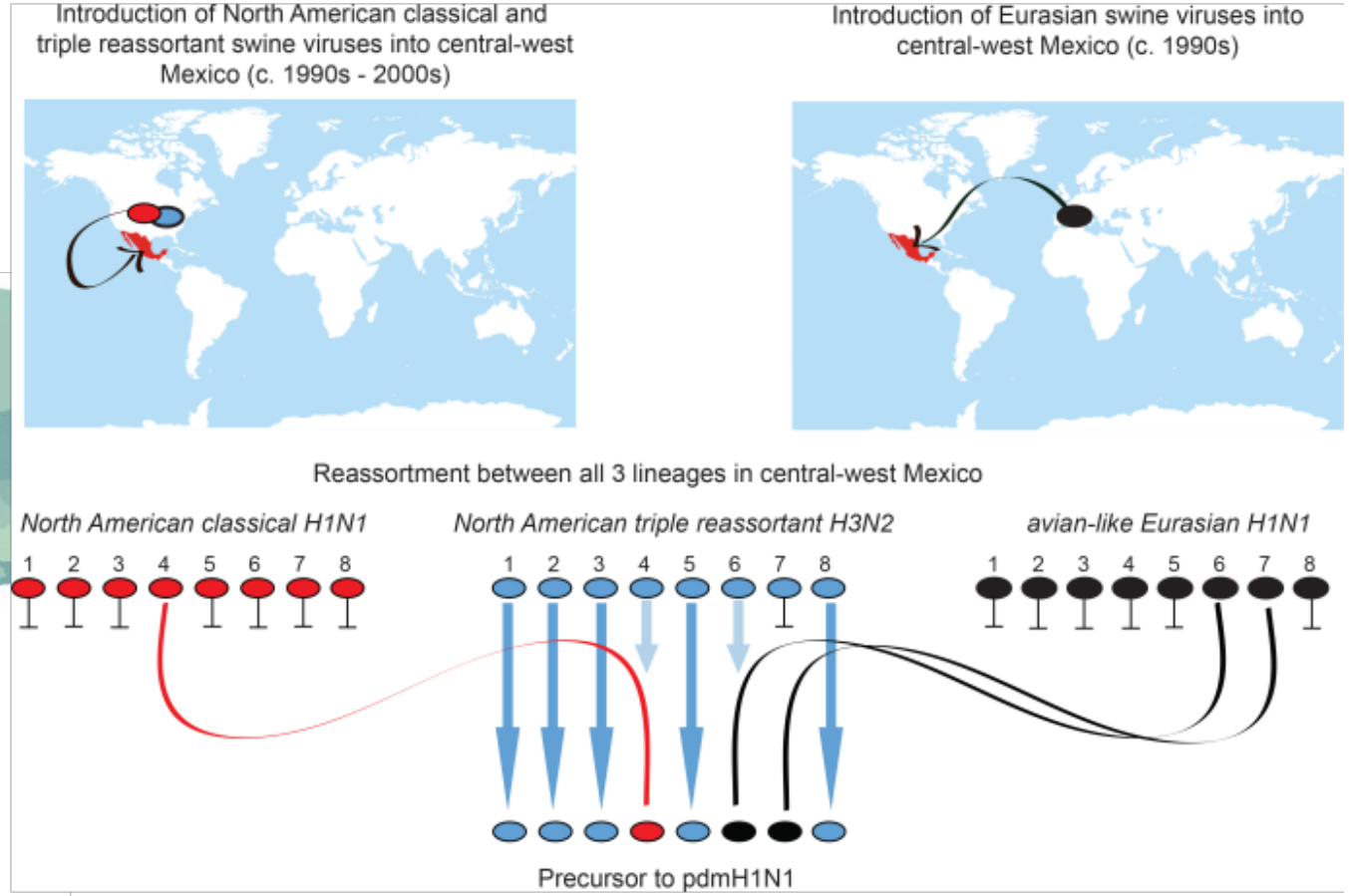
Wild species at threat

The spread of influenza A virus in a globalized word

Origins of the 2009 H1N1 influenza pandemic in swine in Mexico

Ignacio Mena[1,2†], Martha I Nelson[3†], Francisco Quezada-Monroy[4], Jayeeta Dutta[5], Refugio Cortes-Fernández[4], J Horacio Lara-Puente[4], Felipa Castro-Peralta[4], Luis F Cunha[5], Nídia S Trovão[1,2,3,6], Bernardo Lozano-Dubernard[4], Andrew Rambaut[3,7,8], Harm van Bakel[5], Adolfo García-Sastre[1,2,9*]

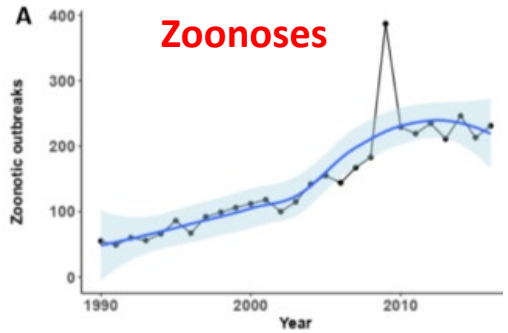
Sources of live swine imports into Mexico

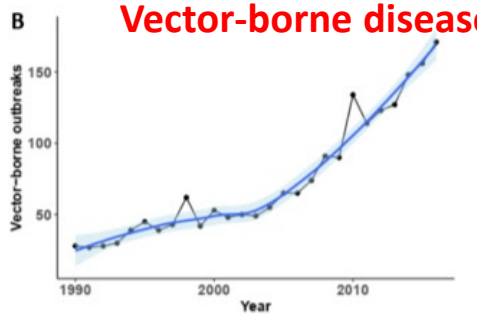


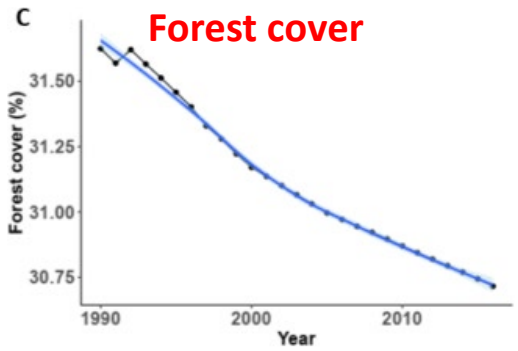
expansion of IAV diversity in swine was resulting from long-distance live swine trade

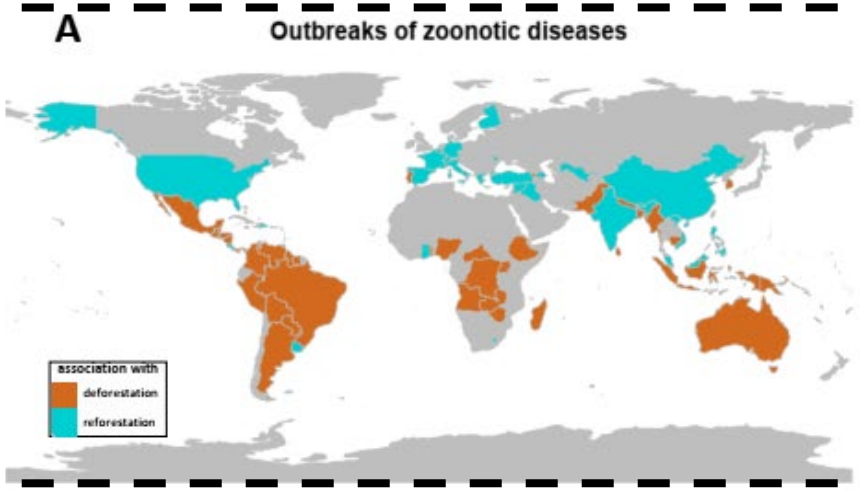
Déforestation et plantations commerciales

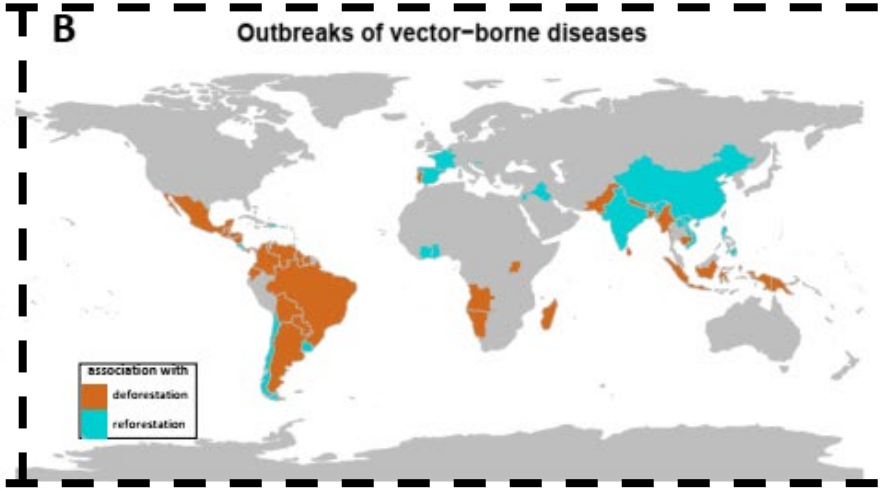
Outbreaks of Vector-Borne and Zoonotic Diseases Are Associated With Changes in Forest Cover and Oil Palm Expansion at Global Scale

