

# Conference

## Biodiversity and Re/insurance



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### The power of Biodiversity

# What is biodiversity ? The need for being inclusive



Beautiful, useful



ugly, dangerous



or



Most organisms belong to both kinds : **no angels, no devils !**

Biodiversity includes **all** living beings and the systems they form, including us !

**They may all contribute to our lives**

# The contributions of biodiversity : a few significant examples

Paper wasps are often perceived as a disturbance

They are actually garbage cleaners, pollinators and even more ...



## Role of social wasps in *Saccharomyces cerevisiae* ecology and evolution

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Polistine wasps shelter yeast during winter and contaminate grapes in the summer  
... permitting alcoholic fermentation and winemaking

# Multiple contributions of biodiversity : a few significant examples

Coral reefs are famous biodiversity systems

... bleaching with the rise of sea temperature  
and water acidification



## LETTER

doi:10.1038/nature12677

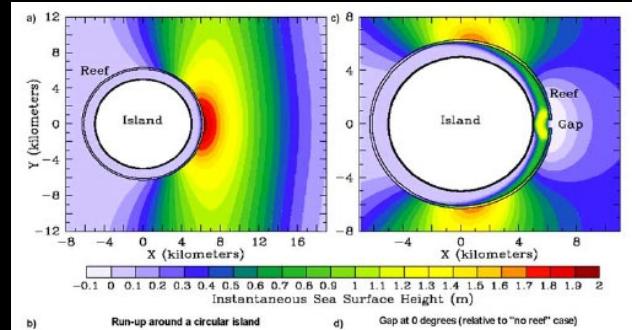
### DMSP biosynthesis by an animal and its role in coral thermal stress response

Jean-Baptiste Raina<sup>1,2,3</sup>, Dianne M. Tapiolas<sup>2</sup>, Sylvain Forêt<sup>3,4</sup>, Adrian Lutz<sup>2,3,5</sup>, David Abrego<sup>2†</sup>, Janja Ceh<sup>6</sup>, François O. Seneca<sup>1,2†</sup>, Peta L. Clode<sup>7,8</sup>, David G. Bourne<sup>2</sup>, Bette L. Willis<sup>1,3</sup> & Cherie A. Motti<sup>2</sup>

Who knows they produce dimethylsulphoniopropionate (DMSP) eliciting cloud formation and climate regulation?

Or that they protect 100-300 million people from tsunamis or rogue waves ?

Kunkel C.M., Hallberg R.W. & Oppenheimer M. (2006). Coral reefs reduce tsunami impact in model simulations. *Geophysical Research Letters*, 33.

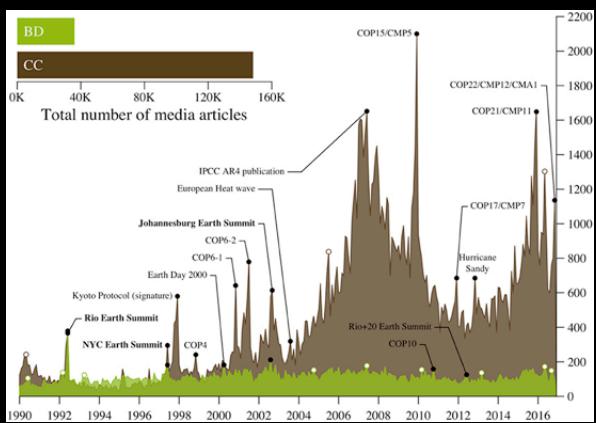
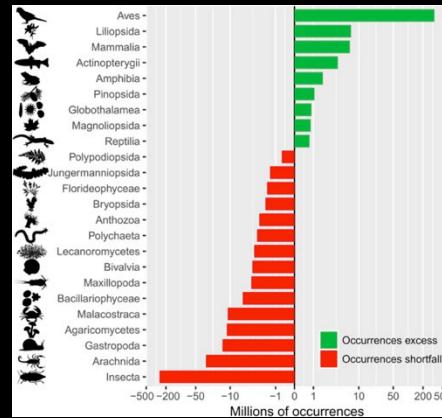


