



# Biodiversité, science et société

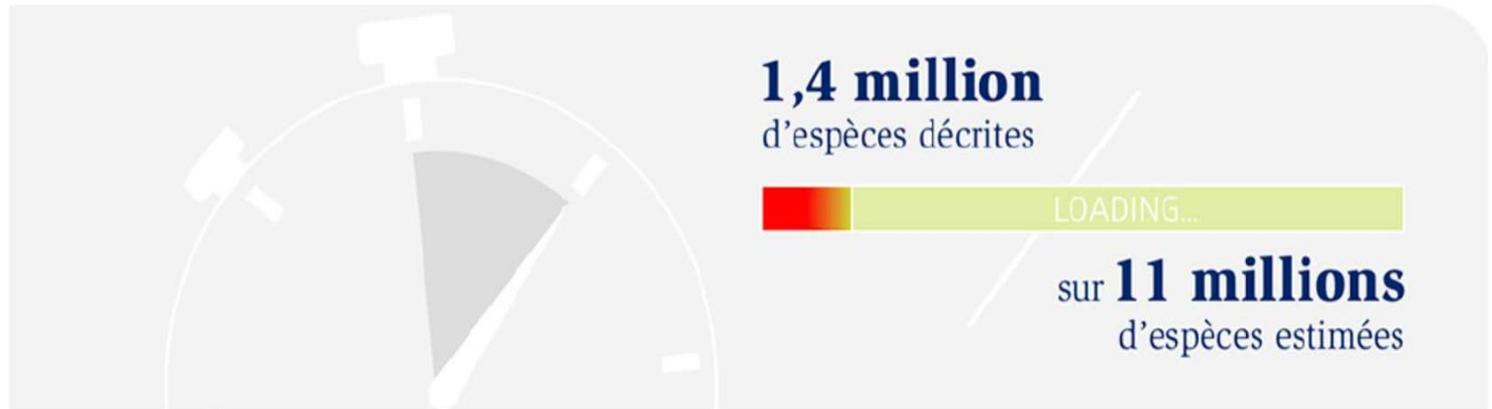
Hélène SOUBELET  
Fondation pour la recherche sur la biodiversité (FRB)

Membres  
Fondateurs  
de la FRB:





## Le vivant, inconnu

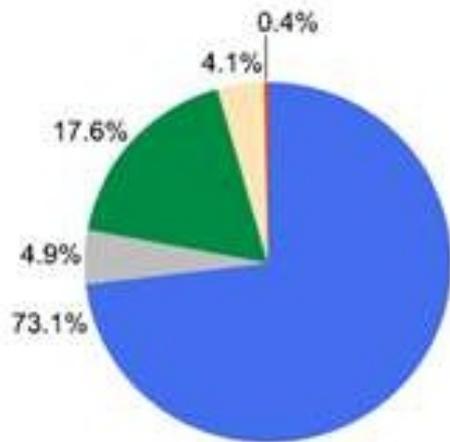


Groupe	Espèces déjà décrites	Espèces à décrire	
		Estimation la plus haute	Estimation probable
Virus	5 000	500 000	500 000
Bactéries	4 000	3 000 000	400 000
Champignons	80 000	1 500 000	1 000 000
Protozoaires	40 000	100 000	200 000
Végétaux	250 000	500 000	300 000
Vertébrés	45 000	50 000	50 000
Nématodes	15 000	1 000 000	500 000
Mollusques	70 000	180 000	200 000
Crustacés	130 000	150 000	150 000
Arachnides	75 000	1 000 000	750 000
Insectes	950 000	100 000 000	8 000 000

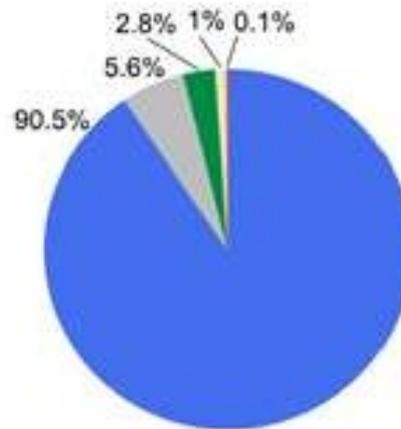
= 1 664 000

≈ 11 750 000

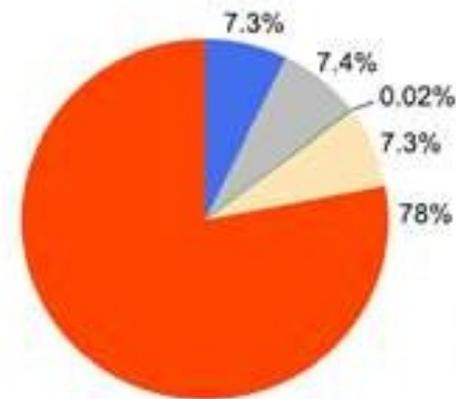
## Le vivant, inconnu



Wilson (1992)



