

La biodiversité : une alliée dans la prévention de certaines maladies infectieuses ?

Santé, Biodiversité, “One Health”

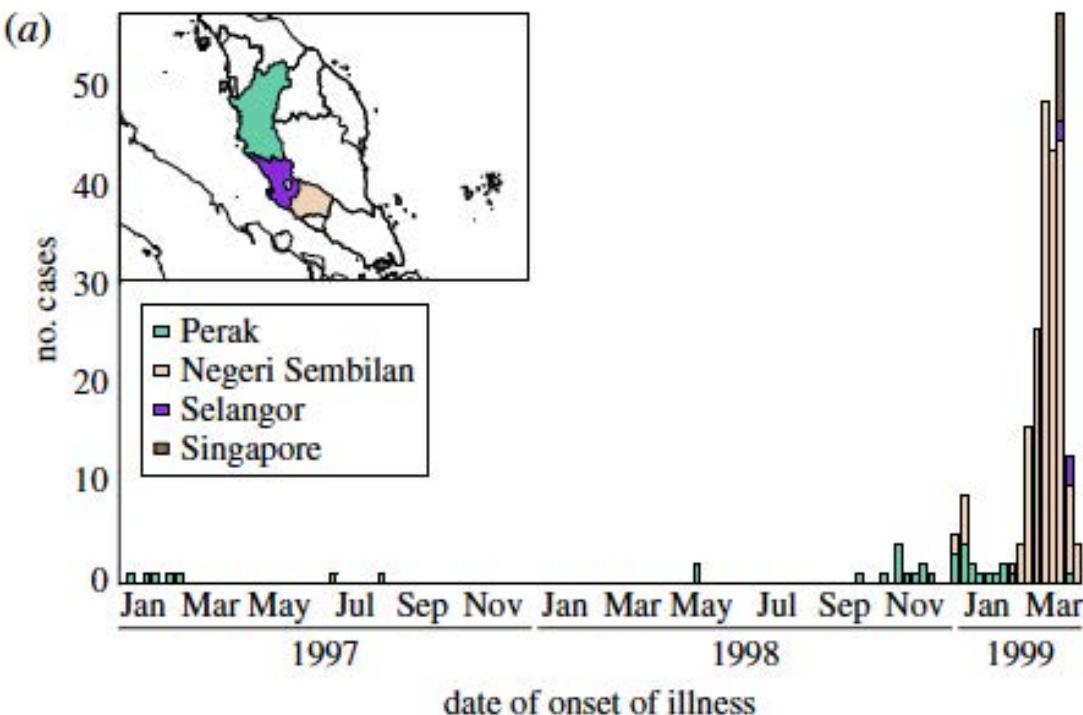
Serge Morand

serge.morand@cirad.fr
serge.morand@umontpellier.fr

Une histoire de cochons de chauves-souris et d'humains

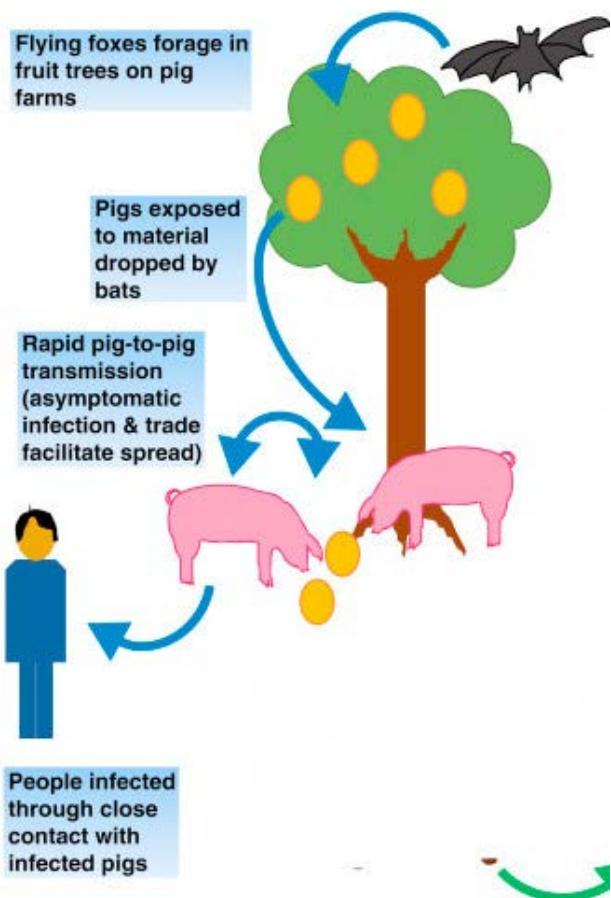
Agricultural intensification, priming for persistence and the emergence of Nipah virus: a lethal bat-borne zoonosis

Juliet R. C. Pulliam^{1,2,†}, Jonathan H. Epstein³, Jonathan Dushoff^{1,‡},
Sohayati A. Rahman^{4,5,§}, Michel Bunning⁶, Aziz A. Jamaluddin⁷,
Alex D. Hyatt⁸, Hume E. Field⁹, Andrew P. Dobson¹,
Peter Daszak^{3,*} and the Henipavirus Ecology Research
Group (HERG)^{3,¶}



La crise sanitaire s'est traduite par :

- Le décès de 105 personnes sur les 265 infectés
- Plus d'un million de cochons abattus



Conversion des forêts en plantations de palmiers à huile (Borneo)

Mouvements des chauve-souris

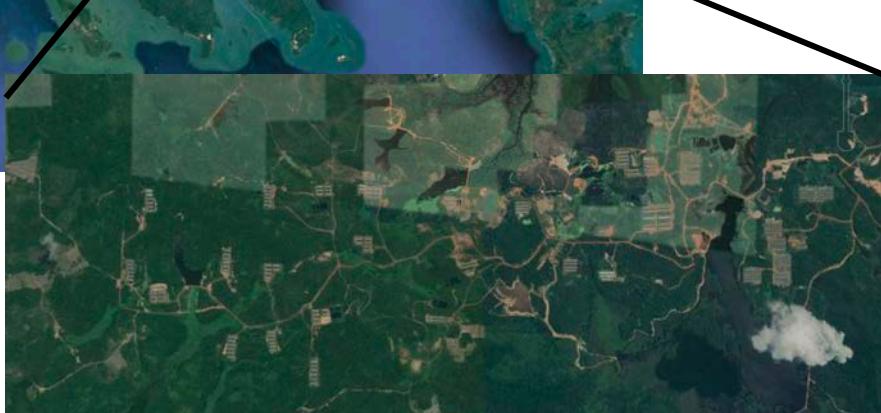
Fermes porcines en Malaisie pour le marché régional (Singapour)

La réponse biosécuritaire : L'île de Bulan

We set you thinking
TODAY
MONDAY 11 FEBRUARY 2019

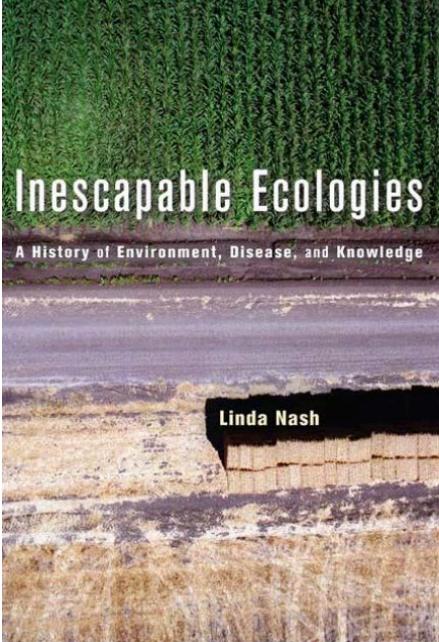
Watching from farm to fork: Keeping food in Singapore safe in the global era

By VICTOR LOH



PT Indo Tirta Suaka filiale du groupe Salim

A la recherche des racines du “One Health”



Thomas Logan, un docteur de la « Nouvelle Frontière » californienne écrit en 1859 :

*.... La meilleure manière d'atteindre la connaissance de l'étiologie des maladies consiste à étudier les **affections de différentes localités en relation avec toutes les conditions et circonstances propres à agir de manière préjudiciable ou non sur la santé des habitants**. Une telle investigation philosophique est particulièrement utile pour retracer les modifications que les maladies peuvent subir du fait de causes locales ou spéciales; et est également conçu pour élucider les **relations des maladies avec le climat, les formations géologiques dominantes, la faune, les végétaux, les minéraux, l'eau, qui varient en fonction de la surface terrestre ...** »*

(Thomas Logan, *Transactions of the American Medical Association*, 1859, Cited in Nash, 2006)

Des racines coloniales

SCIENCE IN AFRICA

A REVIEW OF SCIENTIFIC RESEARCH RELATING
TO TROPICAL AND SOUTHERN AFRICA

BY

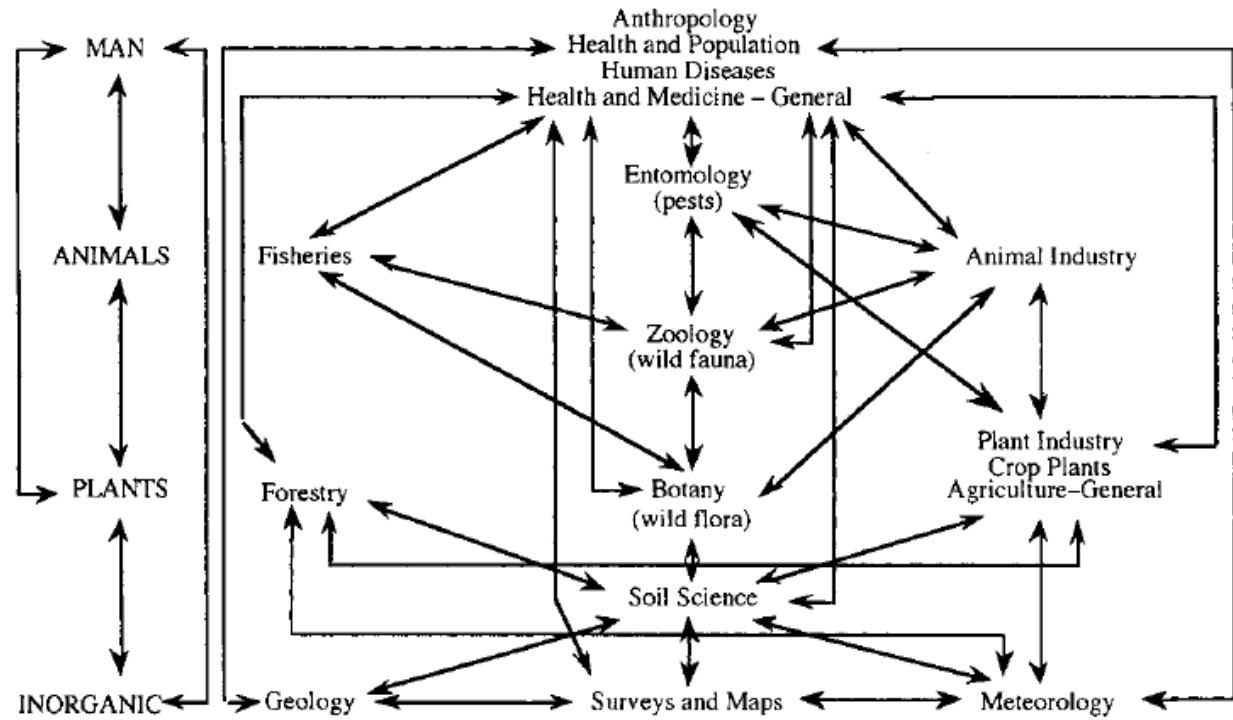
E. B. WORTHINGTON, M.A., Ph.D., (Cantab)
Director of the Freshwater Biological Association of the
British Empire
formerly Demonstrator in Zoology at Cambridge University

Issued by the Committee of the
African Research Survey
under the auspices of the
Royal Institute of International Affairs



OXFORD UNIVERSITY PRESS
LONDON NEW YORK TORONTO
1938

1938



*The colonial scientific network of environmental management
(Worthington 1938 in Ravi Rajam 2006).*

*Julian Huxley, secrétaire de la Zoological Society of London
Co-fondateur du WWF
premier Directeur de l'UNESCO*

Intergovernmental
conference of experts on
the scientific basis
for rational use and
conservation of the resources
of the biosphere

Paris
4-13 September 1968

UNESCO 1968

Unesco

RECOMMENDATION 3 RESEARCH ON HUMAN ECOLOGY

The Conference,

Considering that man is an integral part of most ecosystems, not only influencing but being influenced by his environment; that his physical and mental health, now and in the future, are intimately linked with the dynamic system of natural objects, forces and processes that interact within the biosphere and including also those of man's culture,

Recommends to the Member States and their appropriate institutions, to Unesco, WHO and the international organizations concerned:

1. That research be directed to man's basic ecology and to his social and physical adaptability to the changes of all kinds to which he is being subjected, whether in simple or in more complex societies, including those that are highly technological and urbanized.
2. That continuing and intensified research be undertaken on the ecology of human diseases, with special reference to those associated with environmental change and to the zoonotic diseases arising from interactions between man and animals.
3. That this research be directed at solving increasingly important problems of the establishment of the necessary balance between man and his environment in relation to the maintenance of his health and well-being in their broadest connotations.

One Health

The Theory and Practice
of Integrated Health
Approaches

Edited by
Jakob Zinsstag
Esther Schelling
David Waltner-Toews
Maxine Whittaker
Marcel Tanner



Insight and Innovation in International Development

Dominique F. Charron
Editor

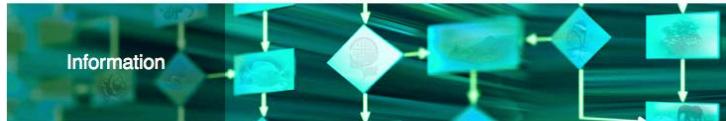
Ecohealth Research in Practice

Innovative Applications
of an Ecosystem Approach to Health

IDRC CRDI

 Springer

Une rédécouverte, mais, une gouvernance complexe !



Information
News & Communications
Web Announcements
Statements
Notifications
News Headlines on Biodiversity

> Information > SBSTTA Recommendation

[Back to SBSTTA Recommendations](#)

SBSTTA 18 Recommendation XVIII/14

XVIII/14. Health and biodiversity



centre Publications Countries Programmes About WHO

Climate change and human health

Biodiversity



What is biodiversity?