# Biodiversity is not properly perceived or understood

Only 20% is known

≈ 2 million species out of 10

mostly charismatic ones

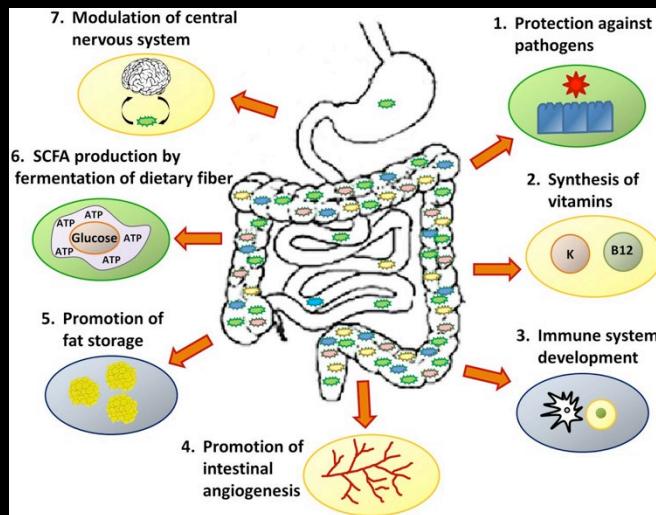


receives much less attention than climate

# Biodiversity is not properly perceived or understood

A large part of biodiversity – the microbes – is invisible, but everywhere and essential

As many bacteria as cells in our body :  
mostly invaluable  
5000 bacteria species  
>100 species on our hands !



## Biodiversity is not properly perceived or understood

Interactions are permanent and essential : no life in isolation



Most trees with fungus associates (the mushroom is not the mycete !)

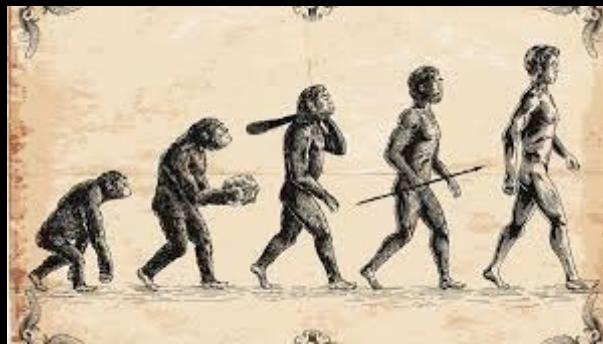
75% of plants need animal pollination for reproduction (or production increase)

All corals have obligatory algal associates

# Biodiversity is not properly perceived or understood

Evolution is naively portrayed as a slow process with

very old events



and naïve grades

# Biodiversity is not properly perceived or understood

Actually, biodiversity evolves every day :

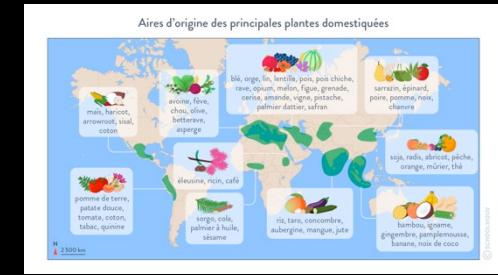
*Every reproduction event or survival differential is evolution*  
E.g., we transmit 100-150 mutations to our kids

Evolution is pervasive in many aspects of our life:



Antibioresistance  
Vaccine escape

Domestication  
Adaptation



# The biodiversity crisis : 5 main causes of the decline

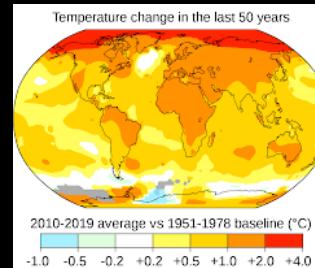
Here again, biodiversity is not easy to deal with