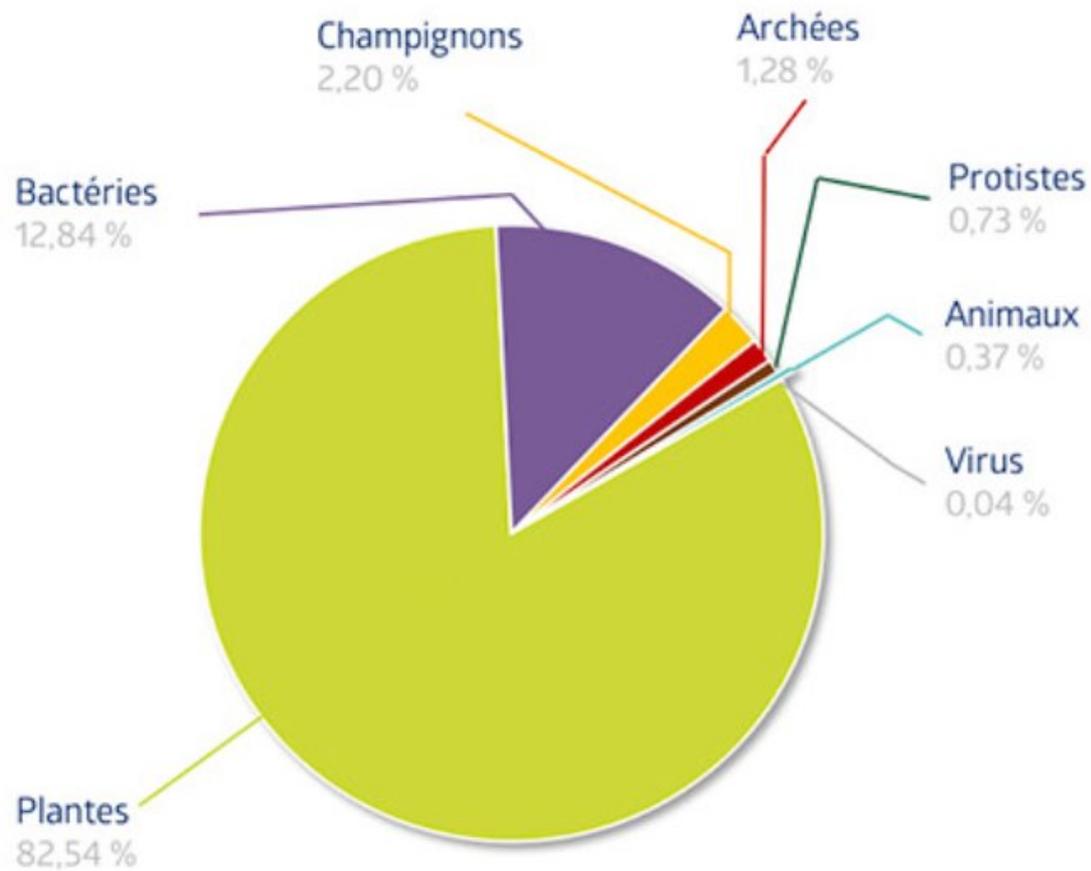
Mora et al. (2011)