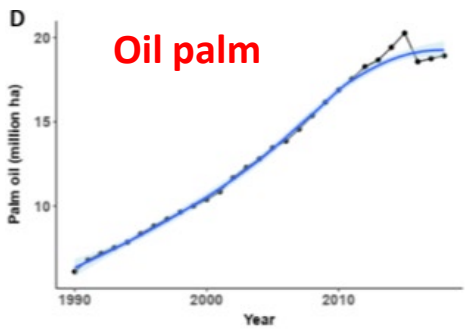


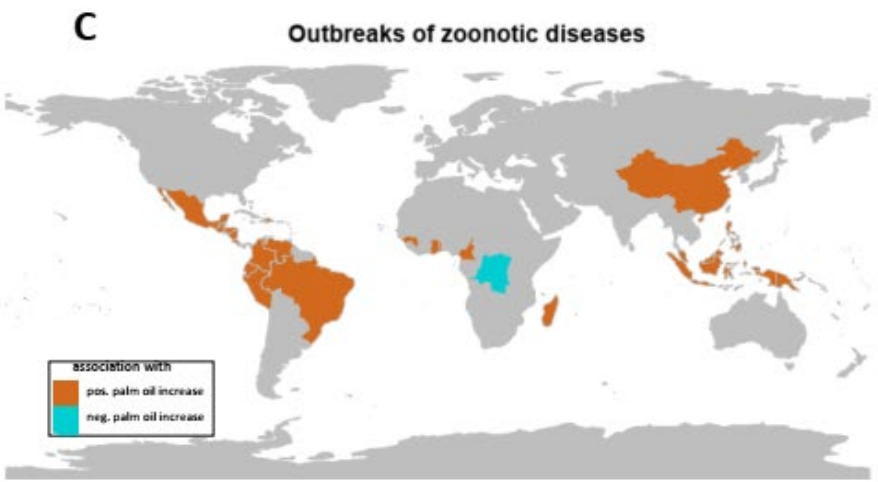


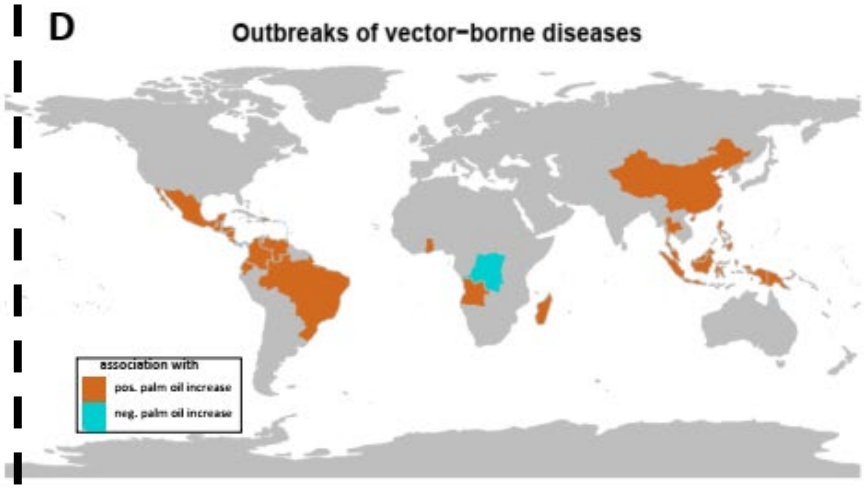




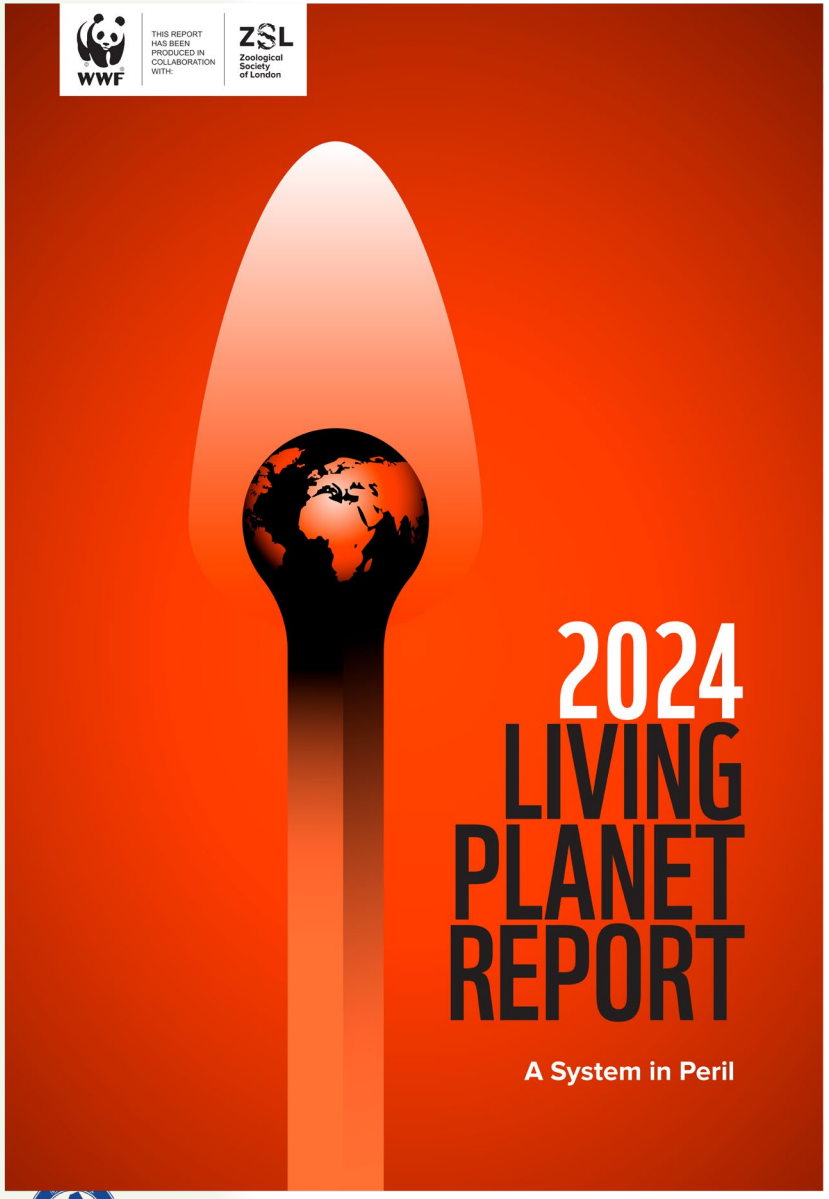








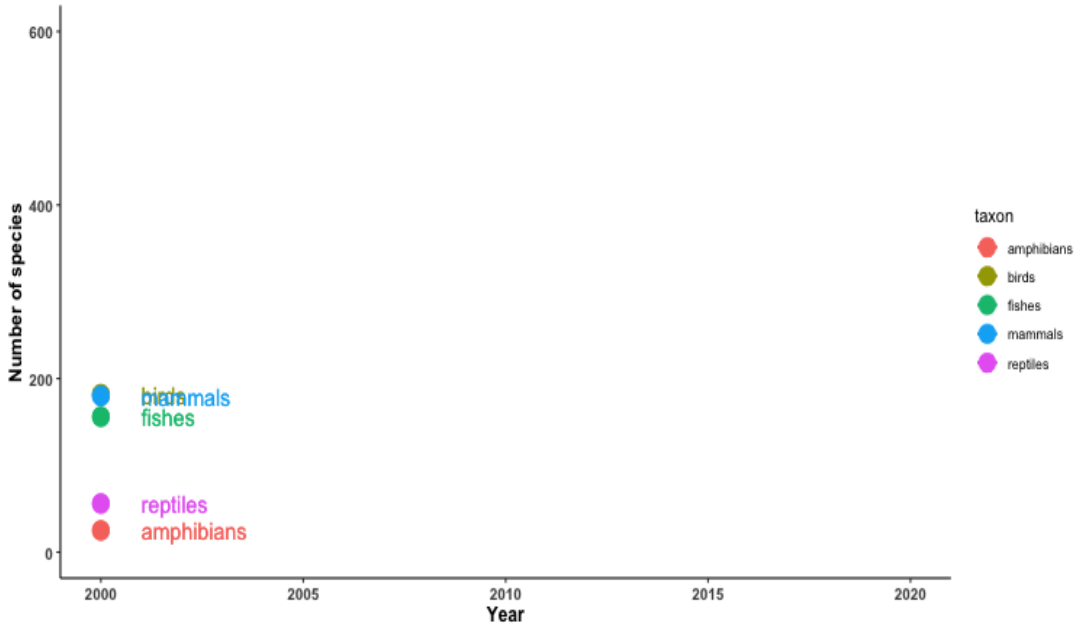
(Morand & Lajaunie 2021)



Biodiversity in crisis

IUCN number of criticially endangred species

2000-2020



Data source: IUCN

THE IUCN RED LIST
OF THREATENED SPECIES™

Living Planet Index

Biodiversity is declining at different rates in different places

The global LPI does not give us the entire picture – there are differences in abundance trends between regions, with the largest declines in tropical areas.

In 2019, the landmark IPBES global assessment on the state of biodiversity divided the world into different geographic regions (Figure 3) in order to complete regular and timely assessments of biodiversity, ecosystem services, their linkages, threats, and the impacts of these at regional and sub-regional levels[1]. Using a smaller spatial scale of regions and sub-regions, rather than a global approach, also allows for a more focused way of monitoring progress towards targets developed under the Convention on Biological Diversity, including the Aichi Biodiversity Targets, Sustainable Development Goals, and National Biodiversity Strategies and Action Plans. In 2020, in order to align with IPBES, regional Living Planet indices have been divided slightly differently to previous years. Following the regional classifications in Figure 3, all terrestrial and freshwater populations within a country were assigned to an IPBES region. In the case of the Americas, this region was further subdivided in two: North America, and Latin America and the Caribbean (Mesoamerica, the Caribbean and South America combined). Trends for each species group are weighted according to how many species are found in each IPBES region. Threats to populations in each region are shown on page 21, and detail behind the trends can be found in the technical supplement.