The crisis cannot be essentialized to one process as for climate

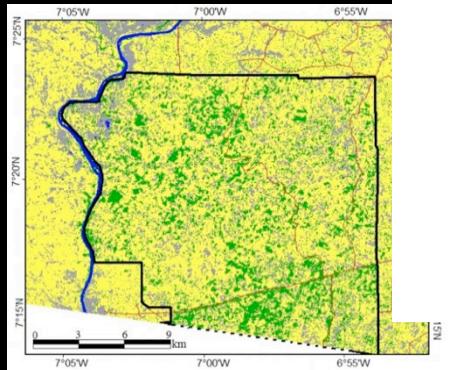
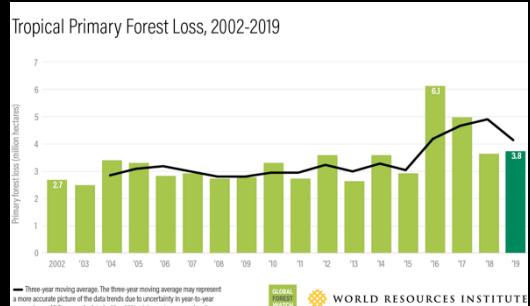
!!! Tippings points for nitrogen, phosphorus, and biodiversity !!!

Five causes, all anthropogenic :

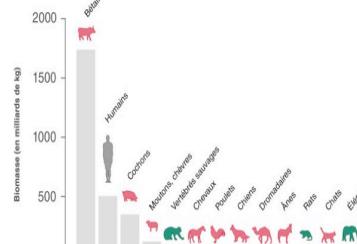
- Land conversion
- Extraction (logging, fishing)
- Pollution (agrochemicals, plastic)
- Climate change
- Invasive exotic species



# The biodiversity crisis: land conversion



3 – LES ANIMAUX DOMESTIQUES DOMINENT LA PLANÈTE  
(Morand & Lajaunie, 2017, données de Václav Smil)



Deforestation does not slow down:

loss of 200 millions hectares of natural forest in 40 years

Fragmentation increases exponentially edge effect, poaching and zoonoses

Linked to both extraction and dramatic increase of domestic livestock

75% of wet areas disappeared during Anthropocene

loss of carbon storage and water regulation

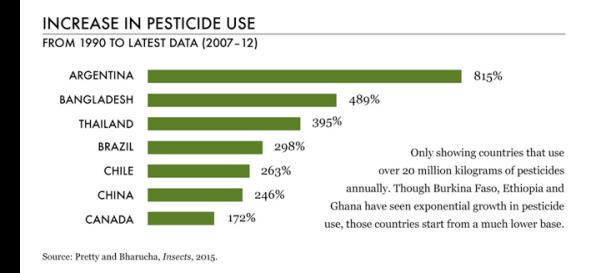
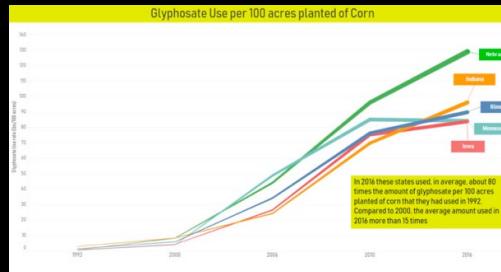
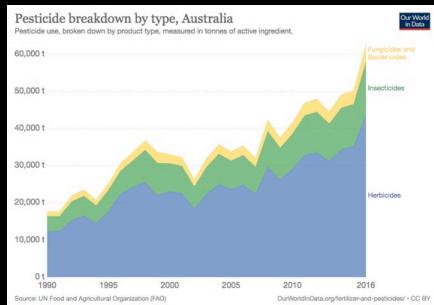
Millions of kilometers of hedges or pastures disappeared

decrease of landscape and biotic diversity and carbon storage

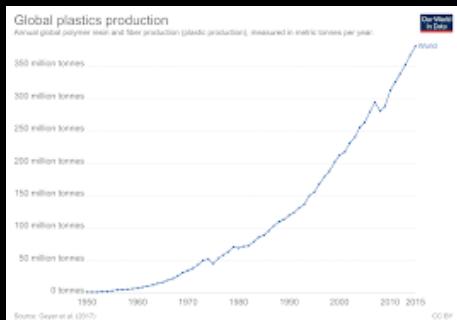
# The biodiversity crisis : ever-increasing pollutions

**Pesticides** : more toxic, today 25 million tons/year ...

Fertilizers (N, P) : 200 million tons/year ...