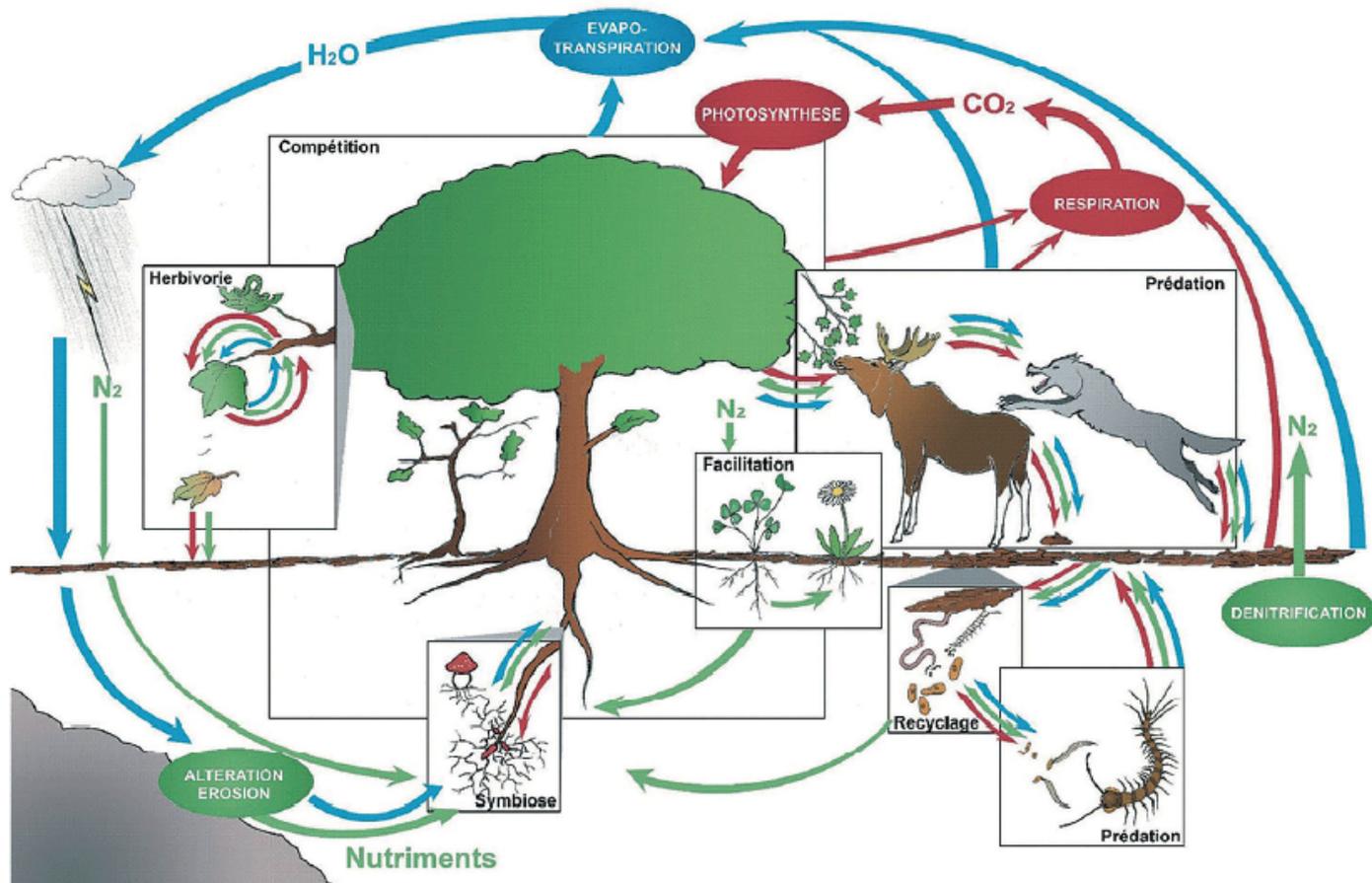
Larsen et al. (2017)