Biodiversity underpins life on Earth, and refers to the variety found in biota from genetic make up of plants and animals to cultural diversity.

What does biodiversity mean for human health?



Food and Agriculture Organization
of the United Nations

About FAO In Action Countries Themes

Home > Themes > Biodiversity

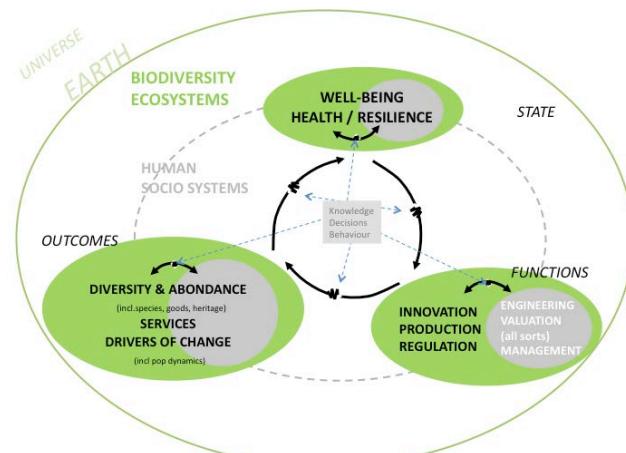
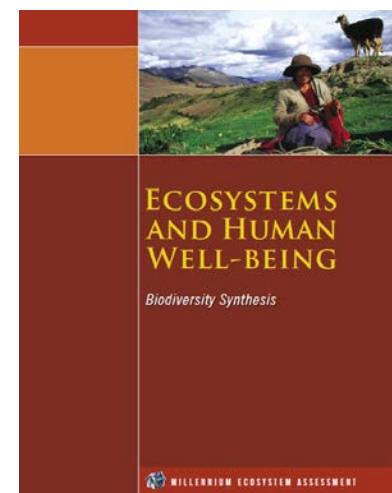
Biodiversity

Biodiversity is essential for food security and nutrition. Thousands of interconnected species make up a vital web of biodiversity within the ecosystems upon which global food production depends.

With the erosion of biodiversity, humankind loses the potential to adapt ecosystems to new challenges such as population growth and climate change. Achieving food security for all is intrinsically linked to the maintenance of biodiversity.

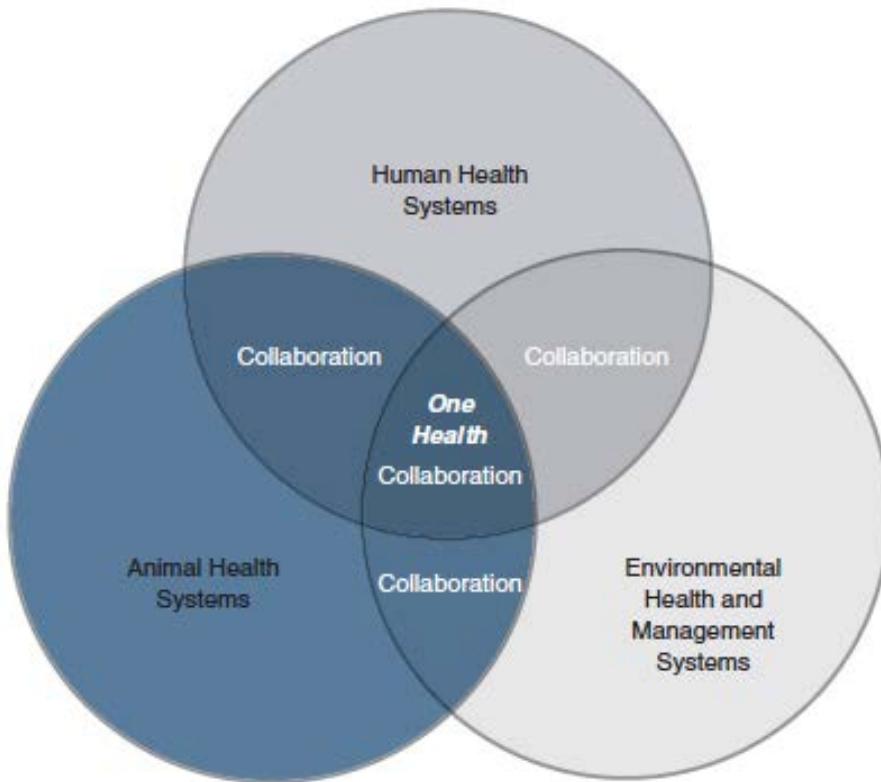


futureearth
research for global sustainability



Investing in One Health

A concerted approach to address shared risks to humans, animals, and the environment



The One Health concept recognizes **the connections between humans, animals, and the environment** and promotes coordination to better understand and manage risks. By improving understanding of animals and/or ecology, it informs risk management and can **prevent disease threats**. Its application can also reinforce other **health objectives**, such as maternal and child health, food and nutrition security, pollution management, and sanitation. An increasing number of countries are taking measures to develop One Health coordination mechanisms to support **multi-sectoral surveillance**, laboratories, risk assessment, communication, and policy development activities.

Taking a Multisectoral, One Health Approach:

A Tripartite Guide to Addressing Zoonotic Diseases in Countries



Strategic planning and emergency preparedness



Surveillance for zoonotic diseases and information sharing



Coordinated investigation and response



Joint risk assessment for zoonotic disease threats



Risk reduction, risk communication, and community engagement



Workforce development

Une épidémie d'épidémies

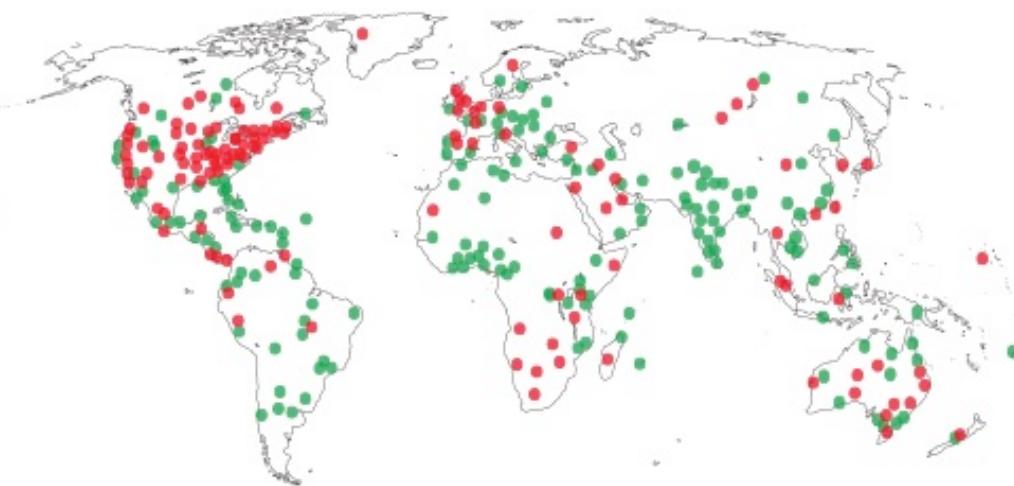
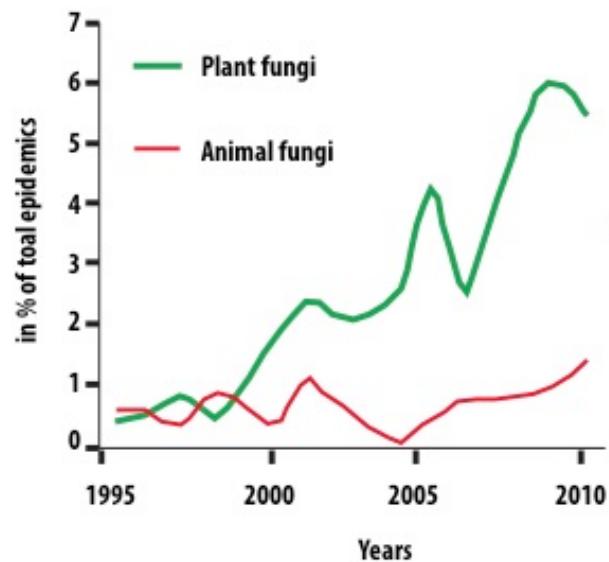


THE STATE OF
THE WORLD'S
BIODIVERSITY
FOR FOOD AND AGRICULTURE

FAO COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE
ASSESSMENTS • 2019



Increasing epidemics in fungal diseases in plants and animals



Emergence of infectious diseases

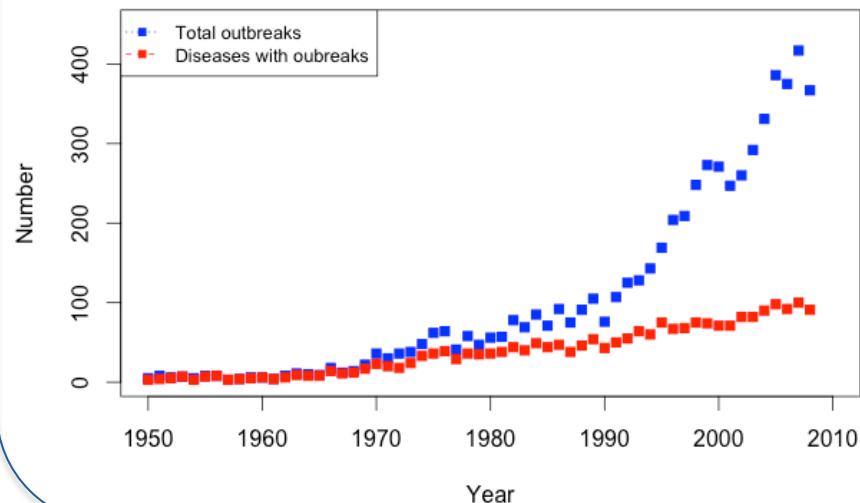
Risks and issues for society

Serge Morand, Muriel Figuié, eds.

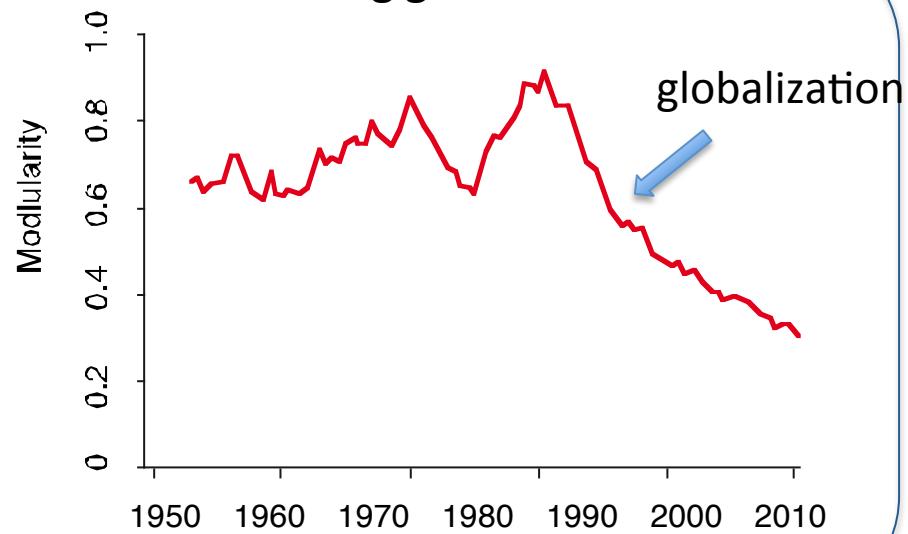


éditions
Quæ

Increasing number of outbreaks and emerging infectious diseases



Increasing global outbreaks



Global trends in emerging infectious diseases

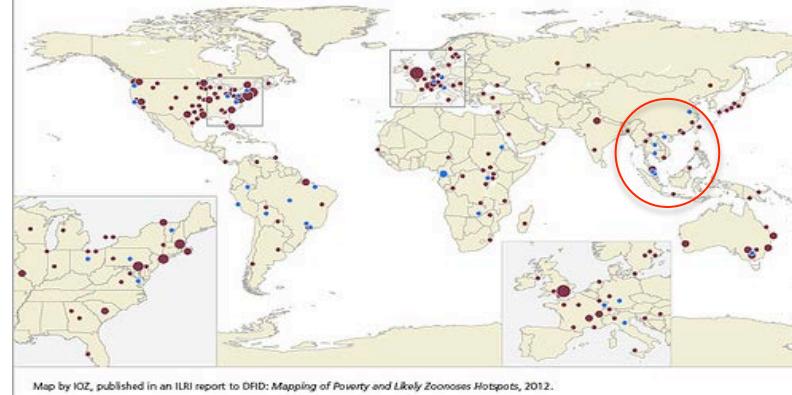
Kate E. Jones¹, Nikkita G. Patel², Marc A. Levy³, Adam Storeygard^{3†}, Deborah Balk^{3†}, John L. Gittleman⁴
& Peter Daszak²

Emerging Zoonotic Disease Events, 1940–2012

Potential Hotspots in US, Western Europe, Brazil, Southeast Asia

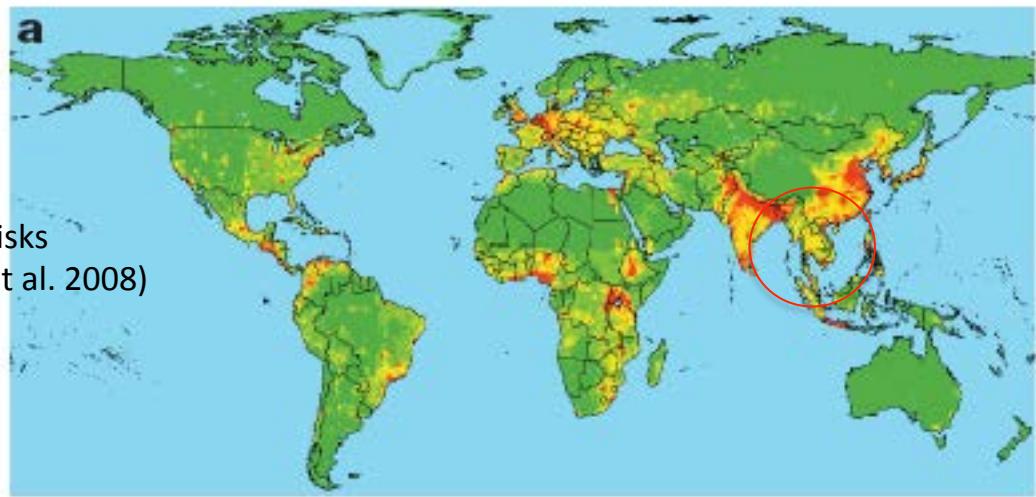
Most emerging human diseases come from animals. This map locates zoonotic events over the past 72 years, with recent events (identified by an ILRI-led study in 2012) in blue. Like earlier analyses, the study shows western Europe and western USA are hotspots; recent events, however, show an increasingly higher representation of developing countries.