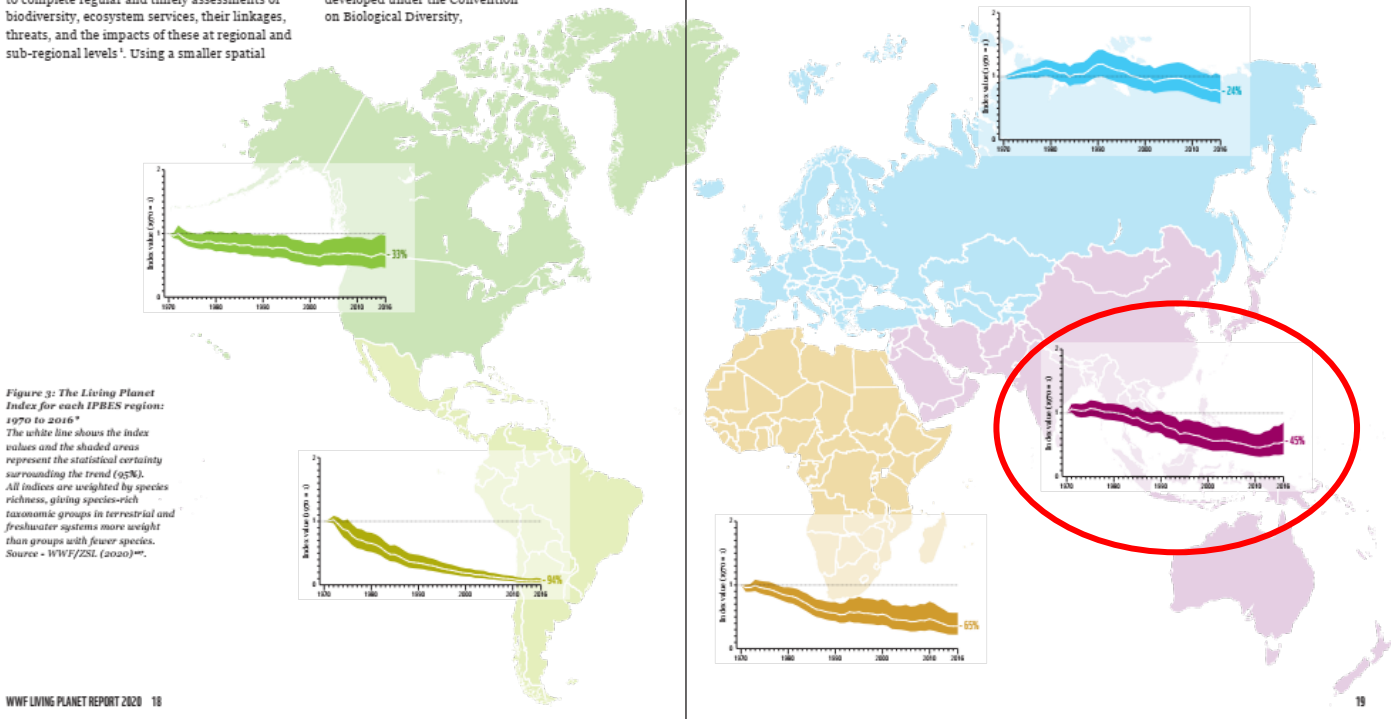
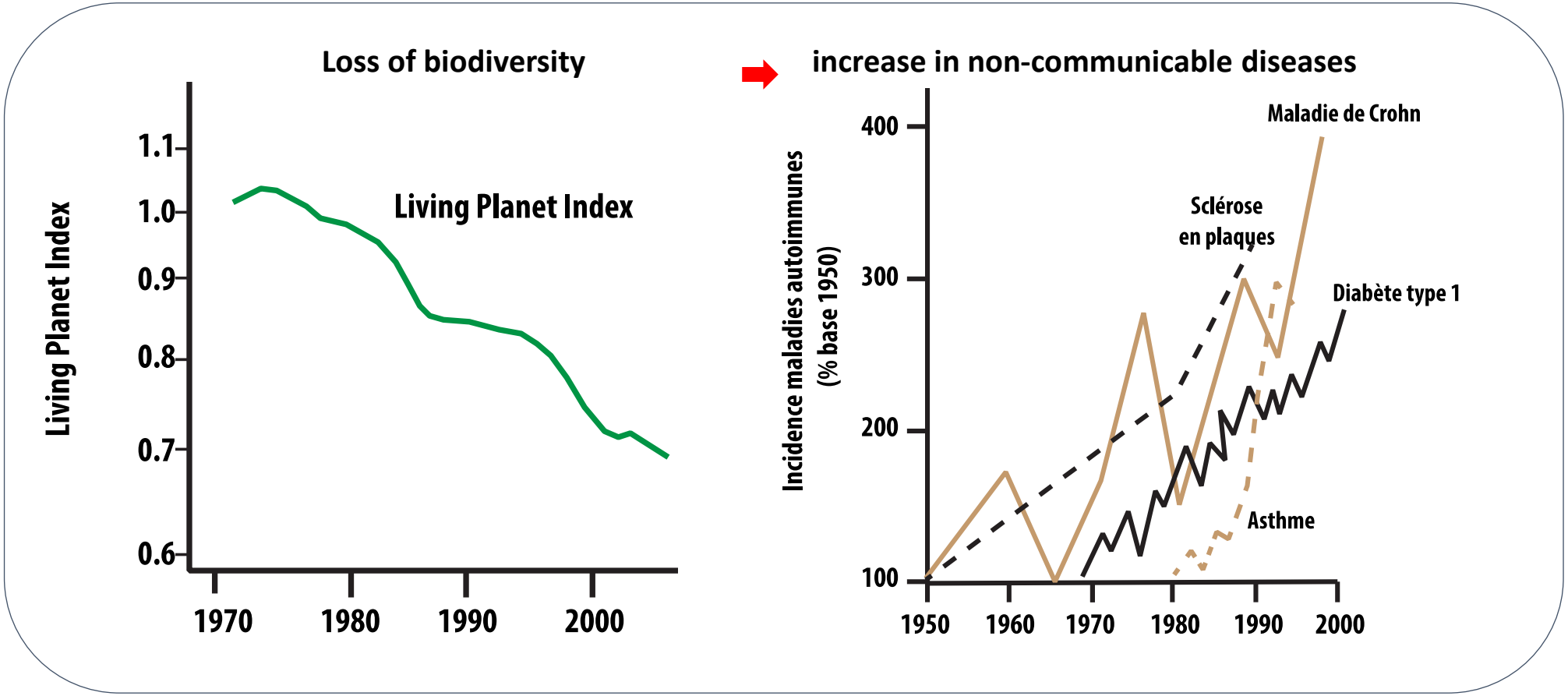


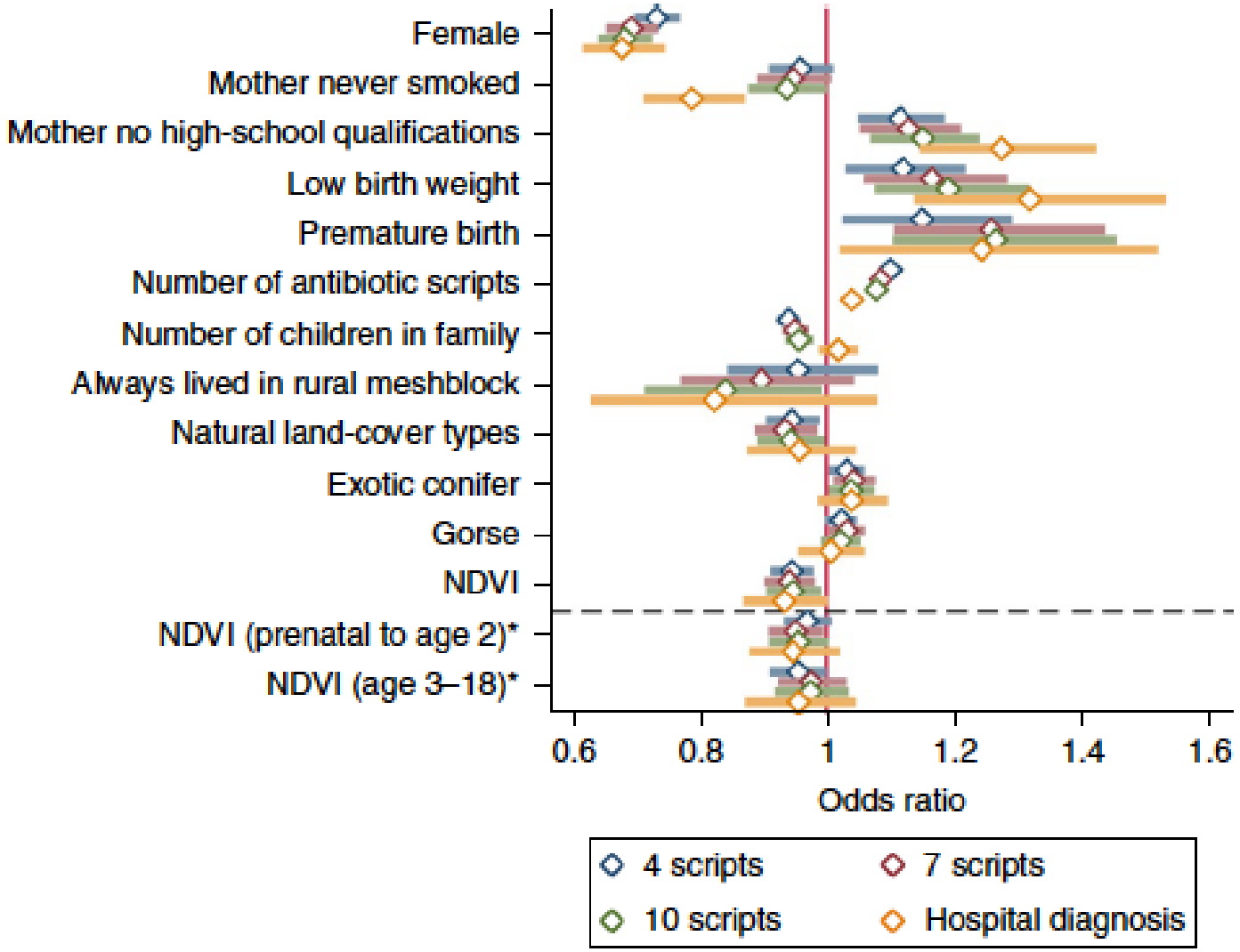
*Figure 3: The Living Planet Index for each IPBES region: 1970 to 2016***
*The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (95%). All indices are weighted by species richness, giving species-rich taxonomic groups in terrestrial and freshwater systems more weight than groups with fewer species. Source - WWF/ZSL (2020)**.*

Biodiversity loss and non-communicable diseases



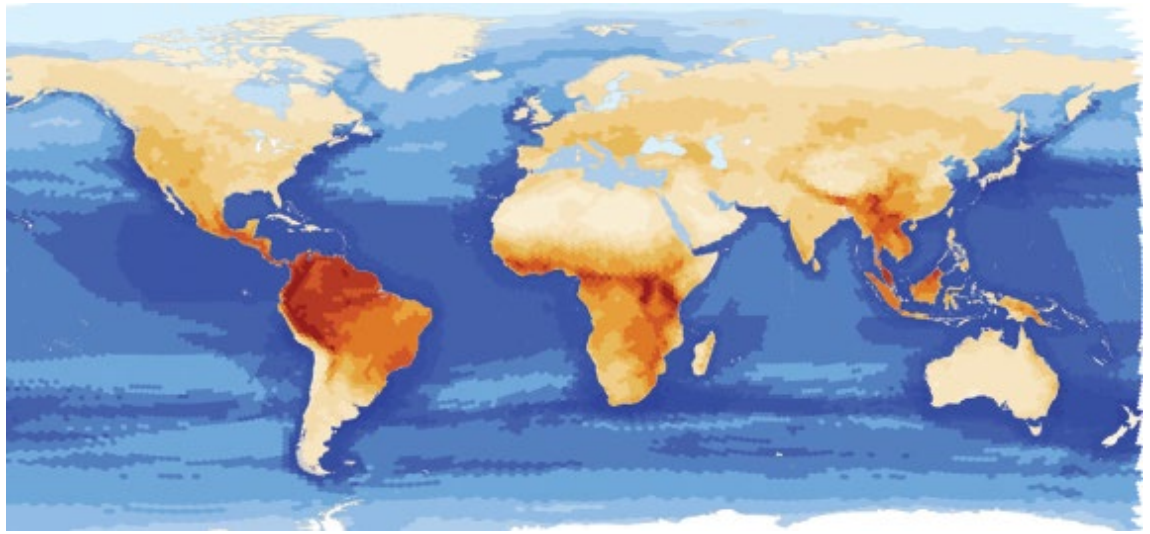
Vegetation diversity protects against childhood asthma: results from a large New Zealand birth cohort