## Le vivant, inconnu



# Le vivant, complexe



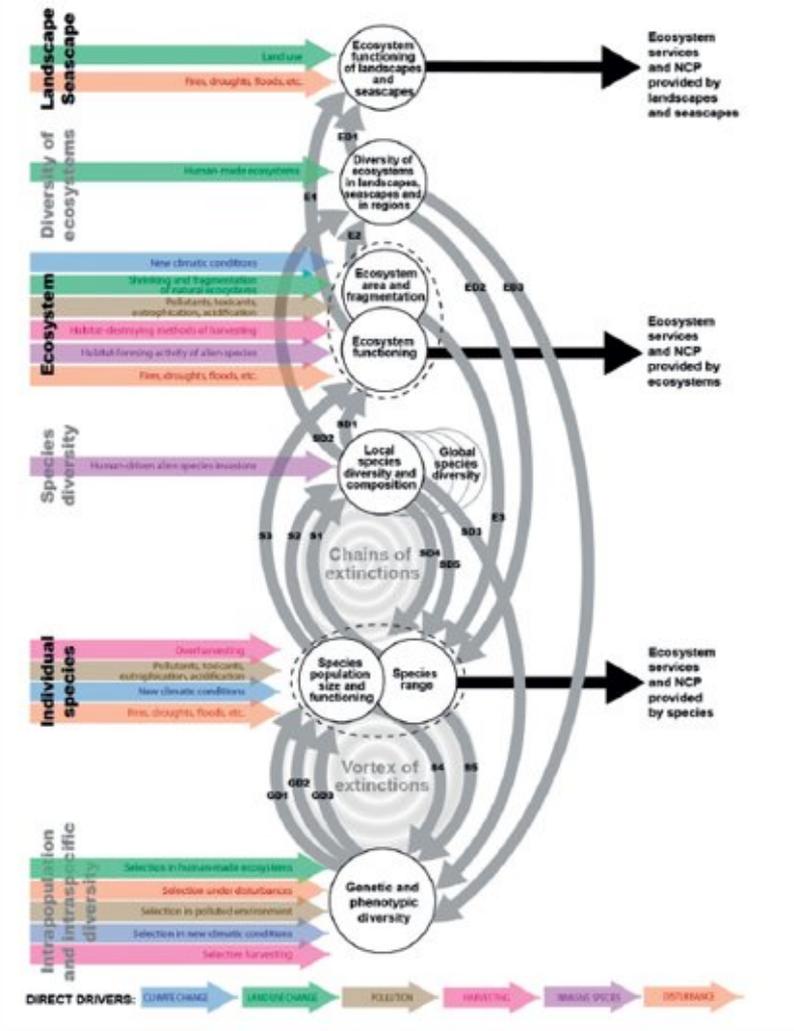
**Figure 4.4:** Représentation schématique des interactions et flux dans les écosystèmes [2]. Schéma I. Gounand. Source: N. Mouquet et al., *Regards sur la biodiversité*, SFE2, Regard R3 (2010). [<https://www.sfecologie.org/regard/regards-3-mouquet/>]

# Le vivant, complexe

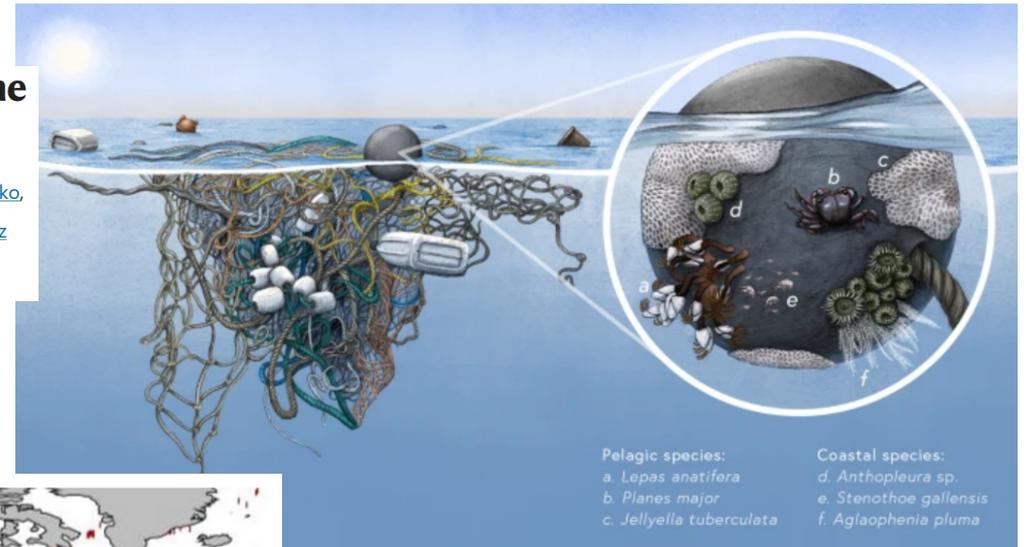
Box 4.2 The main interrelations and feedbacks between hierarchical levels that are important for the future of biodiversity.