- 1 EVENT
- 2–3 EVENTS
- 4–5 EVENTS
- 6 EVENTS
- EVENTS IDENTIFIED IN 2012
(recent emergence)



Map by IOZ, published in an ILRI report to DRI: Mapping of Poverty and Likely Zoonoses Hotspots, 2012.

Emerging Zoonoses Risks
From wildlife (Jones et al. 2008)

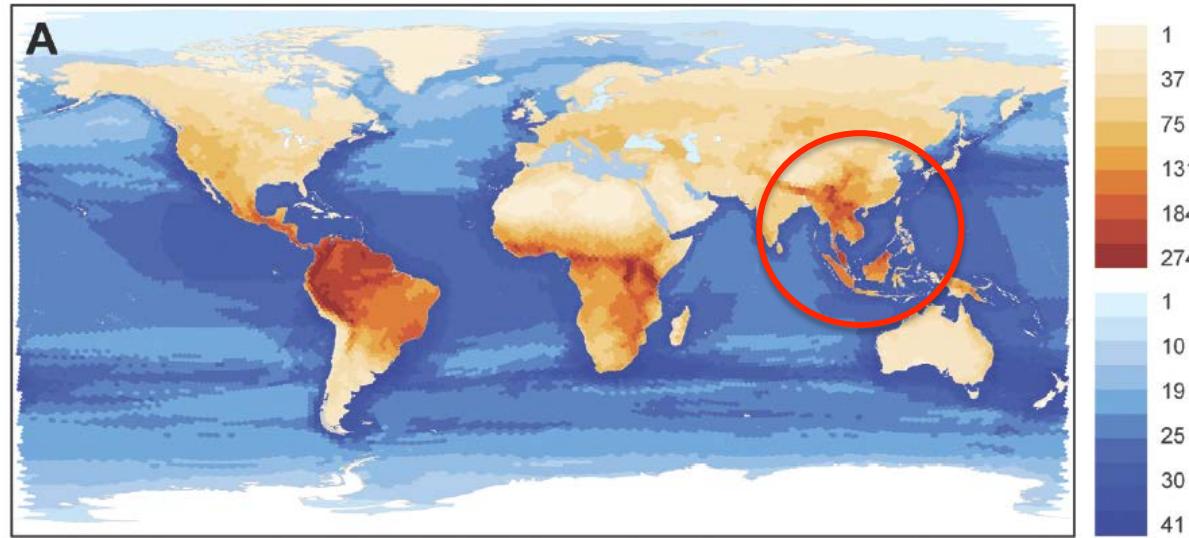


2008

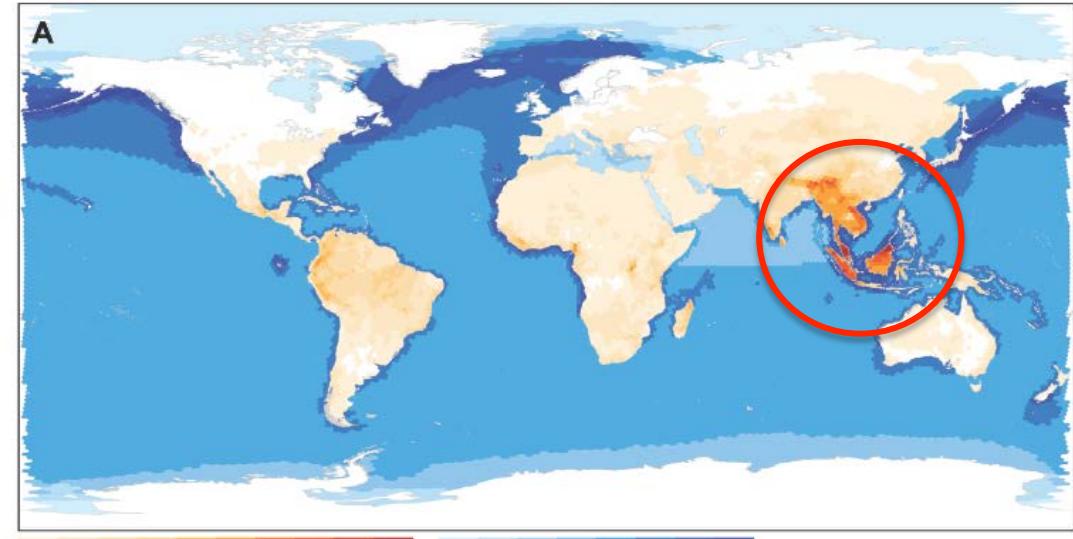
Une crise de la biodiversité

The Status of the World's Land and Marine Mammals: Diversity, Threat, and Knowledge

Hotspot of species richness



Hotspot of species at threat

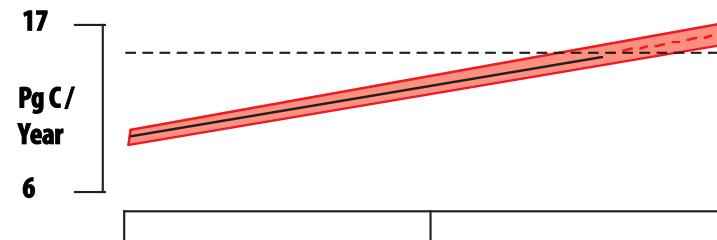




L'accroissement de l'appropriation humaine de la productivité biologique primaire nette est la cause de la crise de biodiversité

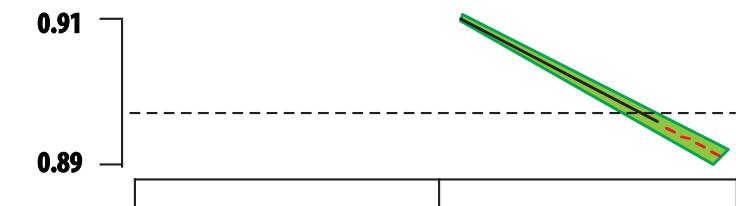
PRESSURE

Human Appropriation
Net Primary Productivity



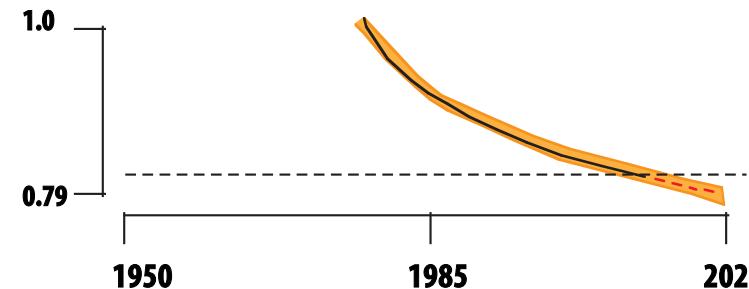
RESPONSE

Red List of Pollinators



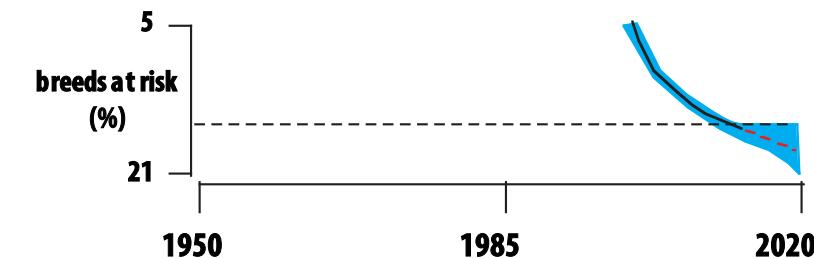
STATE

Living Planet Index



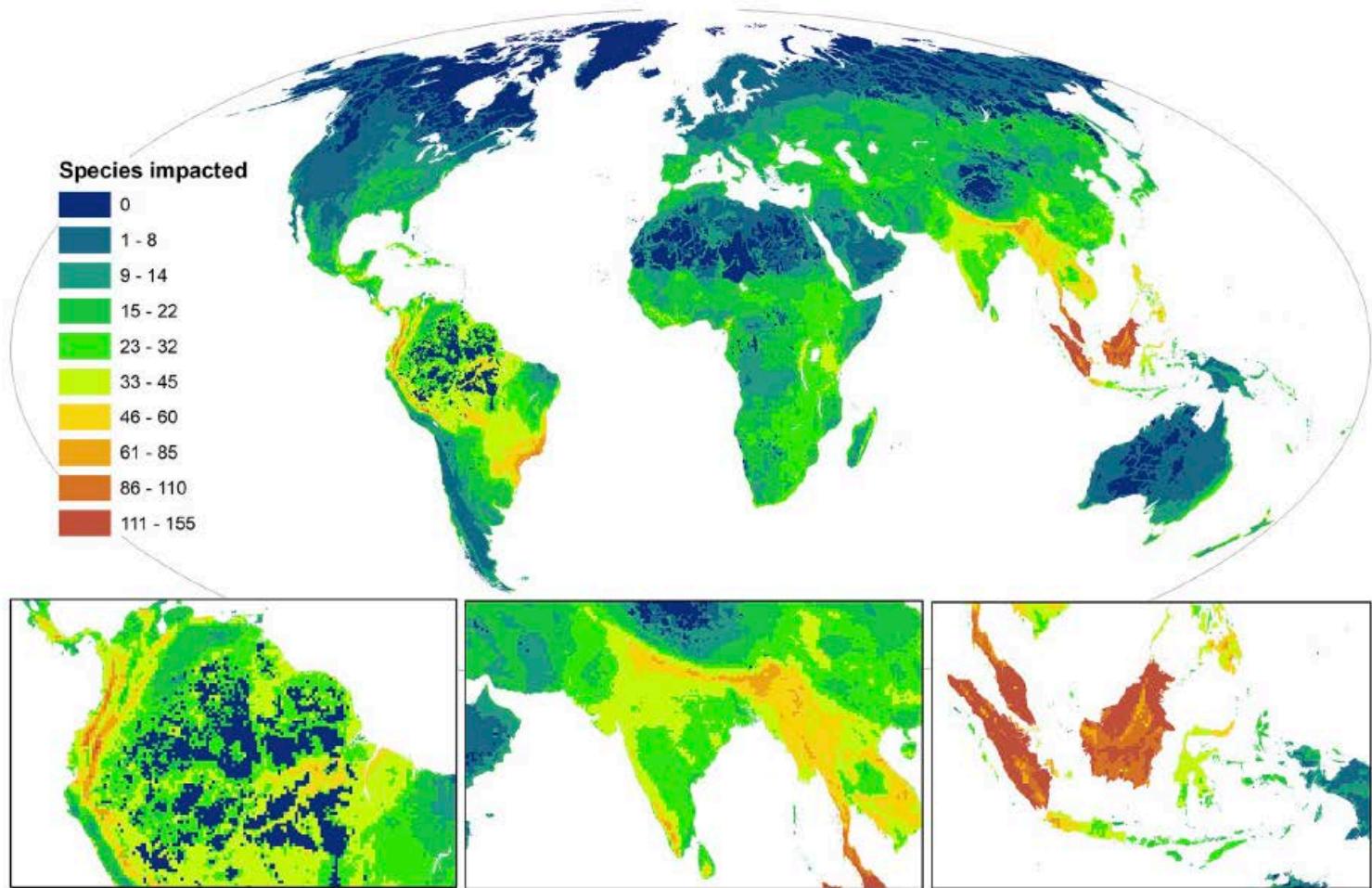
RESPONSE

Genetic diversity of
domesticated animal breeds



Hotspots of human impact on threatened terrestrial vertebrates

James R. Allan^{1,2*}, James E. M. Watson^{1,2,3}, Moreno Di Marco^{1,4}, Christopher J. O'Bryan^{1,2}, Hugh P. Possingham^{2,5}, Scott C. Atkinson^{1,6}, Oscar Venter⁷





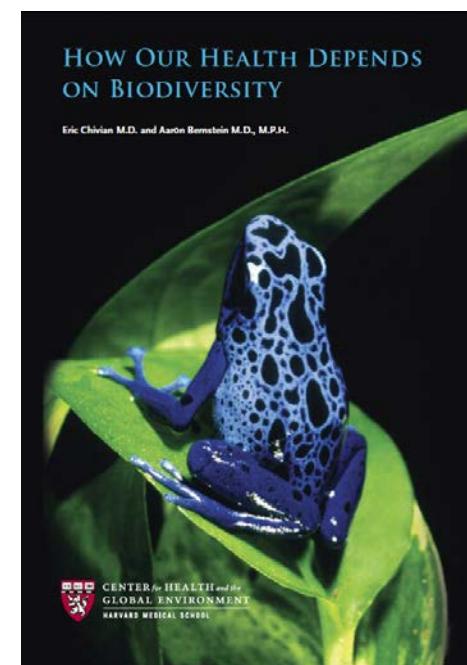
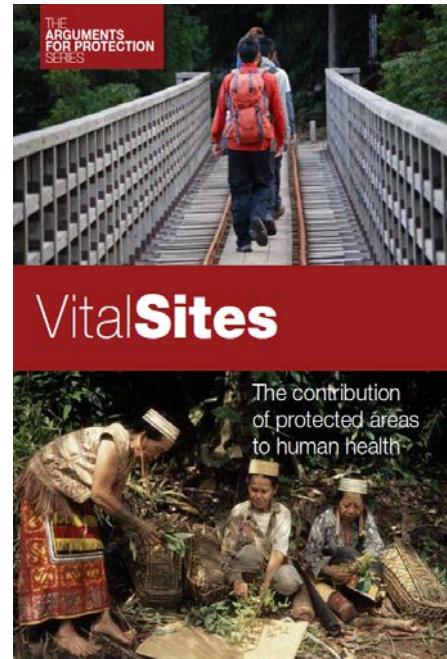
Biodiversity and Health

Serge Morand and Claire Lajaunie

Linking Life, Ecosystems and Societies

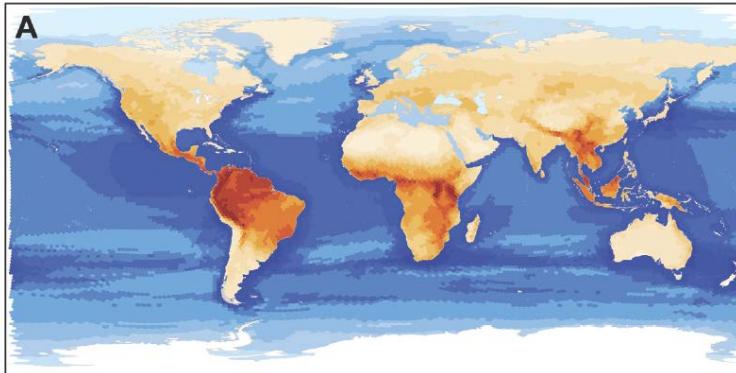


Pourquoi la biodiversité est importante pour la santé et le bien-être ?