Geoffrey H. Donovan

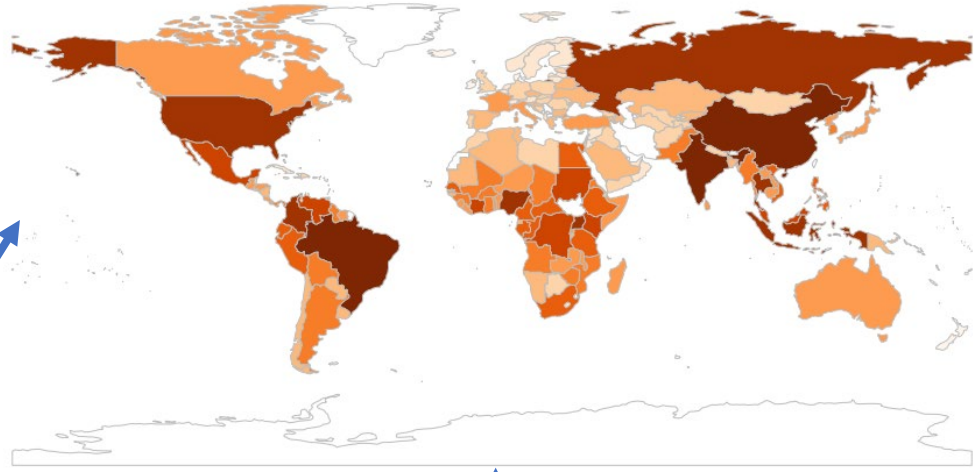


Nature Plant, 2018

Biodiversity
(Mammal species richness)



Known infectious diseases (endemicity)



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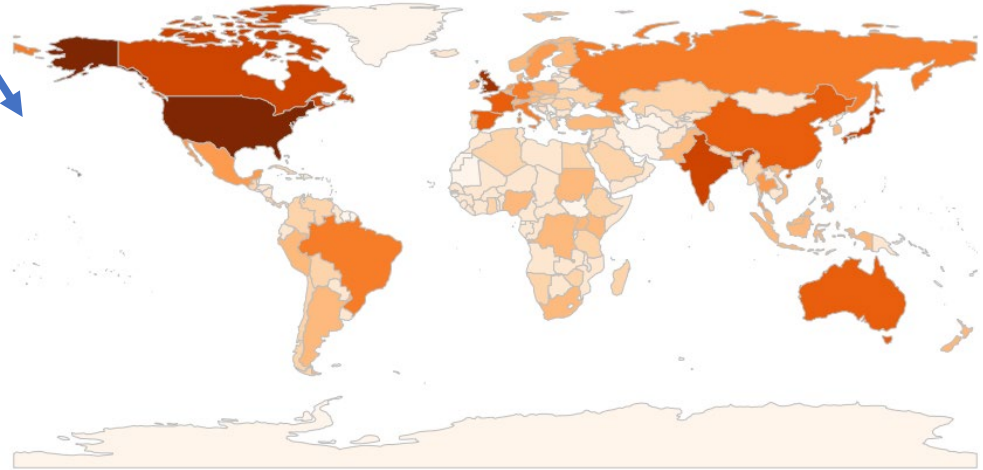
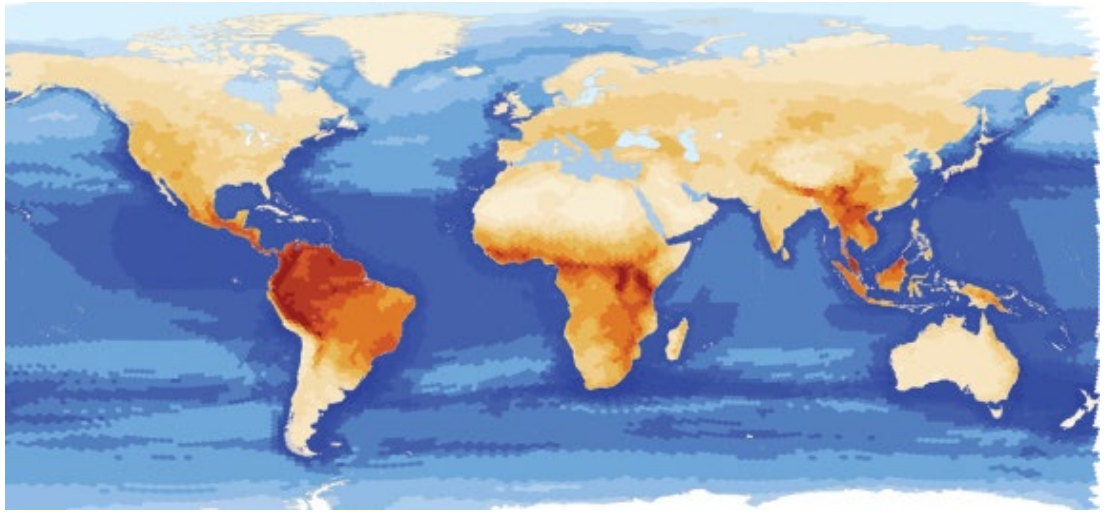
Outbreaks of infectious diseases

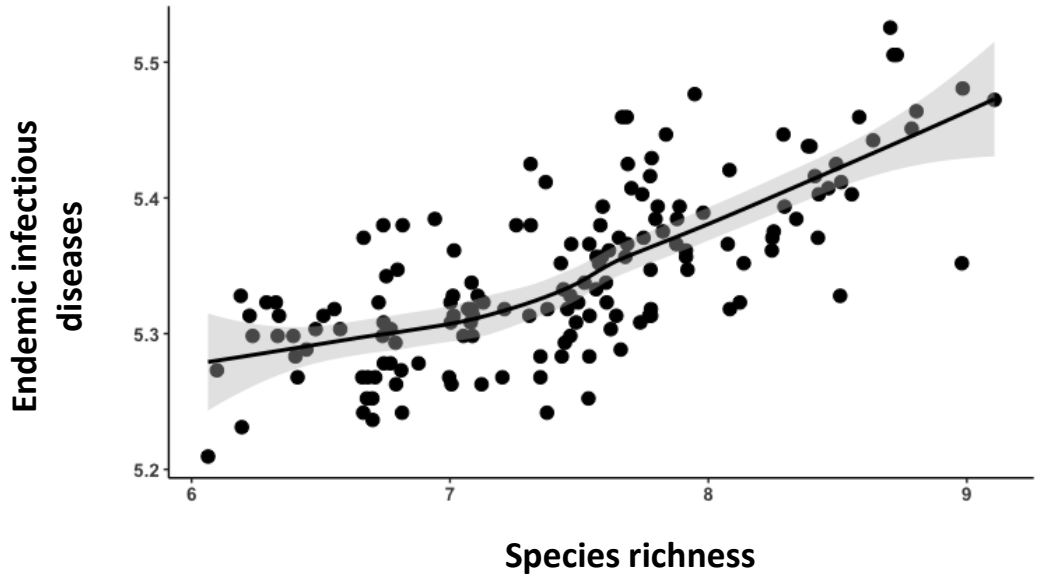


(Schipper et al. Science 2008)

A positive biodiversity – disease richness

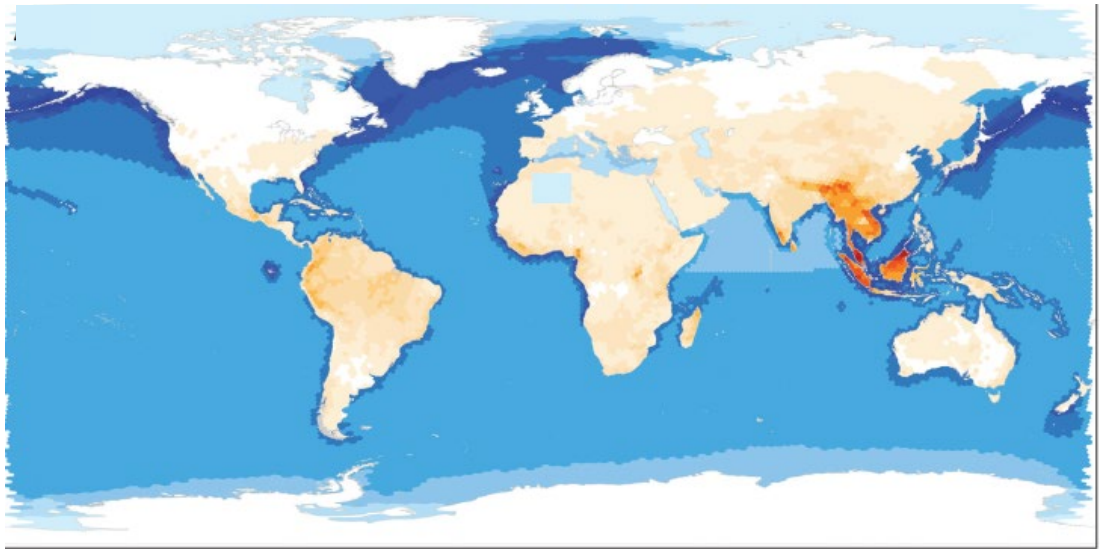
High biodiversity ➡ **High endemicity of infectious diseases**