Direct drivers of global change affect all levels of biodiversity, either directly (coloured arrows) or indirectly through feedbacks (grey arrows). Even one-way interactions are important for

biodiversity response, while self-reinforcing feedbacks can potentially significantly increase expected negative effects of global change drivers (for details, see Appendix 4.2).



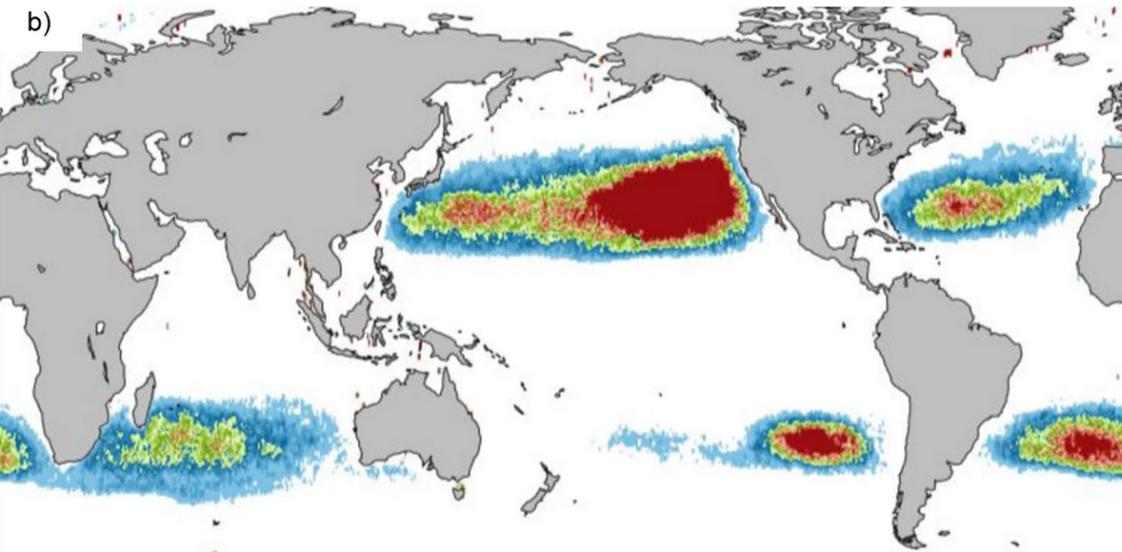
**Fig. 1: Neopelagic community rafting on floating plastic debris in ocean surface waters.**



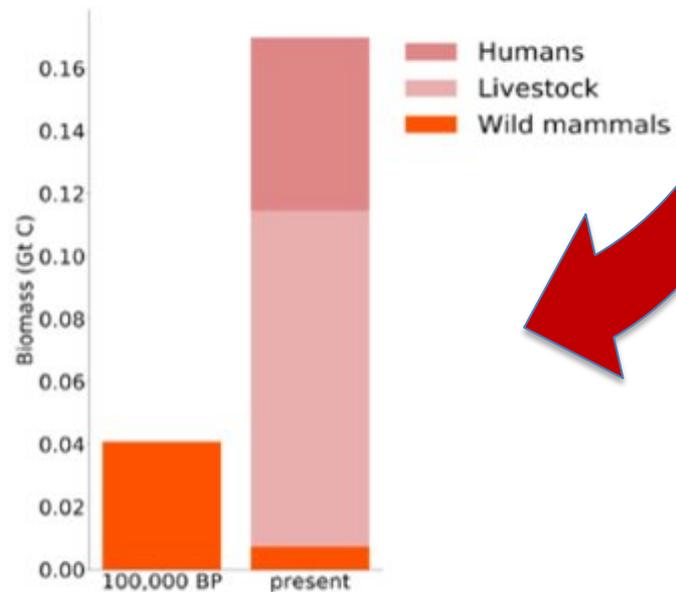
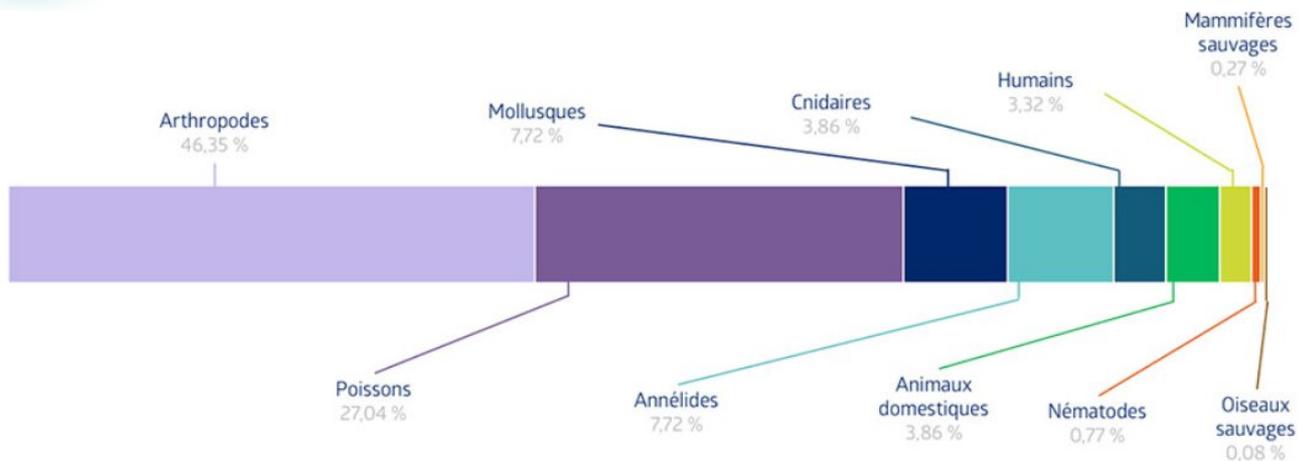
## Emergence of a neopelagic community through the establishment of coastal species on the high seas