Biodiversité et maladies zoonotiques

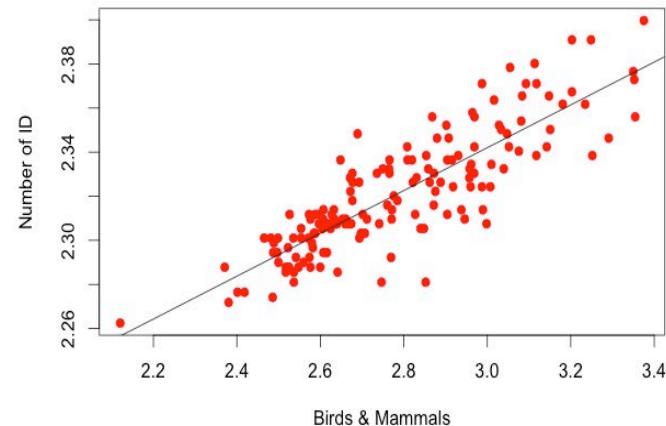
biodiversité forte



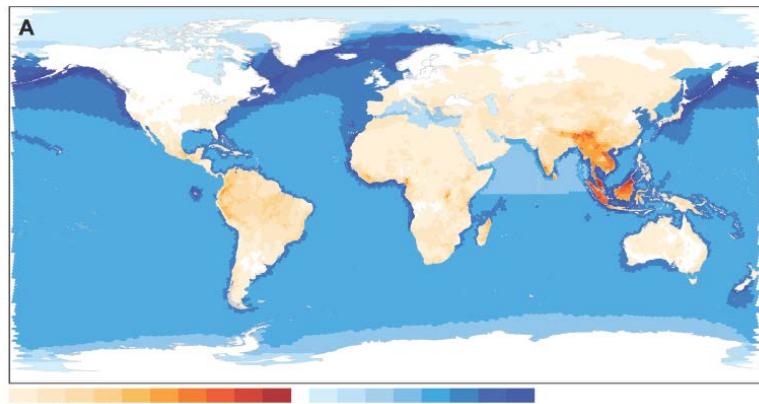
Mammal Species richness



richesse en maladies infectieuses



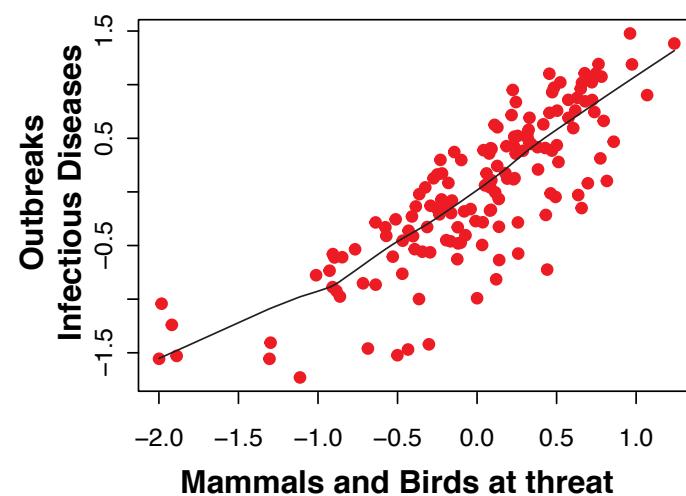
biodiversité en danger



Mammal Species at threat



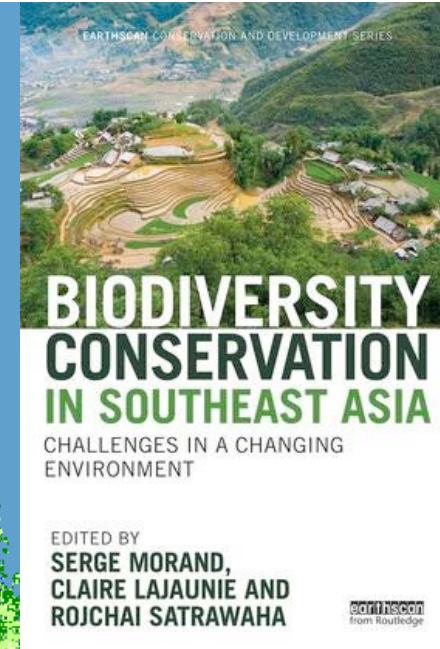
épidémies en plus grand nombre





Un théâtre socio-écologique pour la conservation de la biodiversité et la santé planétaire

Serge Morand
Jean-Pierre Dujardin
Régine Lefait-Robin
Channarn Apiwatthnasorn *Editors*

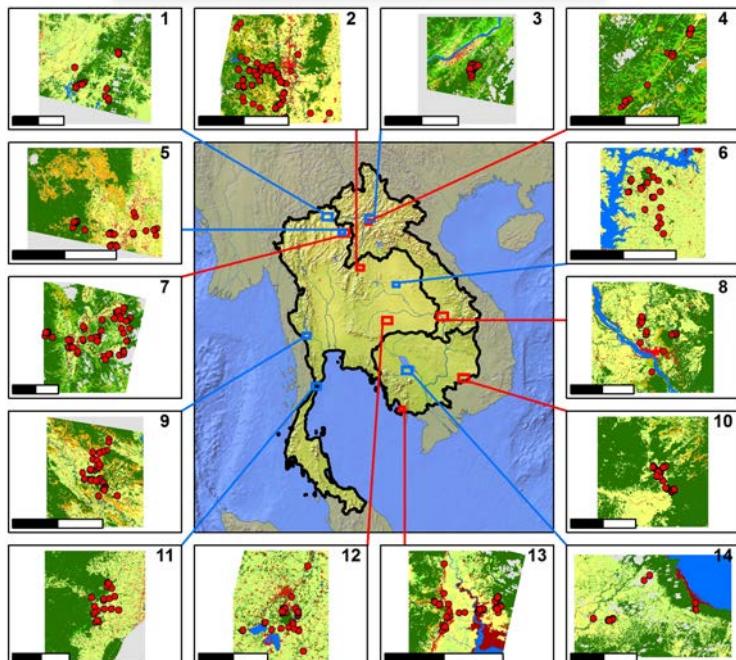
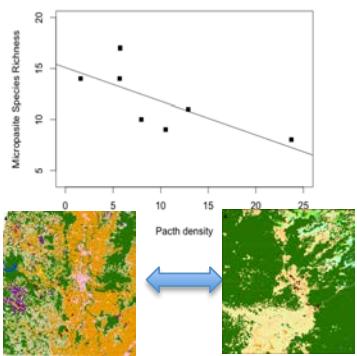


Socio-Ecological
Dimensions
of Infectious
Diseases in
Southeast Asia

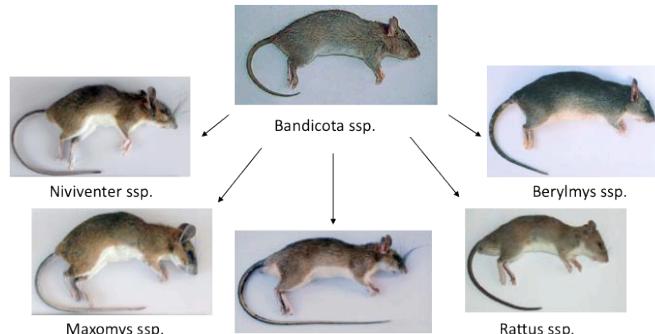
Springer

CERoPath BiodivHealthSEA

LUCL Changes & rodent-borne disease diversity

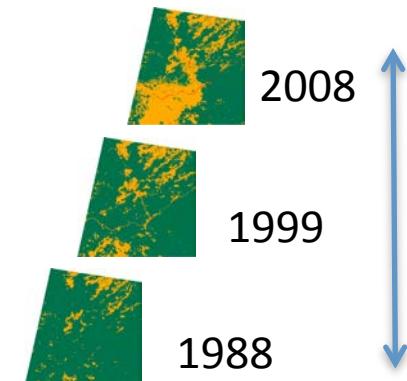


Rodents (22 spp, 4,000)

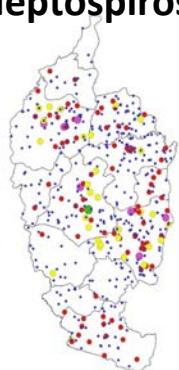


Parasites, pathogens

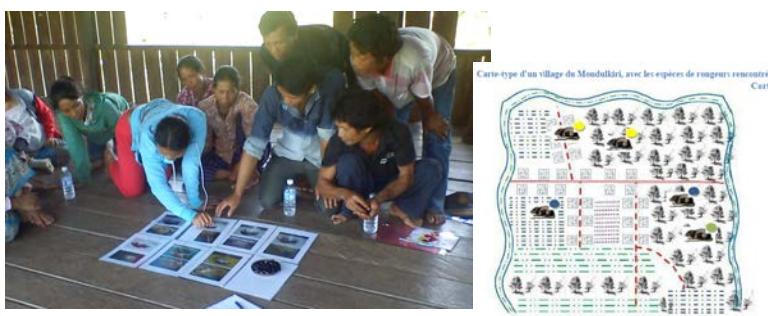
LUCL Temporal change



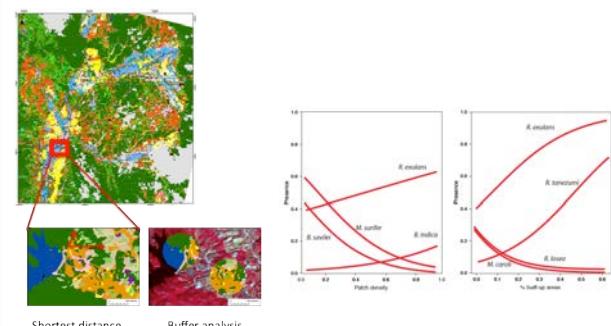
Epidemiology & perception of leptospirosis



Social Representation Participatory Cartography

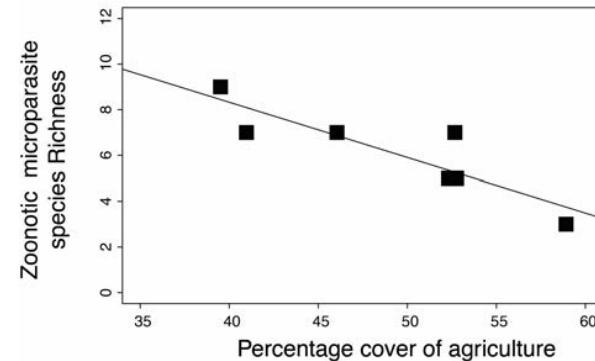
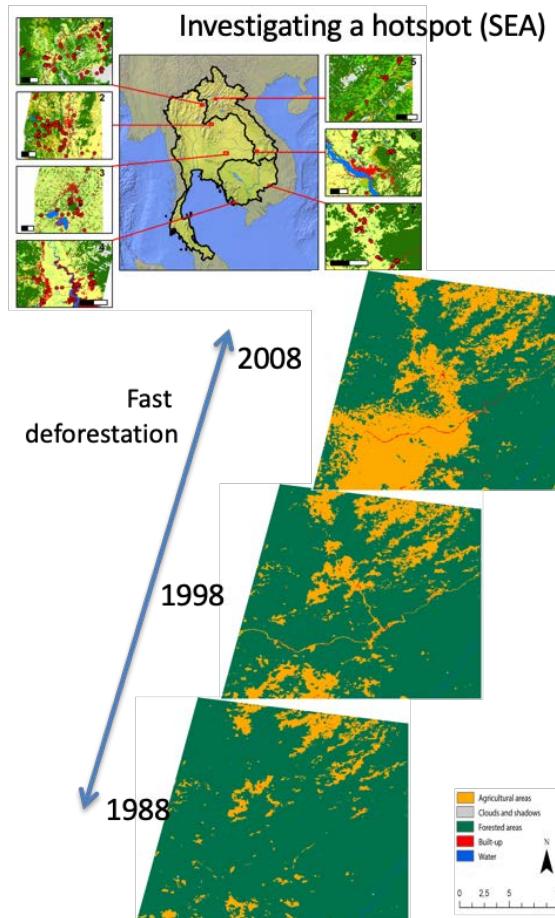


Environmental Niche Modelling

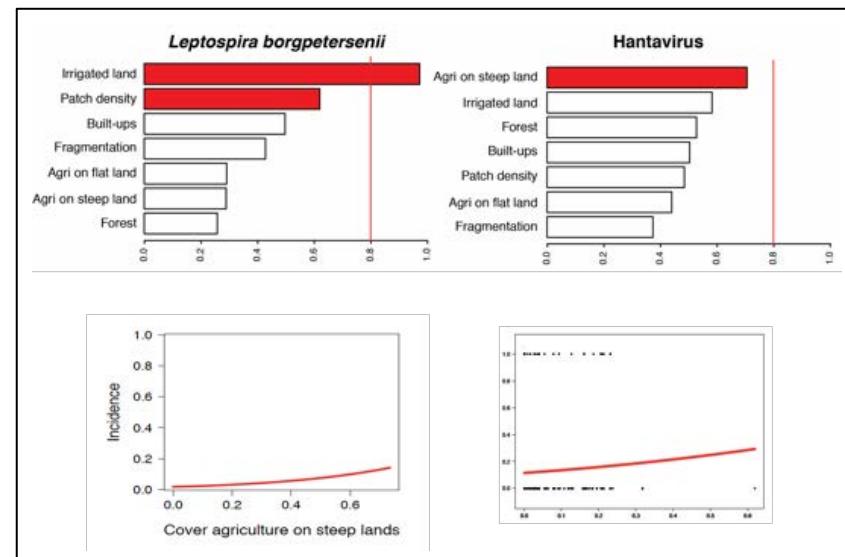


Changing landscapes of Southeast Asia and rodent-borne diseases: decreased diversity but increased transmission risks