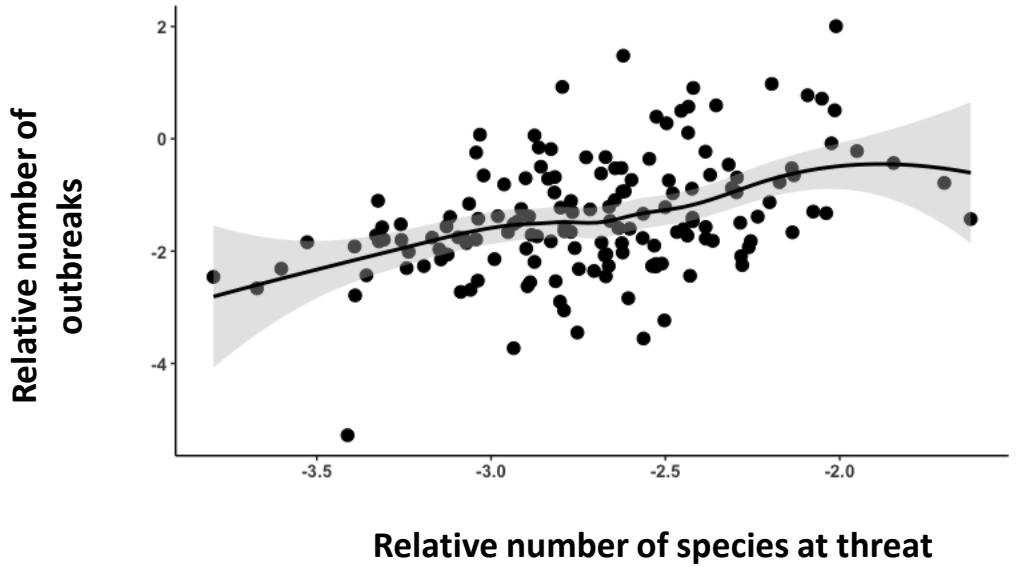


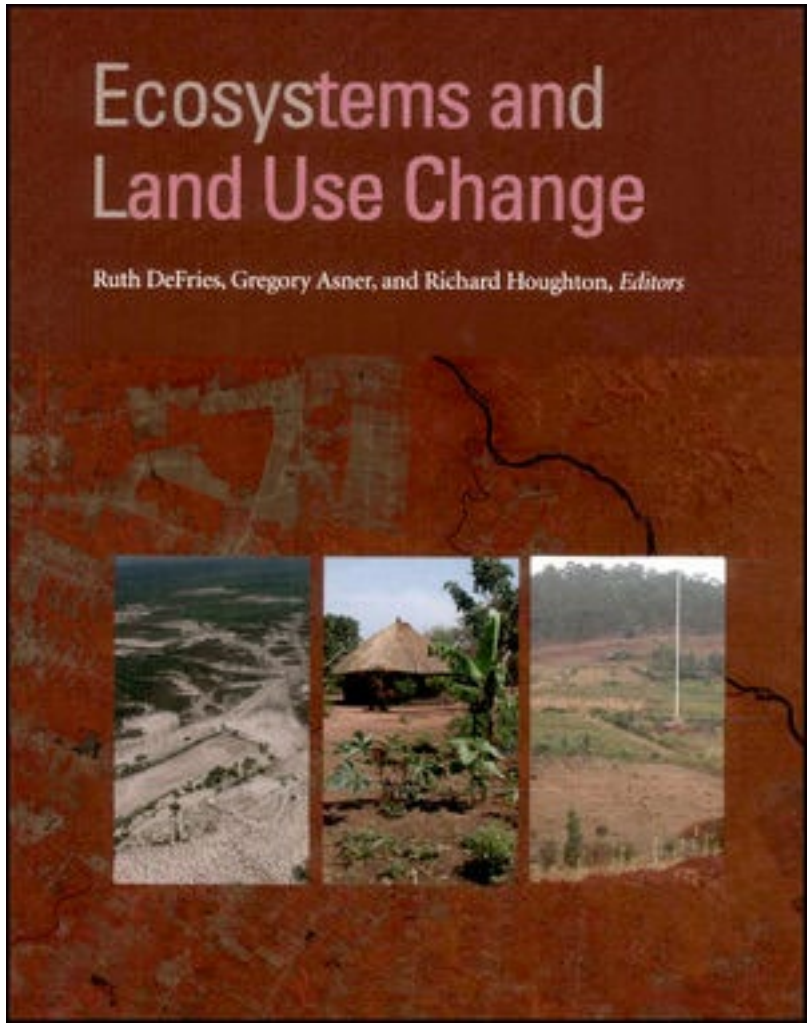


A negative biodiversity – disease transmission

High biodiversity at threat ➡ **Higher number of outbreaks!**

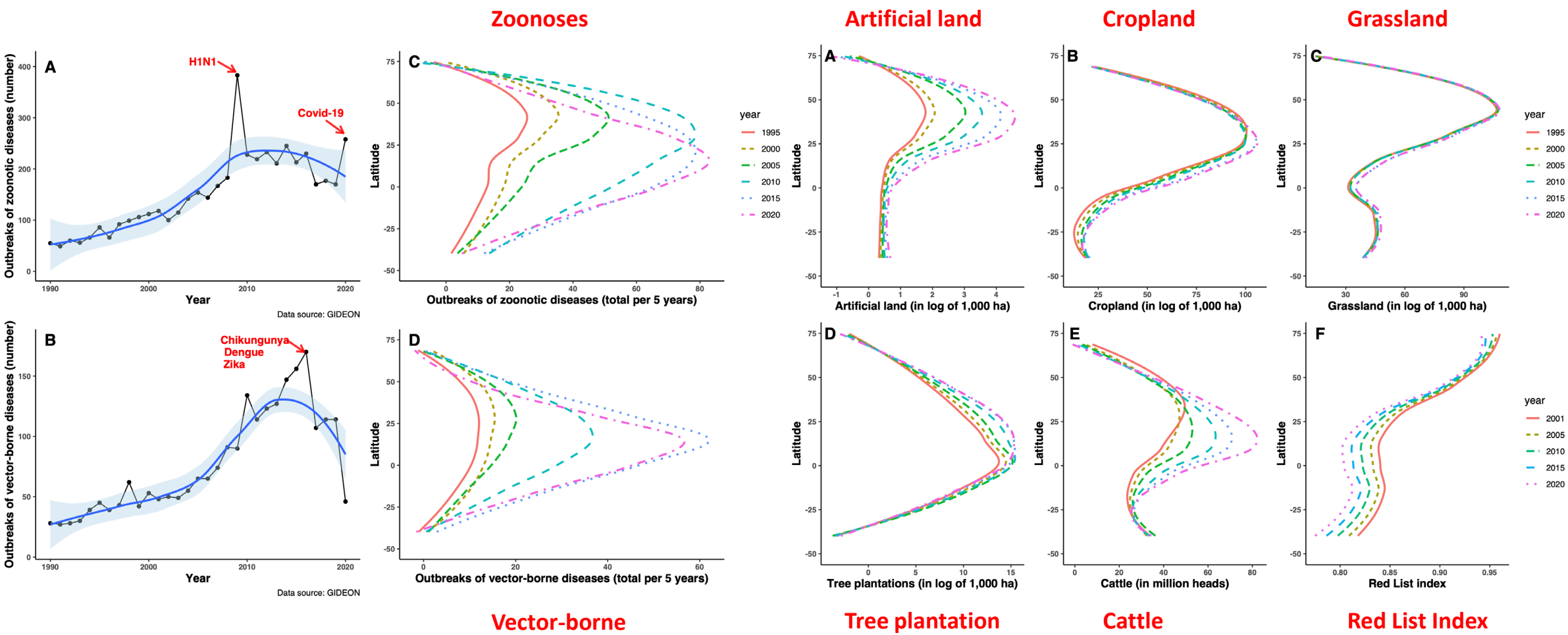




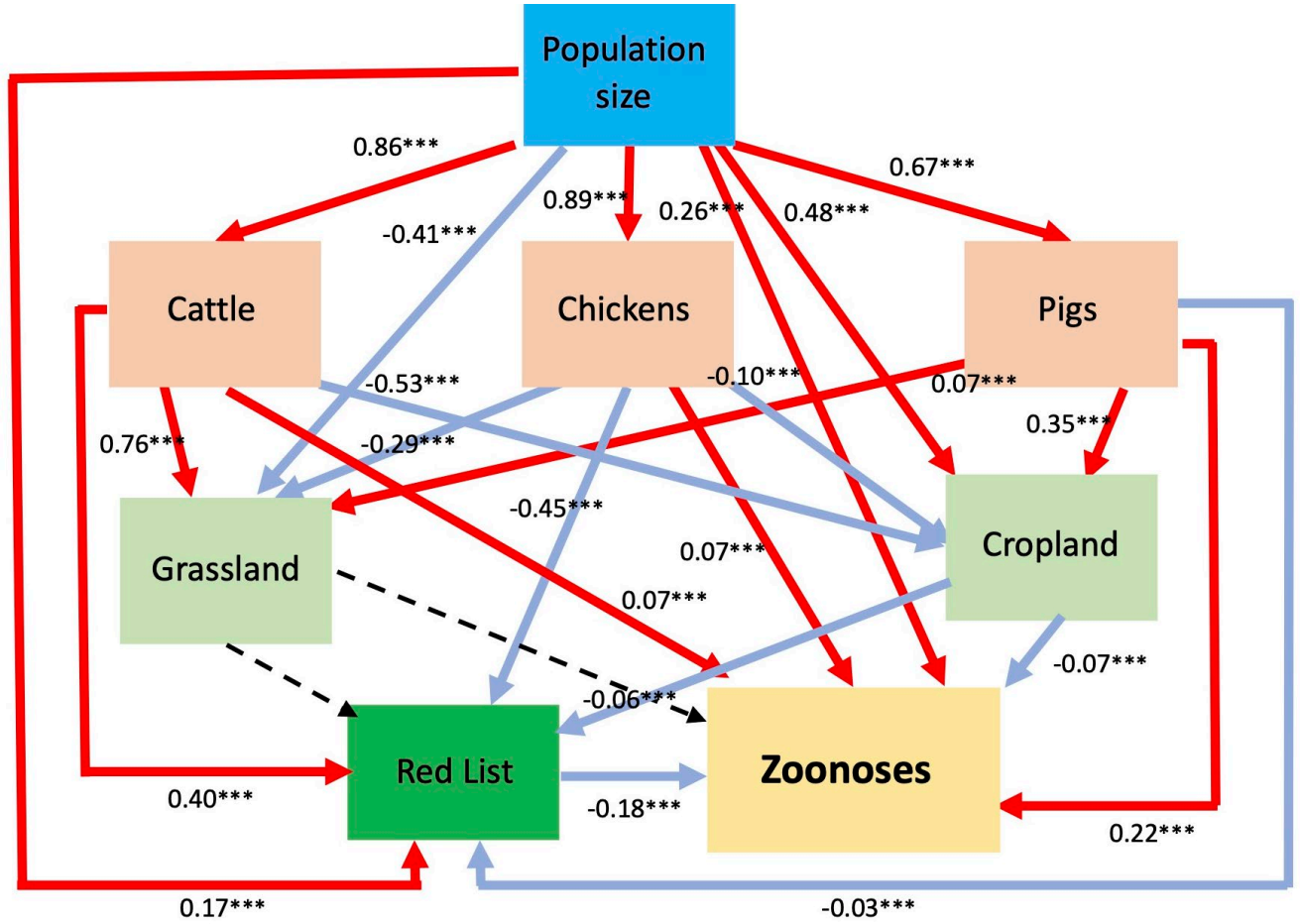


Usage des terres

Latitudinal gradient and change



A synthesis using Structural Equation Modelling



Drivers of outbreaks:

Livestock / Poultry
Biodiversity at threat <- Pigs / chickens / cropland

Mitigation of outbreaks:

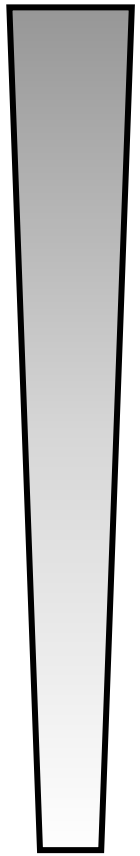
Biodiversity

Grassland

Scaling and connection effects

Global change

Global

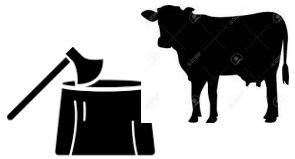


Local

Globalization

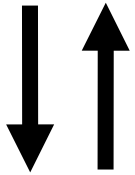
Increasing trade

Land conversion



Biodiversity loss
Deforestation
Agriculture intensification
Livestock expansion
Plantation expansion

mobility



Urbanization

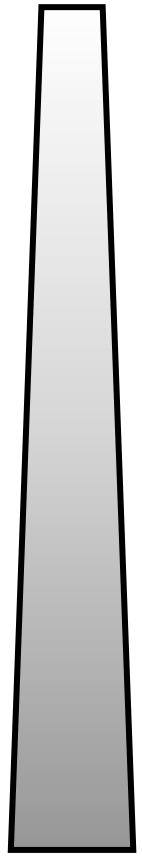
mobility

Infrastructure development

Roads
Dams
Mining

Infectious diseases

Pandemics



Emergence

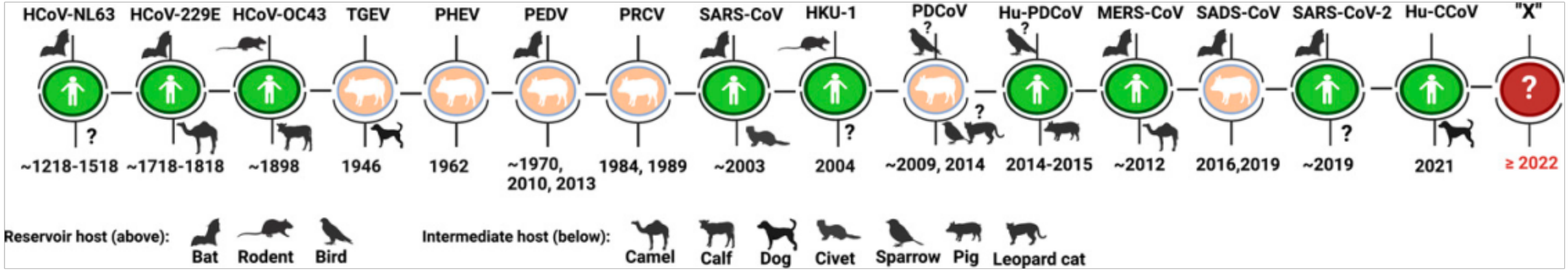
Transmission aux interfaces environnement – faune sauvage – domestique - humains

PNAS PERSPECTIVE OPEN ACCESS

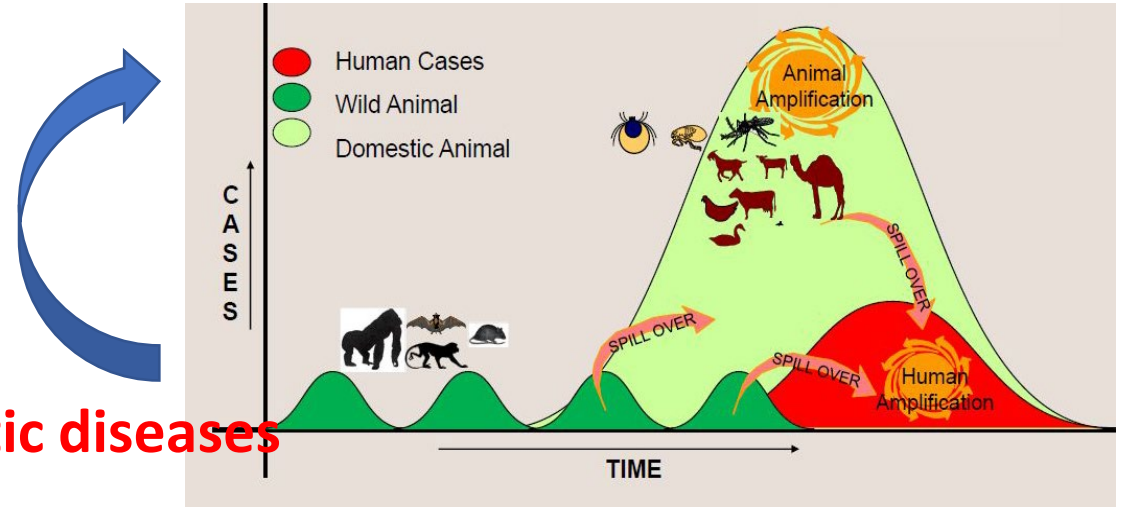
Pandemic origins and a One Health approach to preparedness and prevention: Solutions based on SARS-CoV-2 and other RNA viruses

Gerald T. Keusch[a,1], John H. Amuasi[b,c,d], Danielle E. Anderson[e], Peter Daszak[f], Isabella Eckerle[g,h], Hume Field[f,i], Marion Koopmans[j], Sai Kit Lam[k], Carlos G. Das Neves[l,m], Malik Peiris[n], Stanley Perlman[o], Supaporn Wacharapluesadee[p], Su Yadana[f], and Linda Saif[q,1]

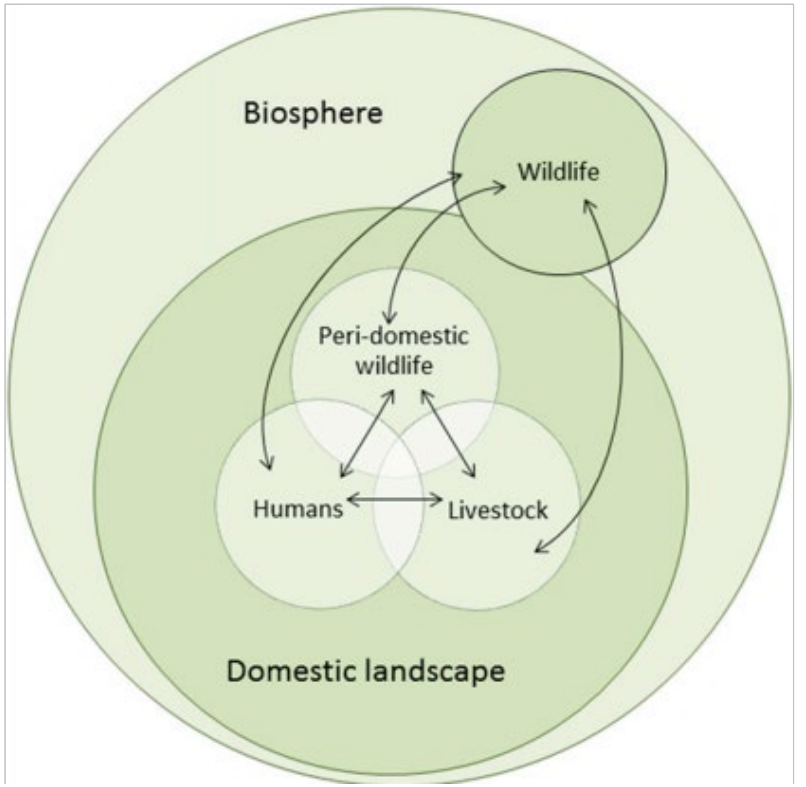
Time line of the emergence of CoVs in people or livestock over the past millennium.



https://doi.org/10.1073/pnas.2202871119



Hot spots of emerging zoonotic diseases



EcoHealth / New York Times 2012

Susceptibility of White-Tailed Deer (*Odocoileus virginianus*) to SARS-CoV-2

Mitchell V. Palmer,[a] Mathias Martins,[b] Shollie Falkenberg,[c] Alexandra Buckley,[d] Leonardo C. Caserta,[b] Patrick K. Mitchell,[b] Eric D. Cassmann,[d] Alicia Rollins,[b] Nancy C. Zylich,[b] Randall W. Renshaw,[b] Cassandra Guarino,[b] Bettina Wagner,[b] Kelly Lager,[d] Diego G. Diel[b]

USDA Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Confirmation of COVID-19 in Deer in Ohio

Food and Agriculture Organization of the United Nations

WORLD ORGANISATION FOR ANIMAL HEALTH

World Health Organization

SARS-CoV-2 in animals used for fur farming

GLEWS+
Risk assessment

20 January 2021

GLEWS+ TRIPARTITE RISK ASSESMENT FOR EMERGING THREATS AT THE ANIMAL, HUMAN, ECOSYSTEM INTERFACE
"GLEWS+" is the Joint FAO–OIE–WHO Global Early Warning System for health threats and emerging risks at the human–animal–ecosystems interface

CORONAVIRUS

Susceptibility of ferrets, cats, dogs, and other domesticated animals to SARS–coronavirus 2

Jianzhong Shi[1]*, Zhiyuan Wen[1]*, Gongxun Zhong[1]*, Huanliang Yang[1]*, Chong Wang[1]*, Baoying Huang[2]*, Renqiang Liu[1], Xijun He[3], Lei Shuai[1], Ziruo Sun[1], Yubo Zhao[1], Peipei Liu[2], Libin Liang[1], Pengfei Cui[1], Jinliang Wang[1], Xianfeng Zhang[3], Yuntao Guan[3], Wenjie Tan[2], Guizhen Wu[2]†, Hualan Chen[1]†, Zhigao Bu[1,3]†

Article

First Description of SARS-CoV-2 Infection in Two Feral American Mink (*Neovison vison*) Caught in the Wild