Linsey E. Haram , James T. Carlton, Luca Centurioni, Mary Crowley, Jan Hafner, Nikolai Maximenko, Cathryn Clarke Murray, Andrey Y. Shcherbina, Verena Hormann, Cynthia Wright & Gregory M. Ruiz

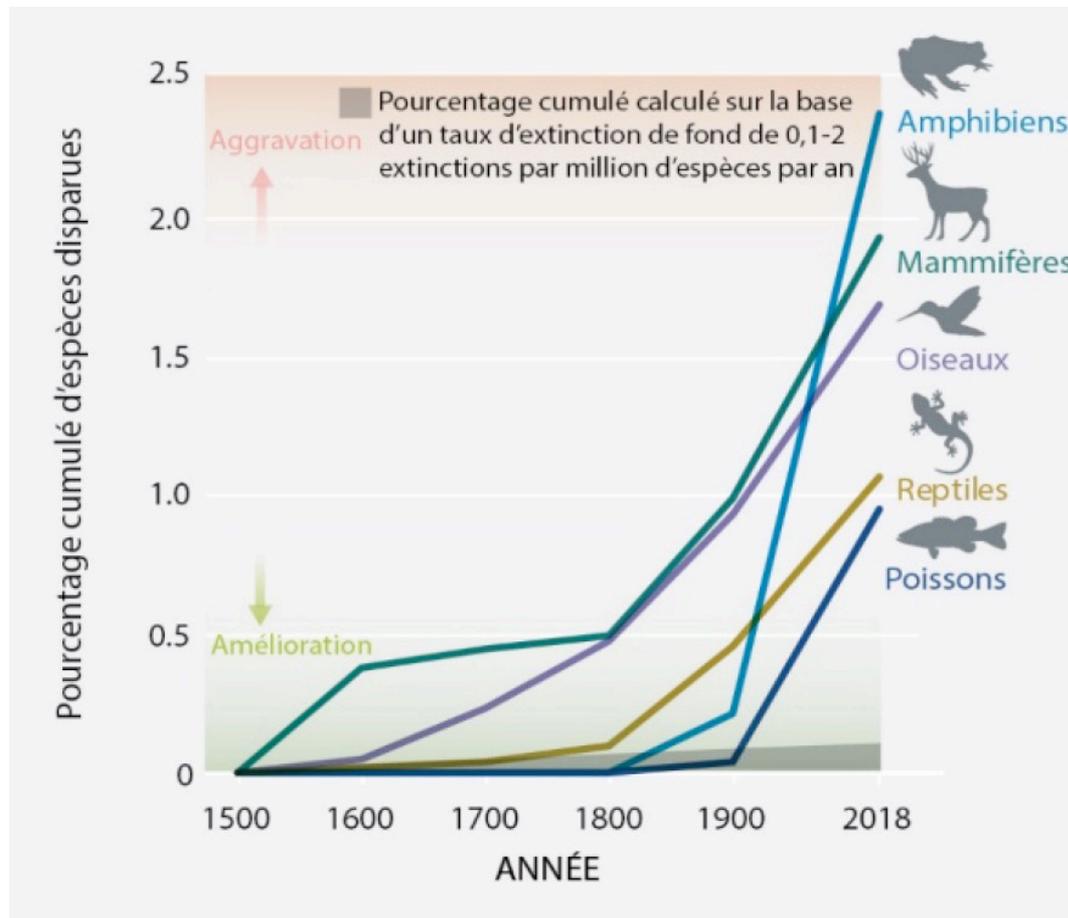
*Nature Communications* 12, Article number: 6885 (2021) | [Cite this article](#)