Déforestation
⇒ Perte de diversité
dont les pathogènes

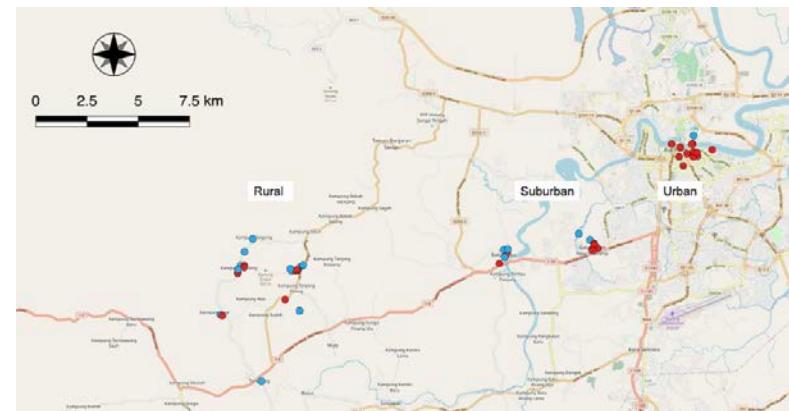
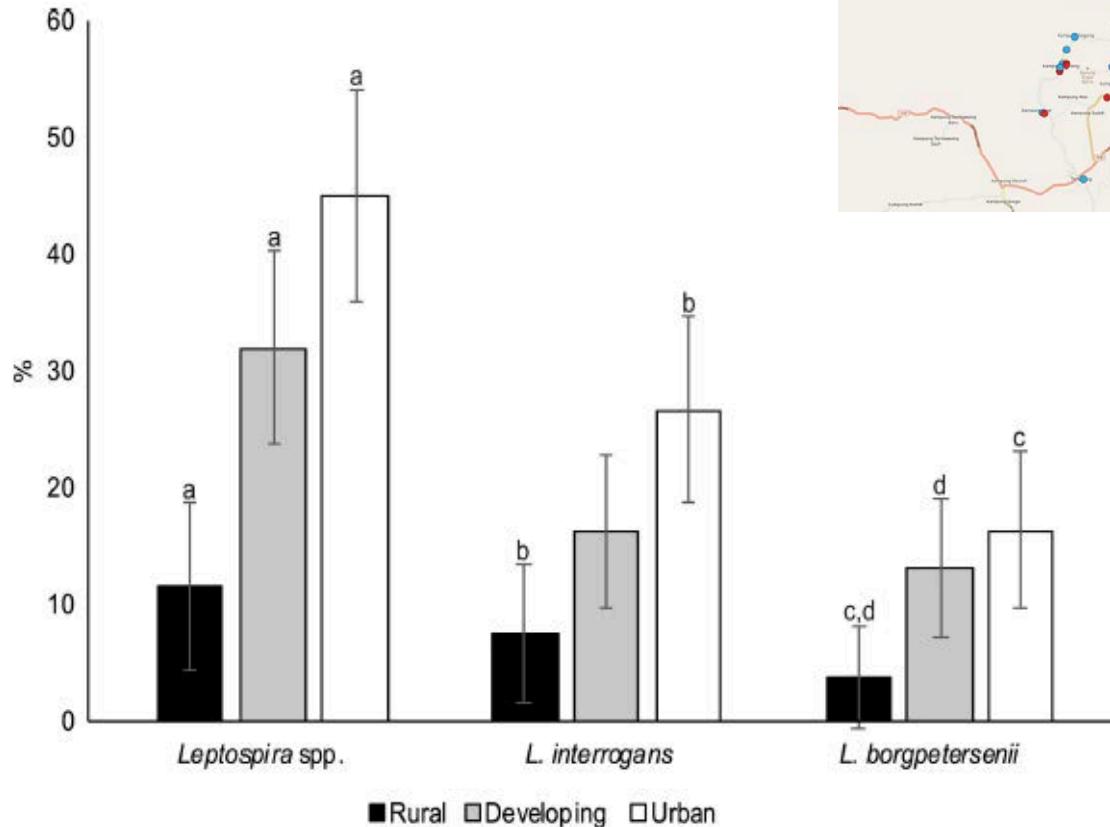


... mais, augmentation des risques zoonotiques avec
l'accroissement des aires agricoles et urbaines



Association of rodent-borne *Leptospira* spp. with urban environments in Malaysian Borneo

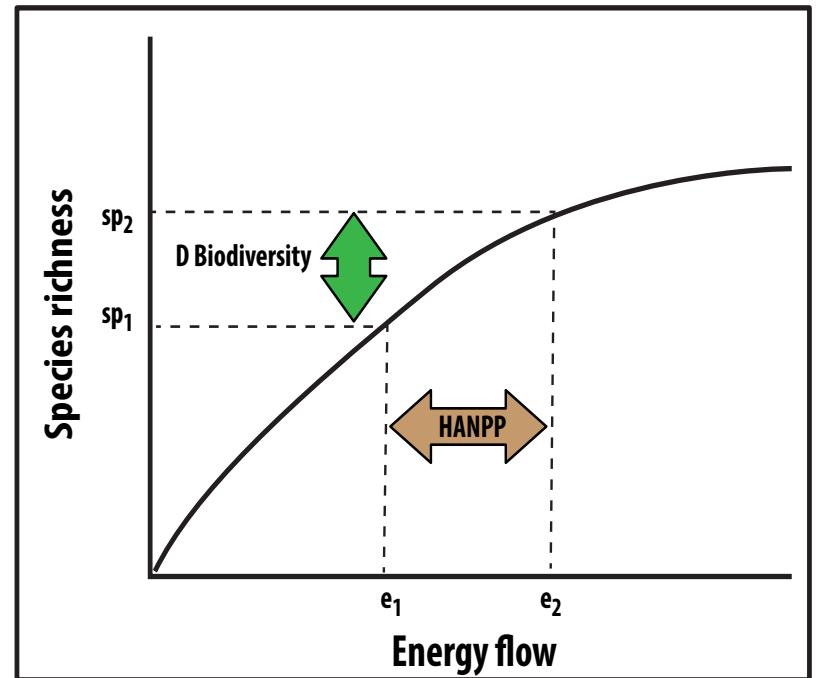
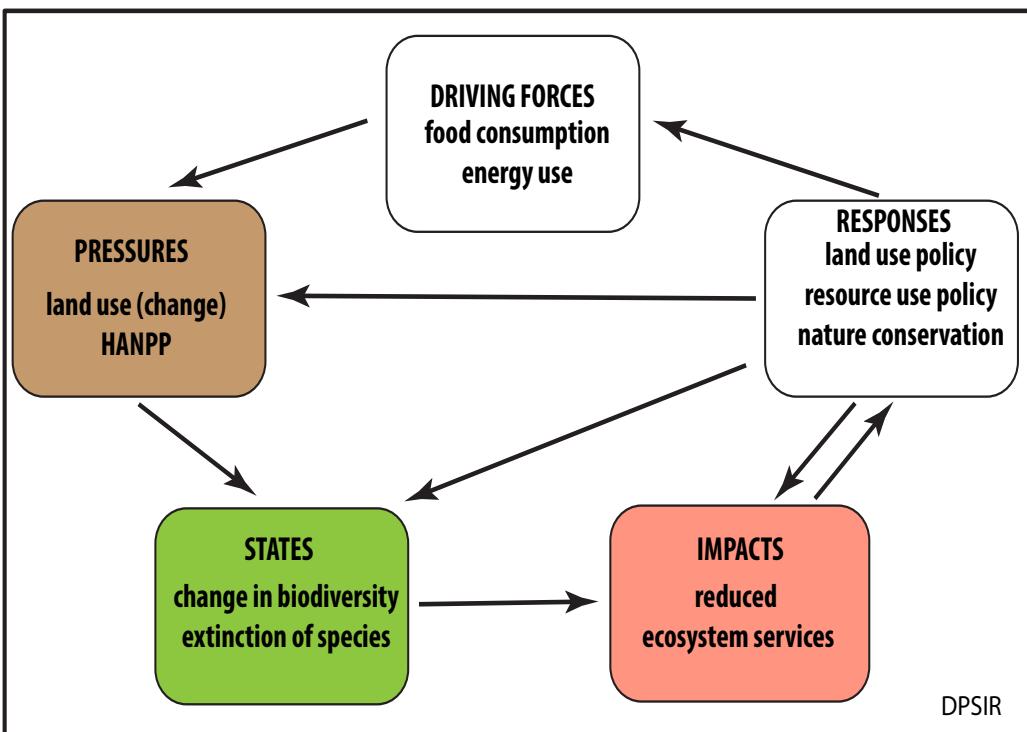
Kim R. Blasdell¹, Serge Morand^{1,2,3,4}, David Perera⁵, Cadhla Firth^{1,6*}



Social-écologie et Appropriation Humaine de la Productivité Primaire Nette

Approche social-écologique et théorie écologique

Lier le métabolisme bio-écologique avec le métabolisme social

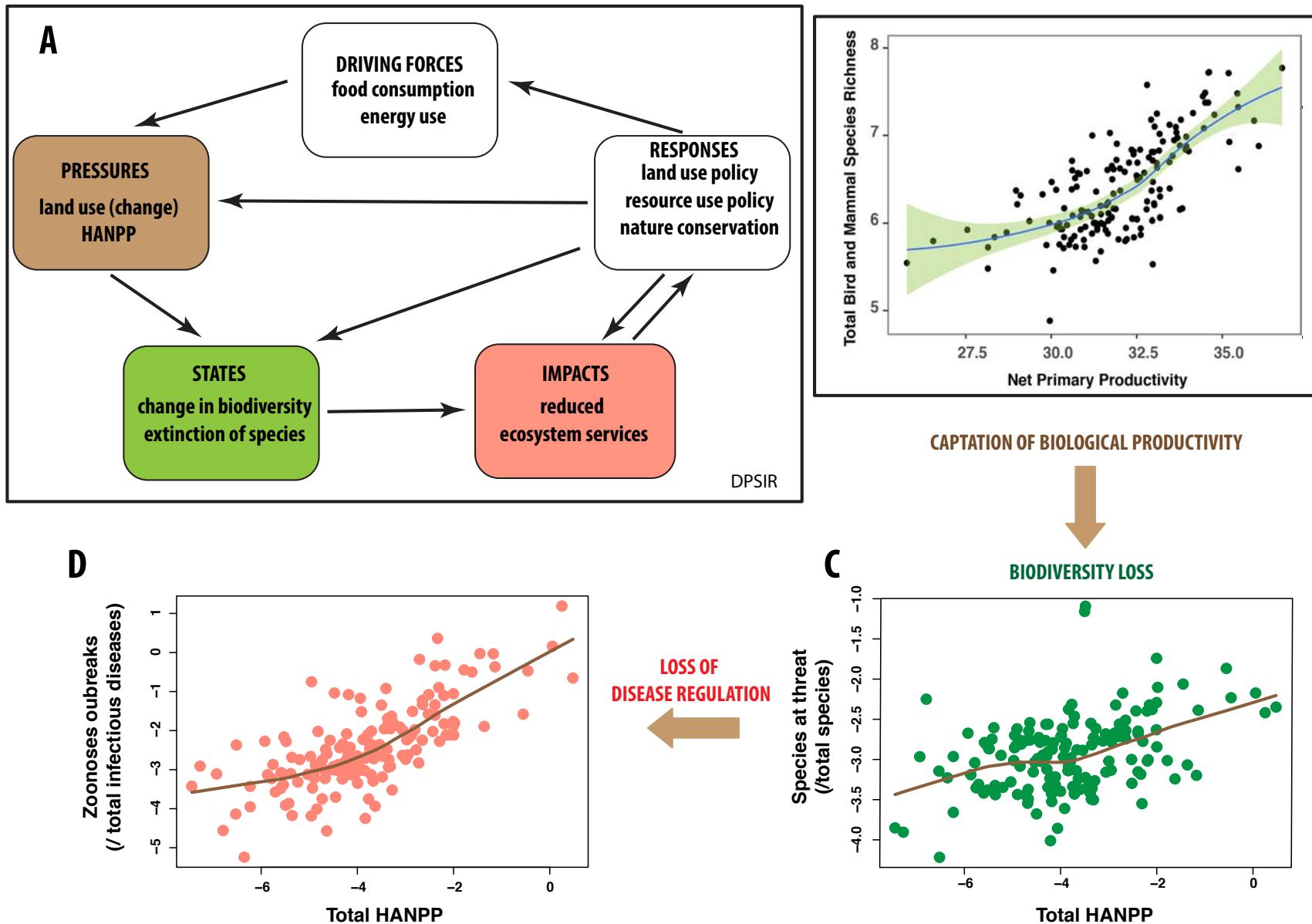


Wright 1983

Haberl et al. 2007

Fischer-Kowalski & Weisz 2016

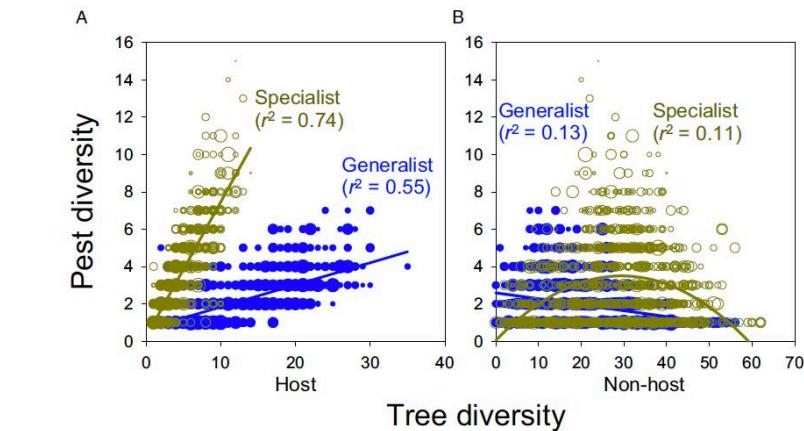
Appropriation Humaine de la Productivité Primaire Nette et perte de regulation écosystémique des maladies