Jordi Aguiló-Gisbert [1,†], Miguel Padilla-Blanco [2,†], Victor Lizana [1,3], Elisa Maiques [4], Marta Muñoz-Baquero [1], Eva Chillida-Martínez [1], Jesús Cardells [1,3,*] and Consuelo Rubio-Guerri [2,*]

POLICY BRIEF

Accelerating One Heath in Asia and the Pacific

Environment and Development

ESCAP 75
MOVING FORWARD TOGETHER

Science-policy dialogue

One Health High Level Expert Panel (OHHLEP)

In November 2020 at the Paris Peace Forum
FAO, OIE, UNEP and WHO create a multidisciplinary
One Health High-Level Expert Panel (OHHLEP)
*with the support of **France** and **Germany***

Co-chairs

Wanda Markotter

Professor, Centre for Viral Zoonoses, University of Pretoria, South Africa

Learn more ›

Thomas Mettenleiter

President of the Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health, Germany

Learn more ›

Food and Agriculture Organization of the United Nations

WORLD ORGANISATION FOR ANIMAL HEALTH

UN environment programme

World Health Organization

Wiku Bakti Adisasmito ›
Professor in Health Policy, University of Indonesia, Indonesia

Casey Barton-Behravesh ›
Personal capacity, United States of America

Salome Bukachi ›
Associate Professor, Institute of Anthropology, University of Nairobi, Kenya

Natalia Cediel Becerra ›
Lecturer and researcher, Universidad de la Salle Bogotá, Colombia

Janice Ciacci-Zanella ›
Veterinarian researcher in the area of Animal Virology and Director General of Swine and Poultry Research Center, EMBRAPA, Brazil

Osman Dar ›
Consultant in Global Public Health, Public Health England / Director - One Health Project, Chatham House, Royal Institute of International Affairs, United Kingdom of Great Britain and Northern Ireland, Pakistan

Baptiste Dungu ›
Chief Executive Officer, Onderstepoort Biological Products SOC (OBP), South Africa, Democratic Republic of the Congo

George Fu Gao ›
Director-General, Chinese Center for Disease Control and Prevention, People's Republic of China

Margaret Khaitsa ›
Professor of International Veterinary Epidemiology, Mississippi State University, Uganda

Catherine Machalaba ›
Senior Policy Advisor and Senior Scientist, EcoHealth Alliance, United States of America

Serge Morand ›
Director of Research, CNRS, Montpellier University, France

Salama Al Muhairi ›
Director of Veterinary Laboratories Division, Abu Dhabi Agriculture and Food Safety Authority, United Arab Emirates

Pépé Bilivogui ›
Technical Consultant, Project REDISSE (World Bank/OOAS), Guinea

Natalia Casas ›
National Zoonoses Coordinator, Ministry of Health of Argentina, Argentina

Abhishek Chaudhary ›
Assistant Professor, Dept. of Civil Engineering, Indian Institute of Technology (IIT) Kanpur, India

Andrew Alexander Cunningham ›
Deputy Director of Science, Zoological Society of London, United Kingdom of Great Britain and Northern Ireland

Nitish Debnath ›
Team Lead, Fleming Fund Country Grant to Bangladesh, DAI Global, LLC - National Coordinator One Health Bangladesh, Bangladesh

Elmoubasher Farag ›
Senior Infectious Disease Epidemiologist, Head of Communicable Diseases Control Programs, Director-One Health Projects, Qatar Ministry of Public Health (MOPH), Sudan

David Hayman ›
Professor of Infectious Disease Ecology, Massey University, New Zealand

Professor Marion Koopmans ›
Director of the WHO Collaborating Centre for emerging infectious diseases at Erasmus Medical Centre, Netherlands

Professor John S. Mackenzie ›
Emeritus Professor, Curtin University, Perth, Australia

Vyacheslav Smolenskiy ›
Deputy Head, Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing, Russian Federation

Lei Zhou ›
Chief of Branch for Emerging Infectious Disease, China CDC, People's Republic of China

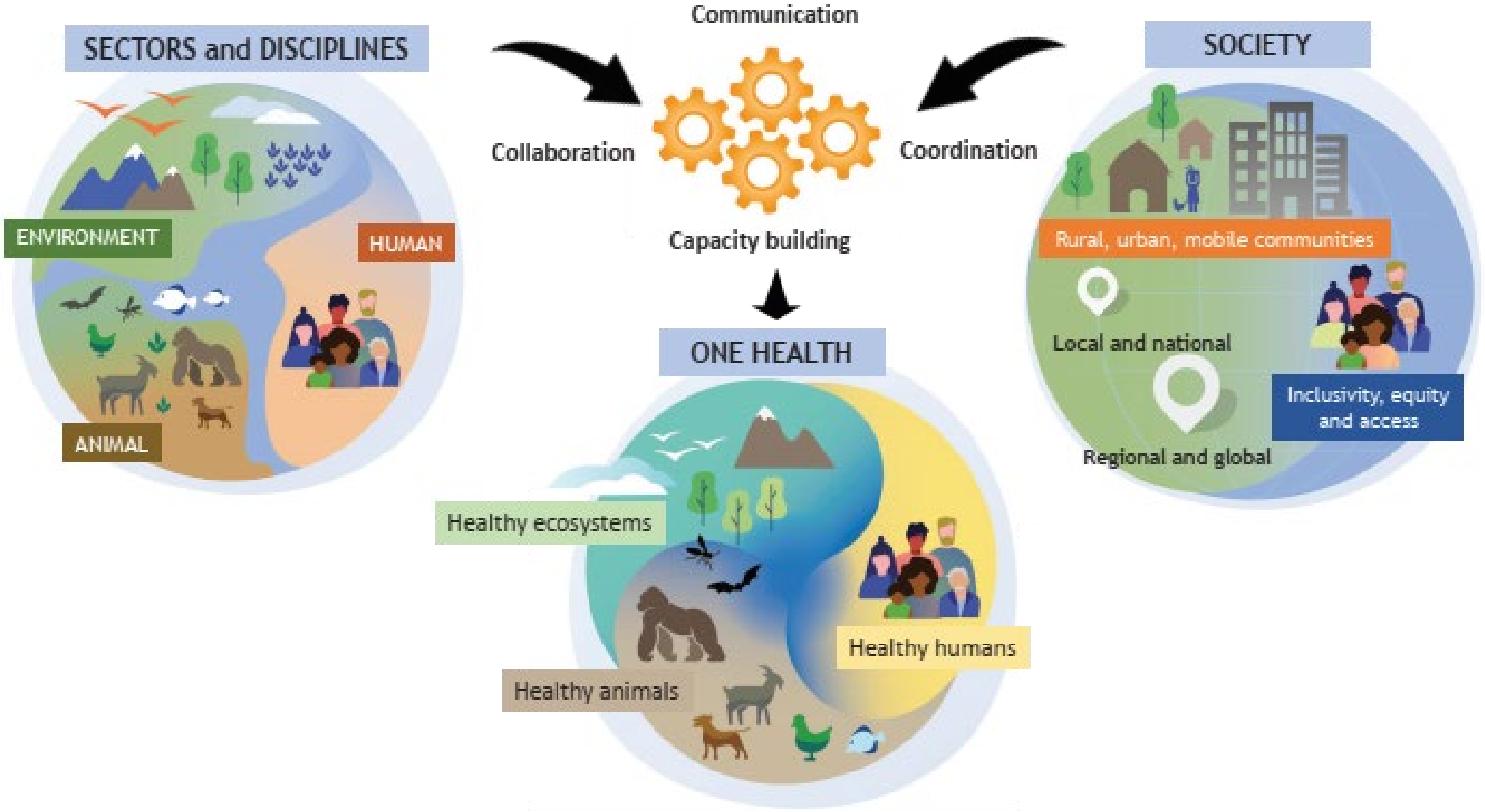
1. A definition of the One Health

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.

One Health High-Level Expert Panel (OHHLEP), (2022) One Health: A new definition for a sustainable and healthy future. PLoS Pathog 18(6): e1010537.


SECTORS and DISCIPLINES
ENVIRONMENT
HUMAN
ANIMAL
Communication
Collaboration
Coordination
Capacity building
SOCIETY
Rural, urban, mobile communities
Local and national
Regional and global
Inclusivity, equity and access
ONE HEALTH
Healthy ecosystems
Healthy humans
Healthy animals

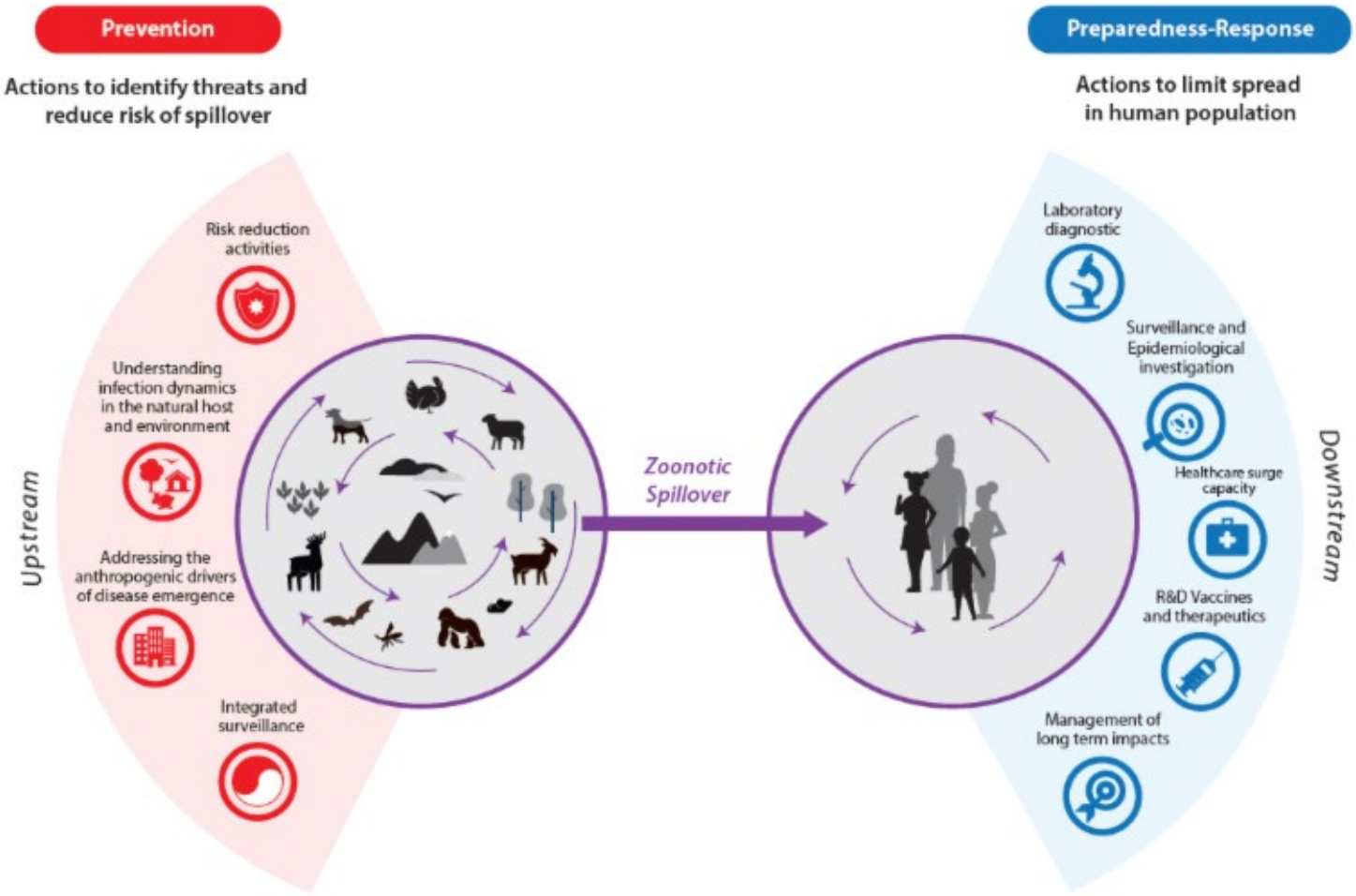
2. A definition of prevention of zoonotic spillover to humans