**Plastic** : 270 million tons/year



40 000 new synthetic molecules,  
6000 are frequent

Many are **endocrine disruptors**

Induced costs in Europe : 157 billion € (1,23% PIB)

# The biodiversity crisis : exotic invasive species

With globalization since 1970: rise by 70% across 21 countries



1400 billion \$ for the world economy (5%)

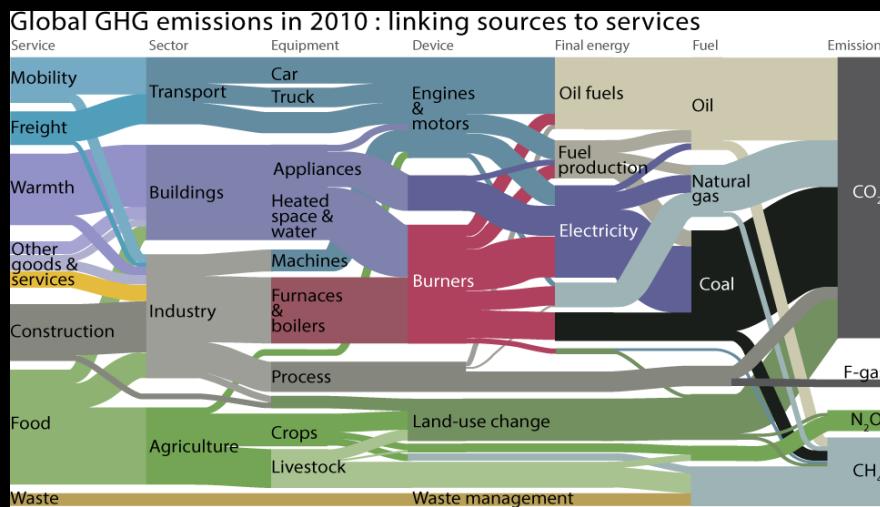
- pest in cultures, genetic pollution
- pathogens and emergence of diseases
- ecosystem disruption



Eradication extremely difficult: reproduction and evolution are strong engines !

# The biodiversity crisis : climate change is biological too

Climate change is misleadingly presented as resulting from the greenhouse effect with gases emitted by using fossil fuels



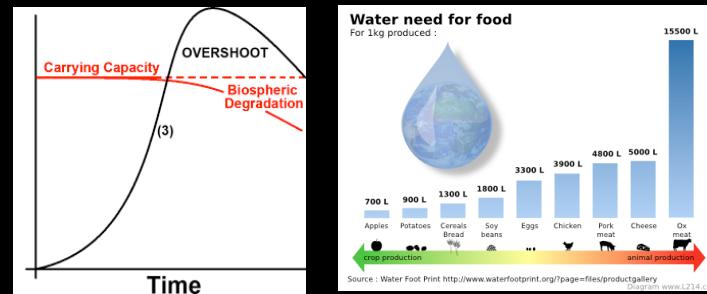
Bajželj B., Allwood J.M. & Cullen J.M.  
(2013). Designing Climate Change  
Mitigation Plans That Add Up.  
*Environmental Science & Technology*,  
47, 8062-8069.

Actually, food production is strongly involved in:

- emitting greenhouse gases such as nitrogen oxide and methan,
- the release of carbon stocks,
- destruction of carbon pumps
- and emission of fine particulates

# Biodiversity services – food, water, climate – are not immanent

Industrial **food** will become prominent for people more and more in large cities :  
limited by soil biology, nitrogen and Phosphorus, pollination  
→ reached a ceiling



Water supply is limited with climate change, food production and loss of wet areas  
→ 2/3 human beings under water stress in the next decades

Biotic Extreme events : ecosystems are intricate with counter-intuitive rules  
→ invasive, downward spirals, epidemics ...

# Biodiversity: so powerful !

This is a hard job to cope with the power of biodiversity:

It reproduces, disperses, evolves ...

We cause global disturbance or destruction -> crises



But we experience endless difficulties with single species  
-> invasive, pathogens ... SARS-Cov-2