Une vue depuis la forêt

Tree diversity regulates forest pest invasion

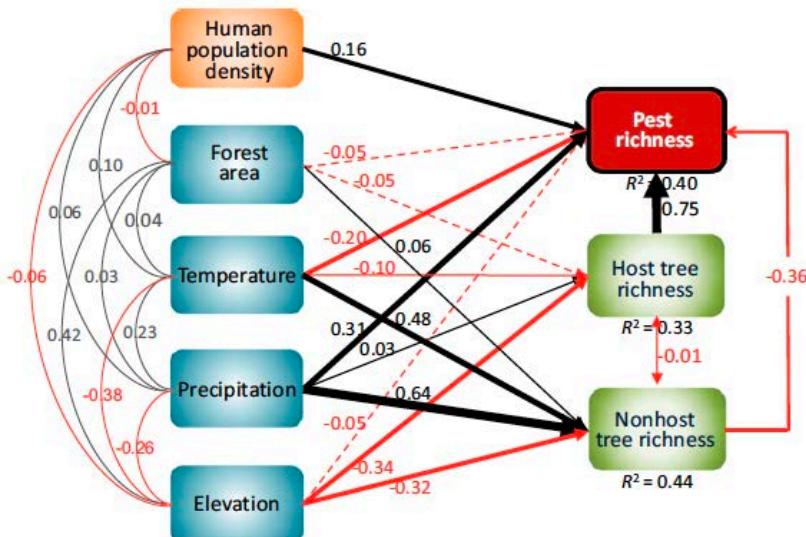
Qinfeng Guo^{a,1}, Songlin Fei^{b,1}, Kevin M. Potter^c, Andrew M. Liebhold^{d,e}, and Jun Wen^f



130,000 parcelles forestières (USA)

La diversité des organismes nuisibles augmente avec la diversité en arbres lorsque celle-ci est faible
⇒ Facilitation ou Amplification

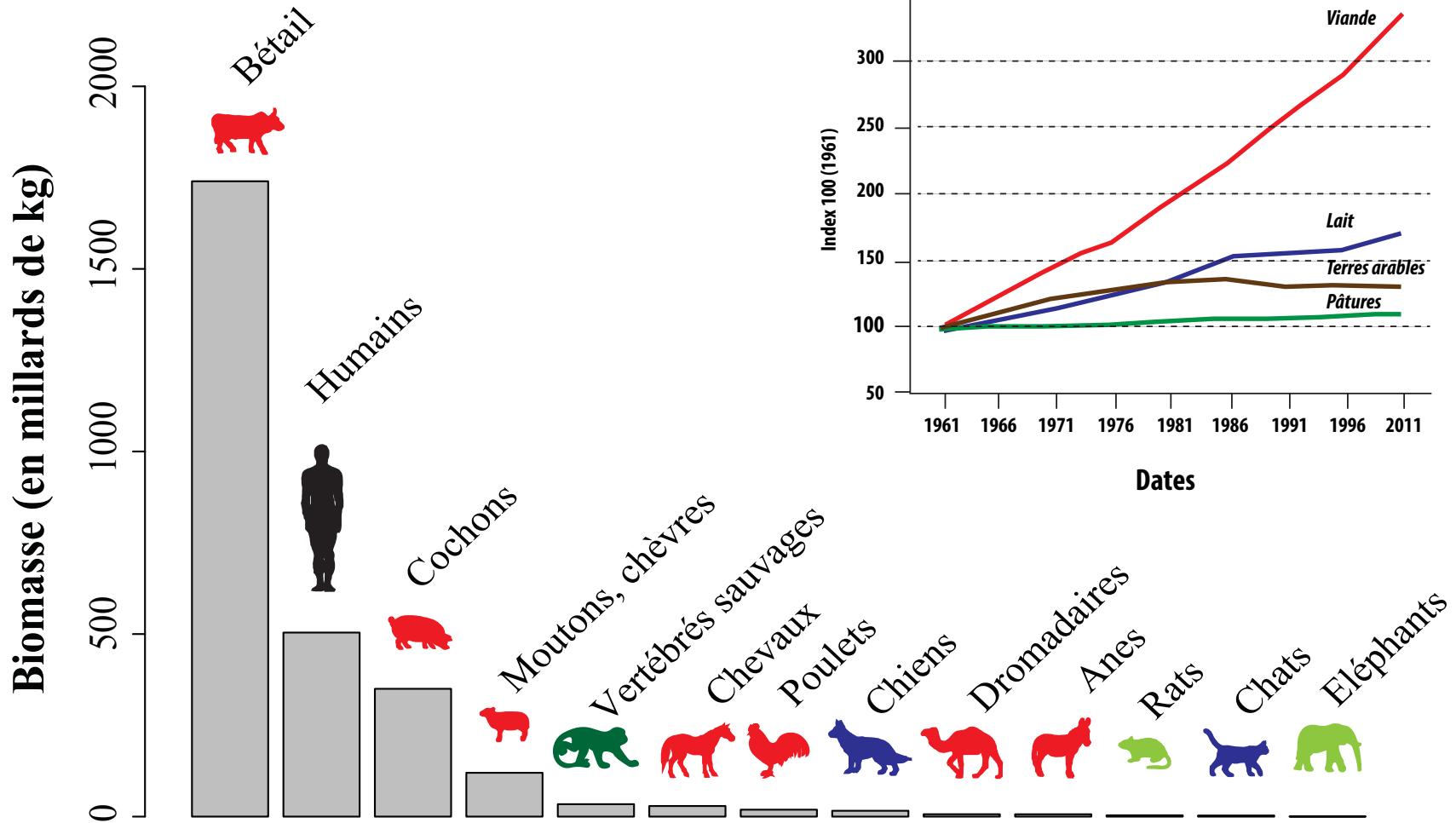
La diversité des organismes nuisibles diminue à haute diversité en arbres
⇒ Dilution



Invasion des ravageurs forestiers est régulée par des mécanismes de facilitation et de dilution qui fonctionnent simultanément

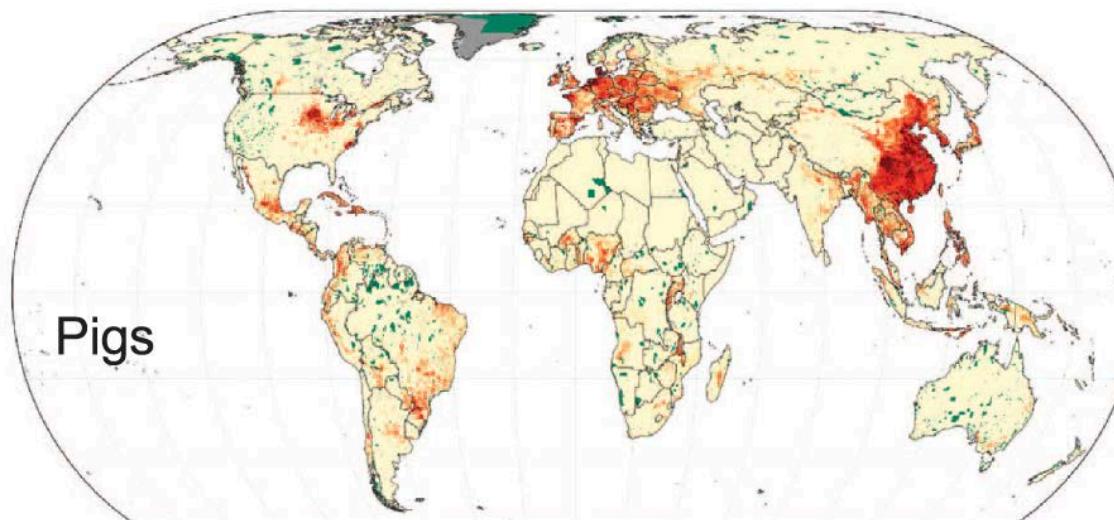
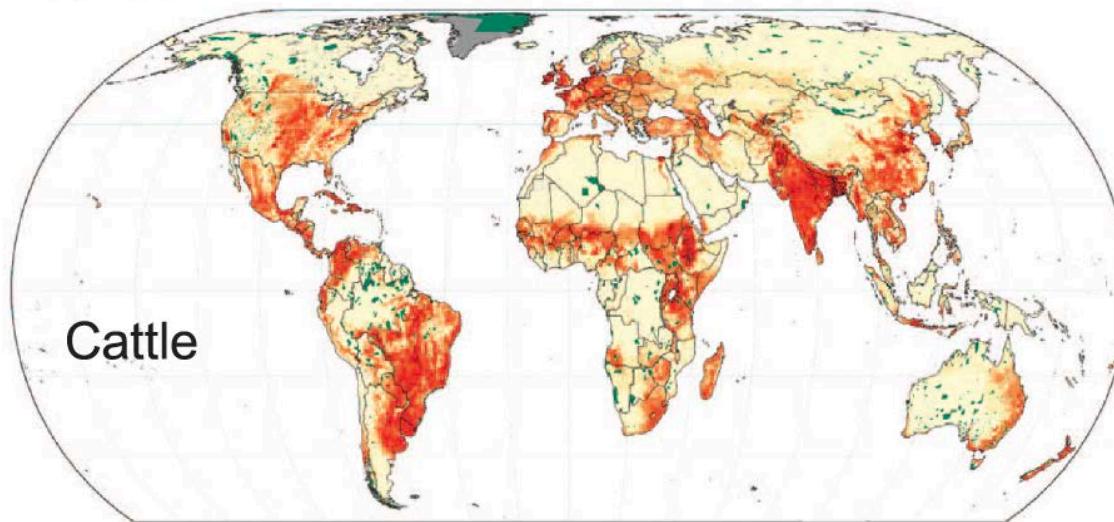
Un monde de vaches

... un monde dominé par les vaches, les cochons



Data Descriptor: Global distribution data for cattle, buffaloes, horses, sheep, goats, pigs, chickens and ducks in 2010

Marius Gilbert^{1,2}, Gaëlle Nicolas¹, Giuseppina Cinardi³, Thomas P. Van Boeckel^{4,5}, Sophie O. Vanwambeke⁶, G. R. William Wint⁷ & Timothy P. Robinson³



[0,1)
[1,5)
[5,10)
[10,20)
[20,50)
[50,100)
[100,250)
[250,1e+06]

Animal Waste, Water Quality and Human Health



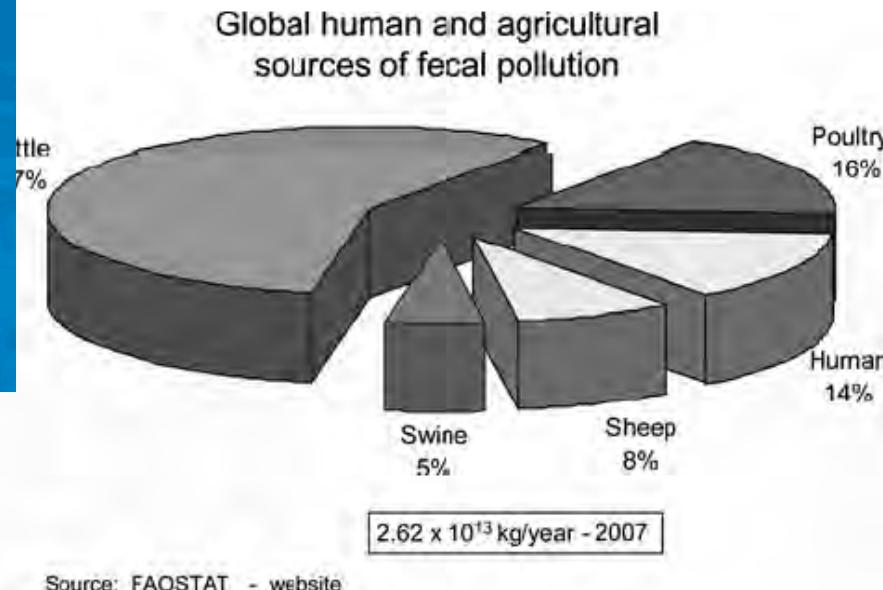
Edited by Al Dufour, Jamie Bartram,
Robert Bos and Victor Gannon



2012

Une planète dans la bouse

La pollution fécale globale par les humains et
leurs animaux d'élevage
=> **26 milliards de tonnes d'excréments par an**



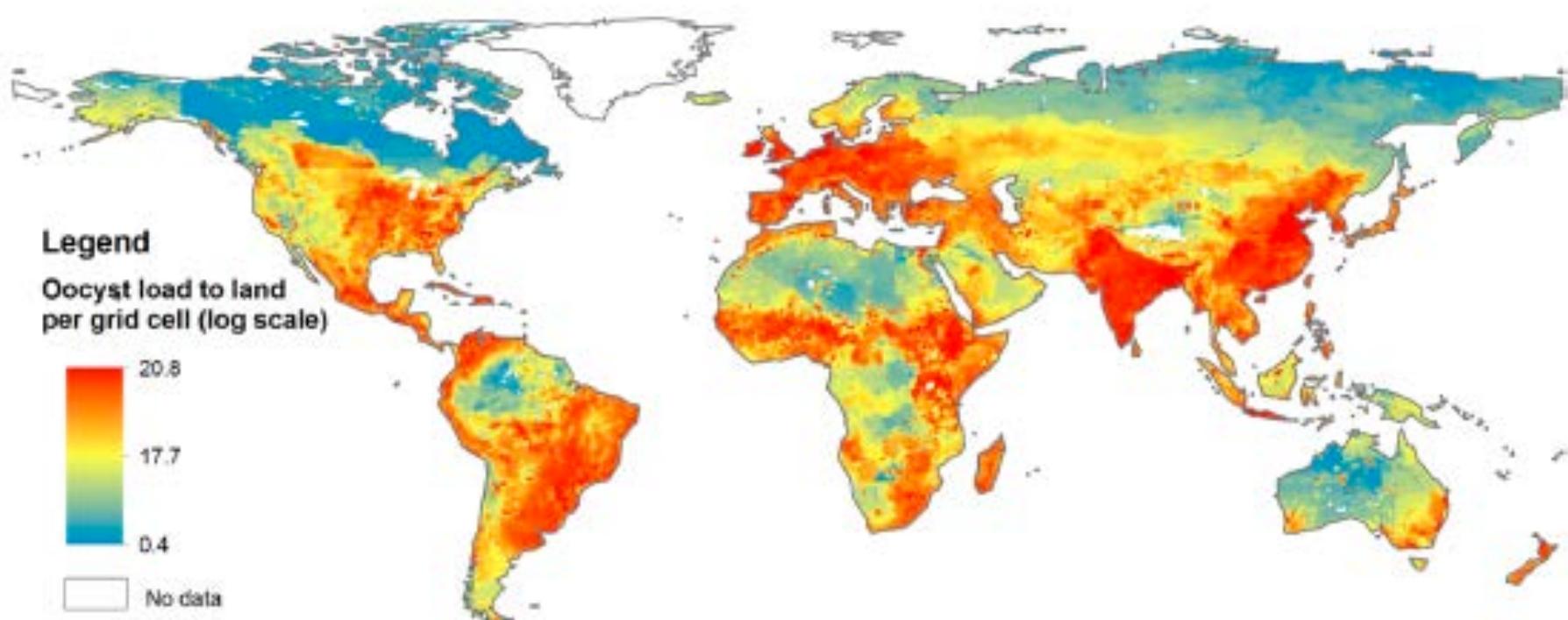
Une vache laitière (600 kg) = > 10 kg de bouse par jour