ONE HEALTH HIGH-LEVEL EXPERT PANEL

PREVENTION OF ZOONOTIC SPILLOVER

FROM RELYING ON RESPONSE TO REDUCING THE RISK AT SOURCE

OHHLEP whitepaper/Opinion piece



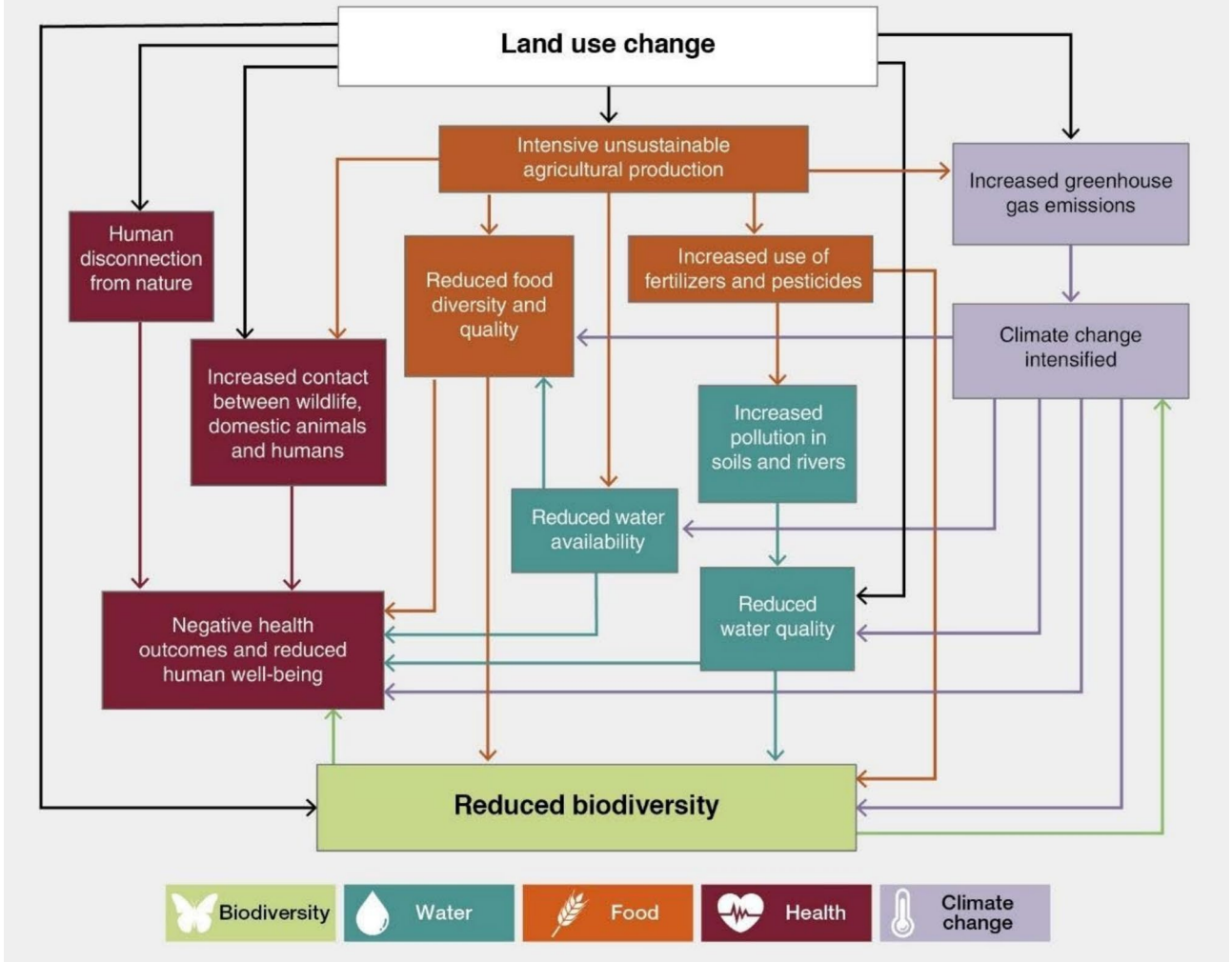
The thematic assessment report on

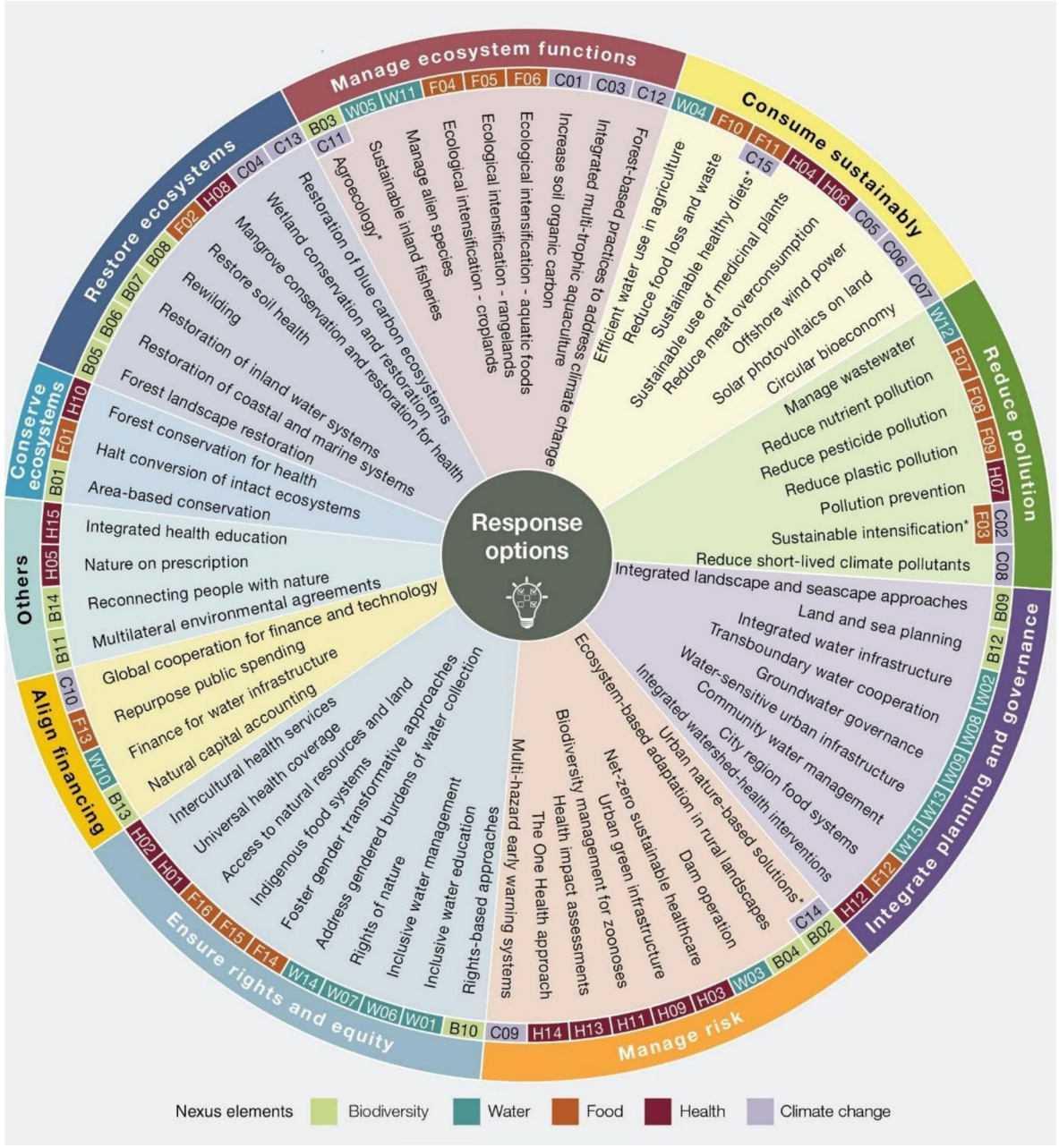
INTERLINKAGES AMONG BIODIVERSITY, WATER, FOOD AND HEALTH

SUMMARY FOR POLICYMAKERS

ipbes

EXAMPLE OF CASCADING NEGATIVE EFFECTS ON NEXUS ELEMENTS





Meilleures options

Planning et gouvernance

Bassins versants, eau et santé

Gestion du risque

Gestion de la biodiversité et zoonoses

L'approche ***One Health***

Evaluation des impacts pour la santé

Infrastructures urbaines vertes

Conservation des écosystèmes

Conservation des forêts pour la santé

Restauration des écosystèmes

Conservation et restauration des mangroves pour la santé

Merci !

HealthDEEP
HEALTH, DISEASE ECOLOGY, ENVIRONMENT AND POLICY
INTERNATIONAL RESEARCH LABORATORY
CNRS - KASETSART UNIVERSITY -MAHIDOL UNIVERSITY

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