Un porc (60 kg) => 2,7 kg de lisier par jour

Un poulet (2 kg) => 100 g de fientes par jour

Global Cryptosporidium Loads from Livestock Manure

Lucie C. Vermeulen,^{*,†} Jorien Benders,[†] Gertjan Medema,^{‡,§} and Nynke Hofstra[†]



320 miliers de trillions d'oocystes par an

Global trends in antimicrobial use in food animals

Thomas P. Van Boeckel^{a,1}, Charles Brower^b, Marius Gilbert^{c,d}, Bryan T. Grenfell^{a,e,f}, Simon A. Levin^{a,g,h,1}, Timothy P. Robinsonⁱ, Aude Teillant^{a,e}, and Ramanan Laxminarayanan^{b,e,j,1}

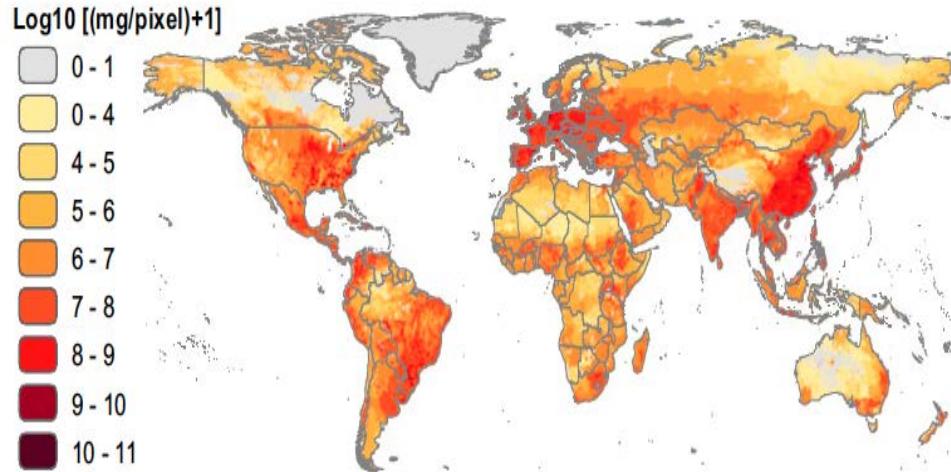


Fig. 3. Global antimicrobial consumption in livestock in milligrams per 10 km²



PHARMACEUTICALS

China's lakes of pig manure spawn antibiotic resistance

Researchers begin to size up a public health threat from burgeoning pork production

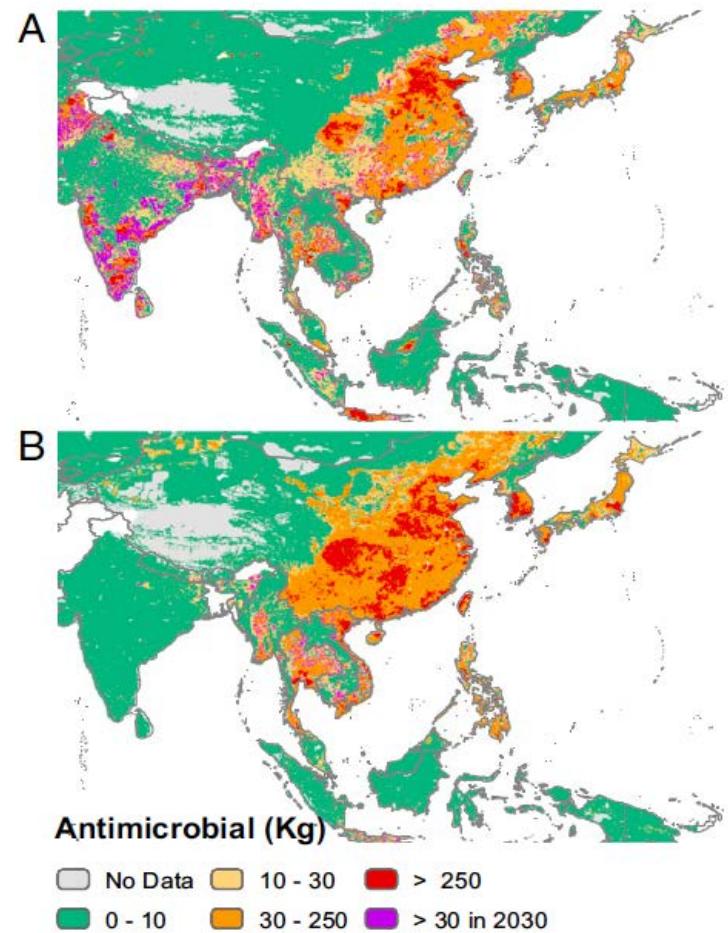
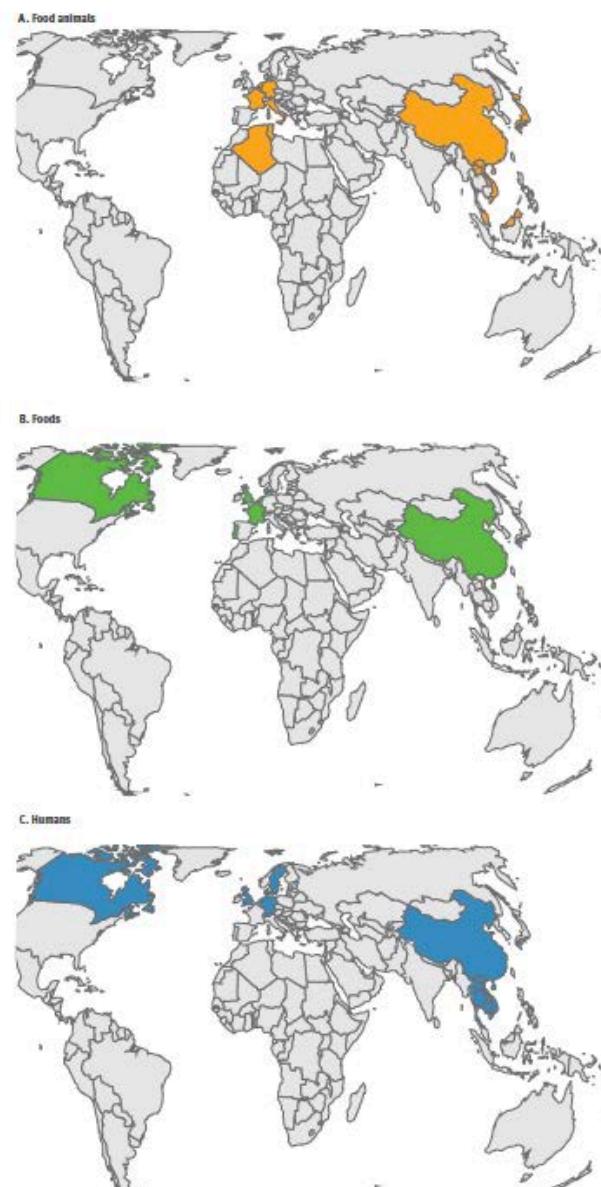
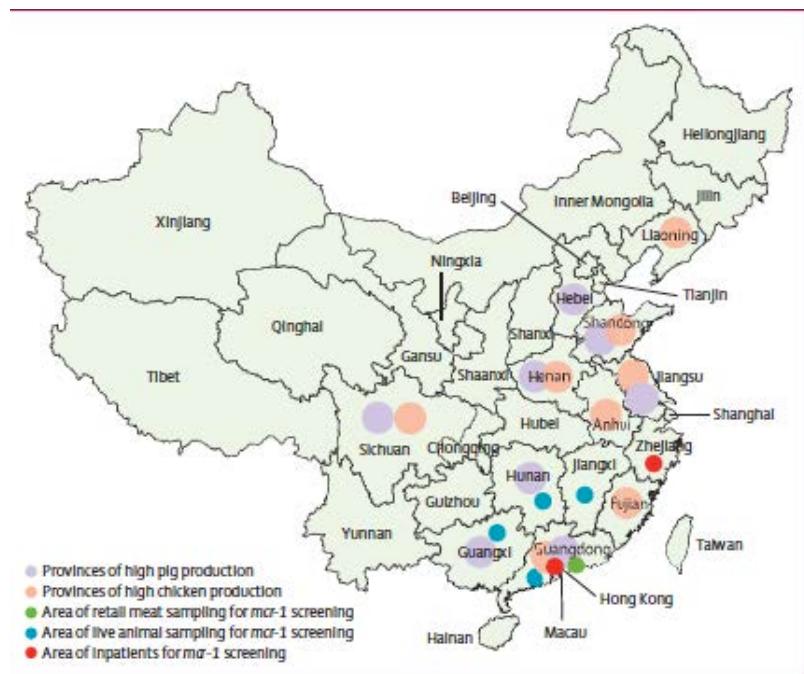


Fig. 4. Antimicrobial consumption in chickens (A) and pigs (B) in 2030. Purple indicates new areas where antimicrobial consumption will exceed 30 kg per 10 km² by 2030.

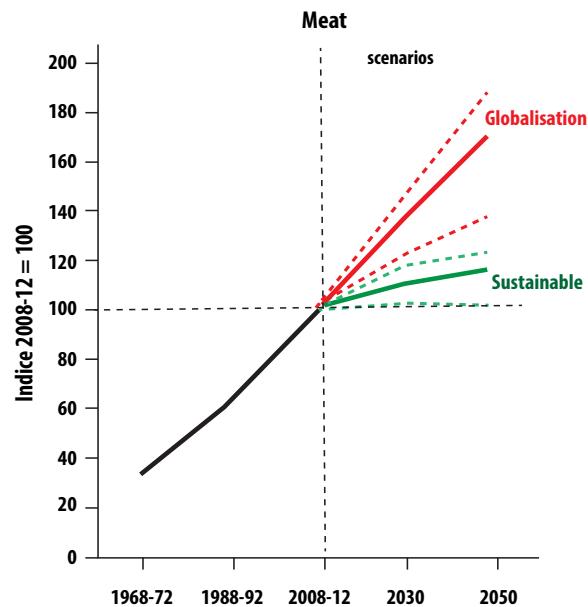
Emergence of plasmid-mediated colistin resistance mechanism MCR-1 in animals and human beings in China: a microbiological and molecular biological study

Yi-Yun Liu*, Yang Wang*, Timothy R Walsh, Ling-Xian Yi, Rong Zhang, James Spencer, Yohei Doi, Guobao Tian, Baolei Da, Lin-Feng Yu, Danxia Gu, Hongwei Ren, Xiaojie Chen, Luchao Lv, Dandan He, Hongwei Zhou, Zisen Liang, Jian-Hua Liu, Jia

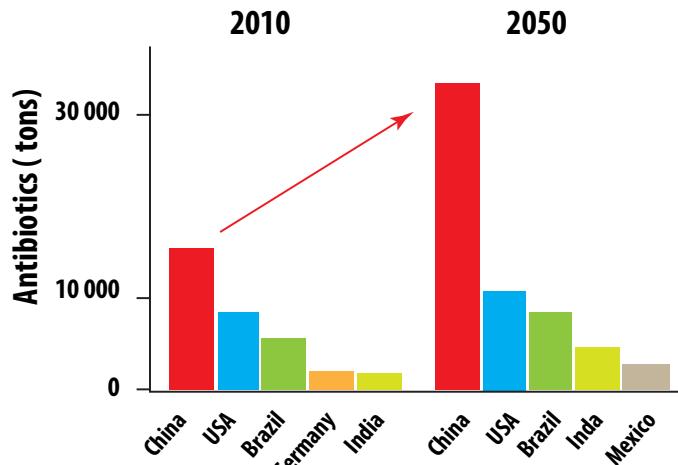
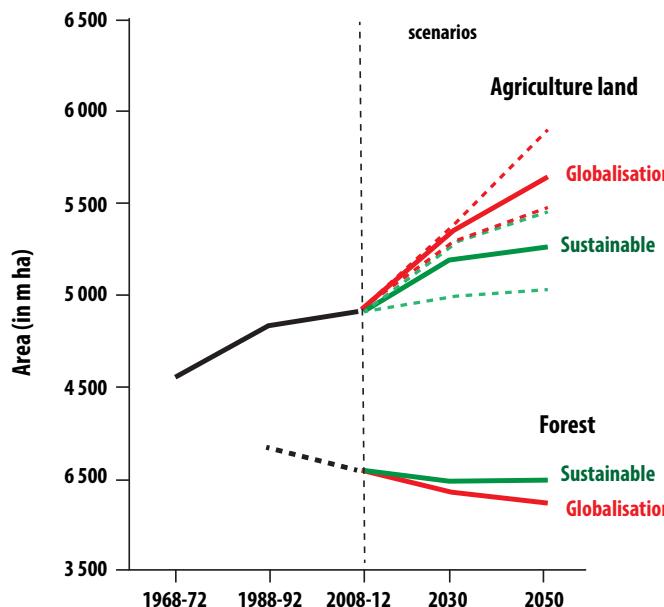


Une planète dominée par l'agriculture et l'élevage industriel

plus de viande



moins de biodiversité



Plus d'antibiotiques et de biocides

Plus de crises sanitaire

Plus de pertes de biodiversité

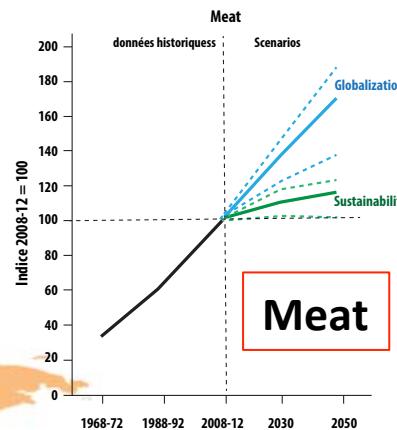
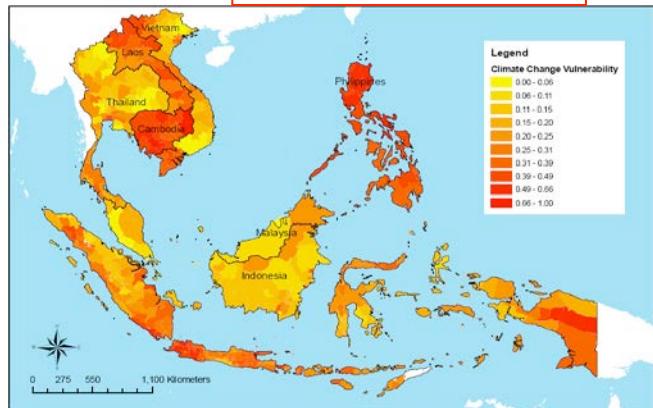
Plus de pertes d'agrodiversité

Anticiper le futur

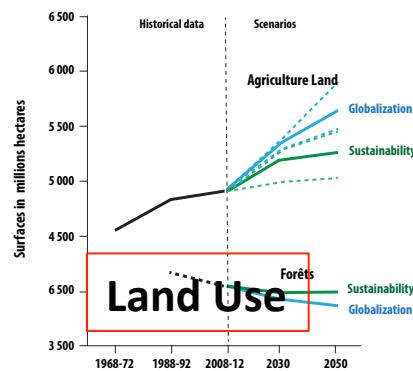
Les Nouvelles Routes de la Soie



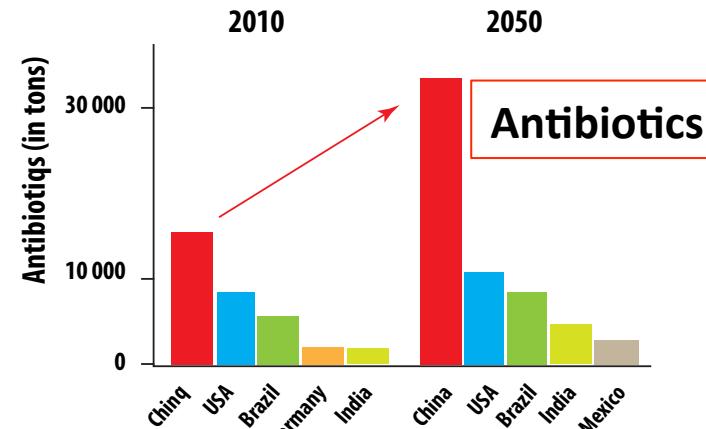
Climate Change



Meat



Land Use

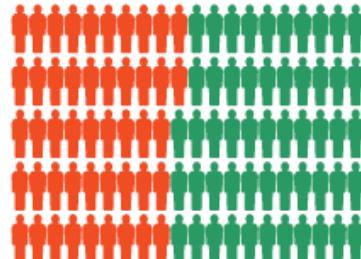


Antibiotics

Urbanization

Stats in the City

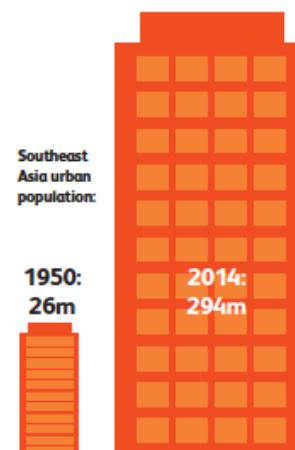
Southeast Asia population 2014:



294m

324m

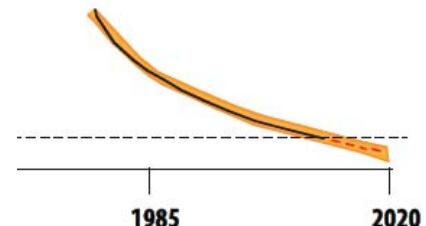
1,000% rise



Biodiversity

STATE

Living Planet Index



1985

2020

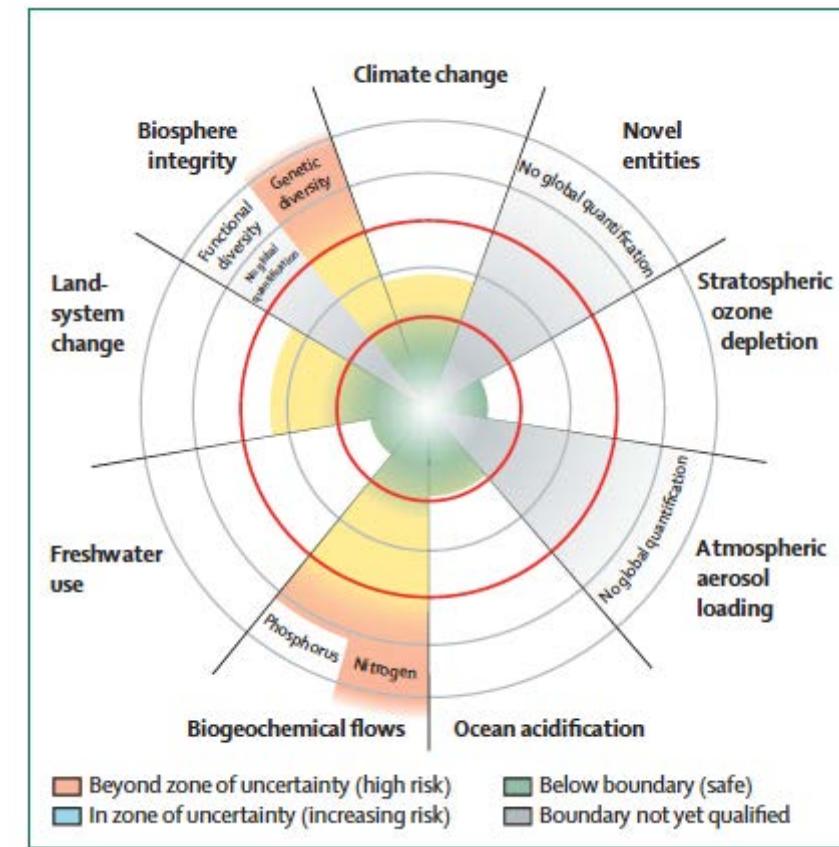
Un autre appel à l'action

**The Rockefeller Foundation-Lancet Commission on
planetary health**

**Safeguarding human health in the Anthropocene epoch:
report of The Rockefeller Foundation-Lancet Commission on
planetary health**

The concept of planetary health is based on the understanding that **human health** and **human civilisation** depend on flourishing **natural systems** and the wise stewardship of those natural systems

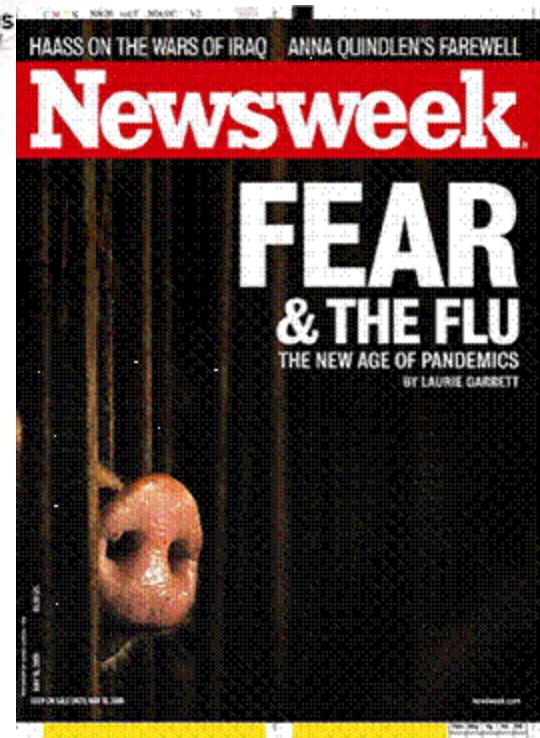
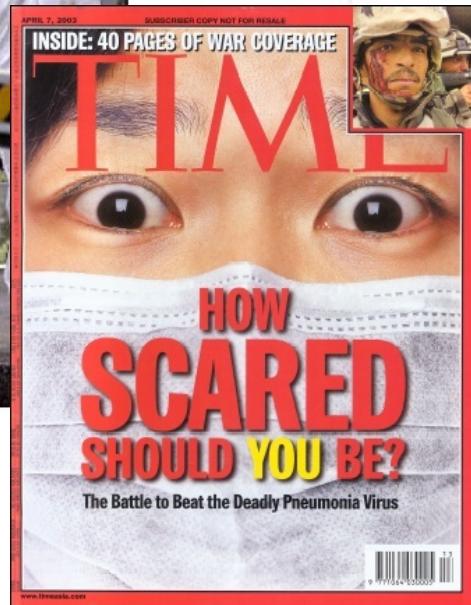
Solutions lie within reach and should be based on the **redefinition of prosperity to focus on the enhancement of quality of life** and delivery of **improved health for all**, together with respect for **the integrity of natural systems**



The present systems of governance and organisation of human knowledge are inadequate to address the threats to planetary health

Le futur que nous voulons

Préparer nos sociétés au pire ? et mettre le monde sous surveillance

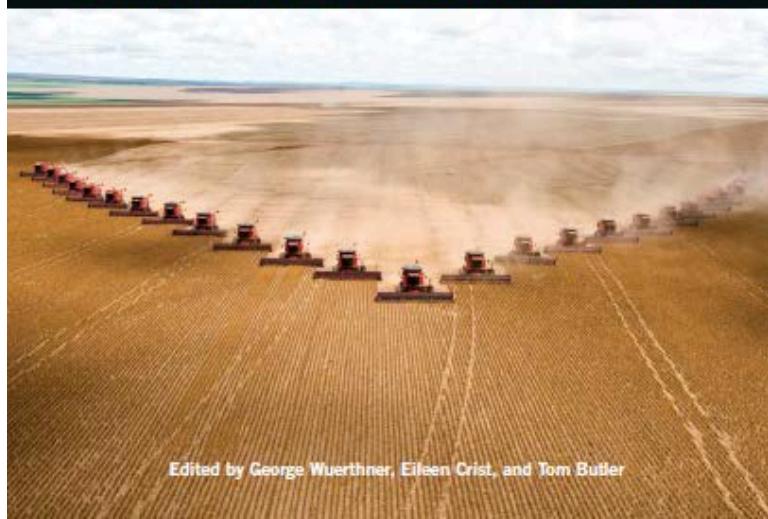


ou préserver la biodiversité pour notre santé et notre bien être



KEEPING THE WILD

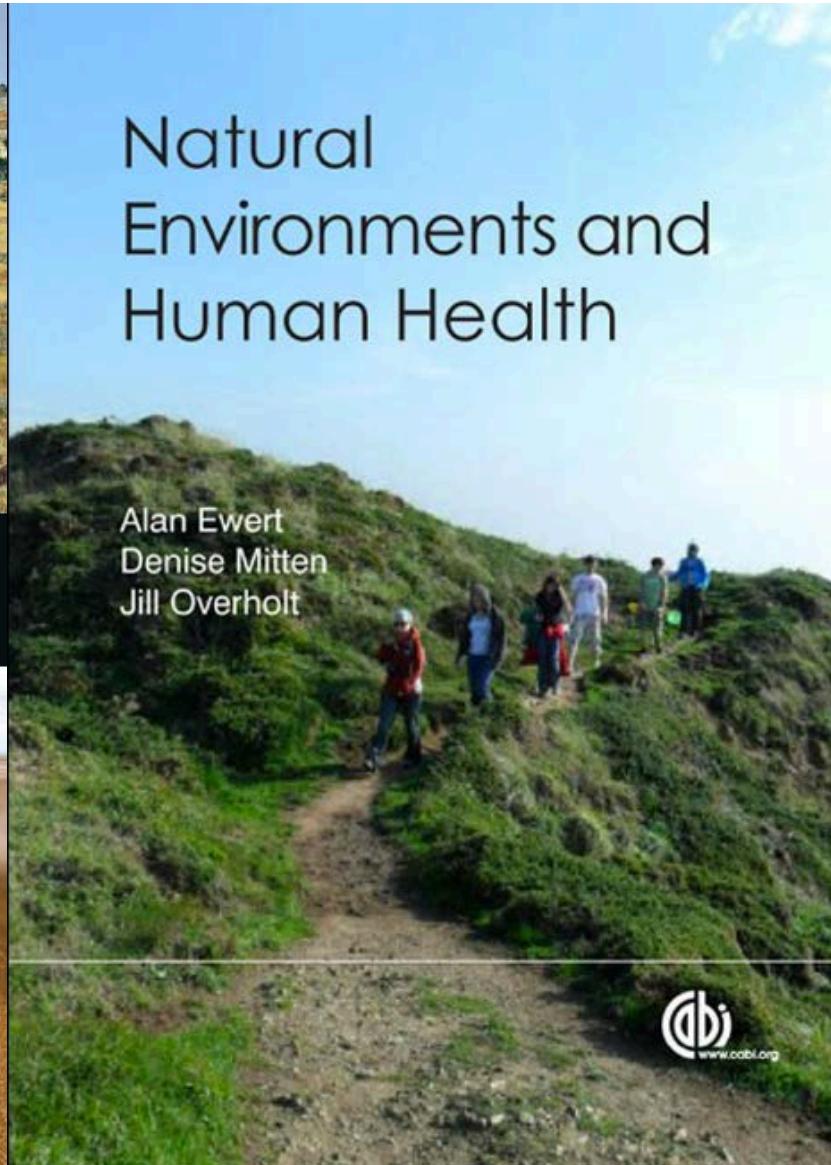
AGAINST THE DOMESTICATION OF EARTH



Edited by George Wuerthner, Eileen Crist, and Tom Butler

Natural
Environments and
Human Health

Alan Ewert
Denise Mitten
Jill Overholt



Merci