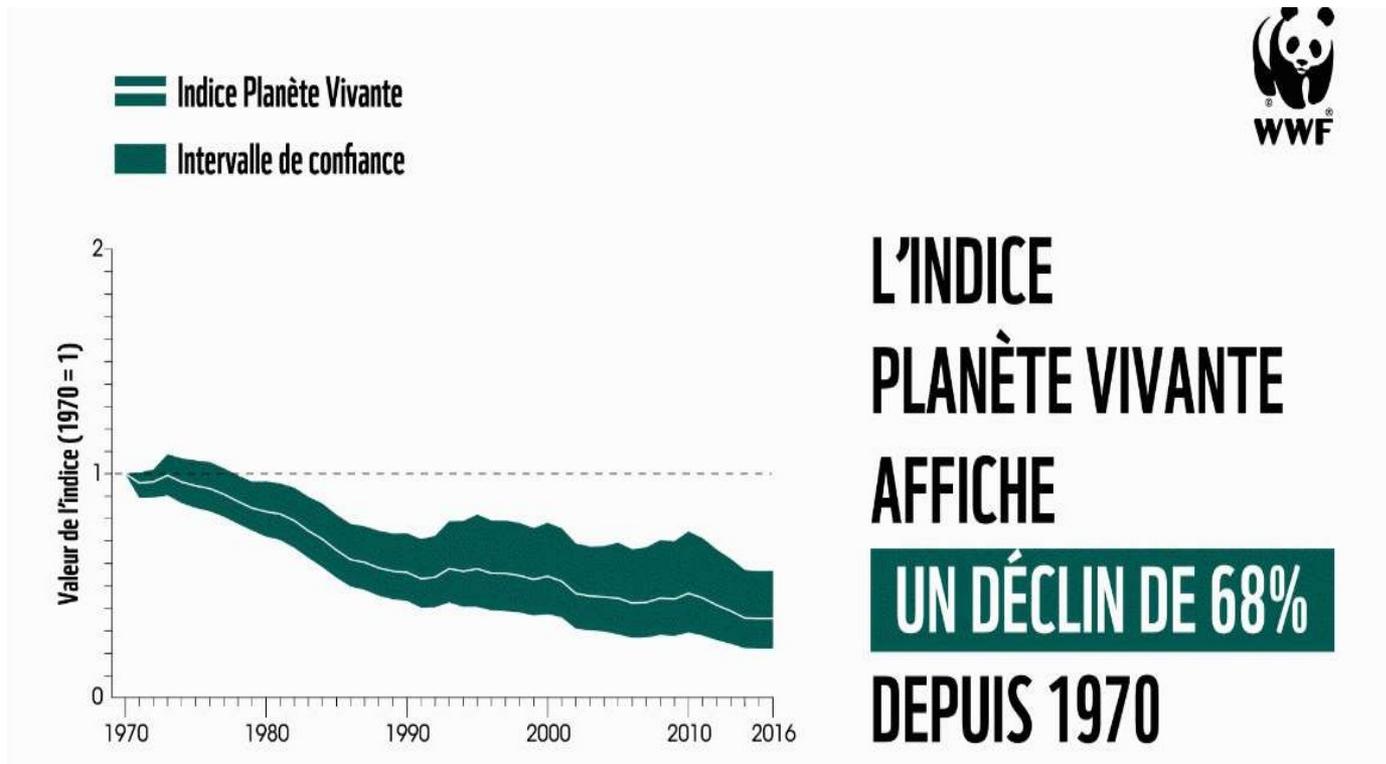
# La biodiversité s'effondre



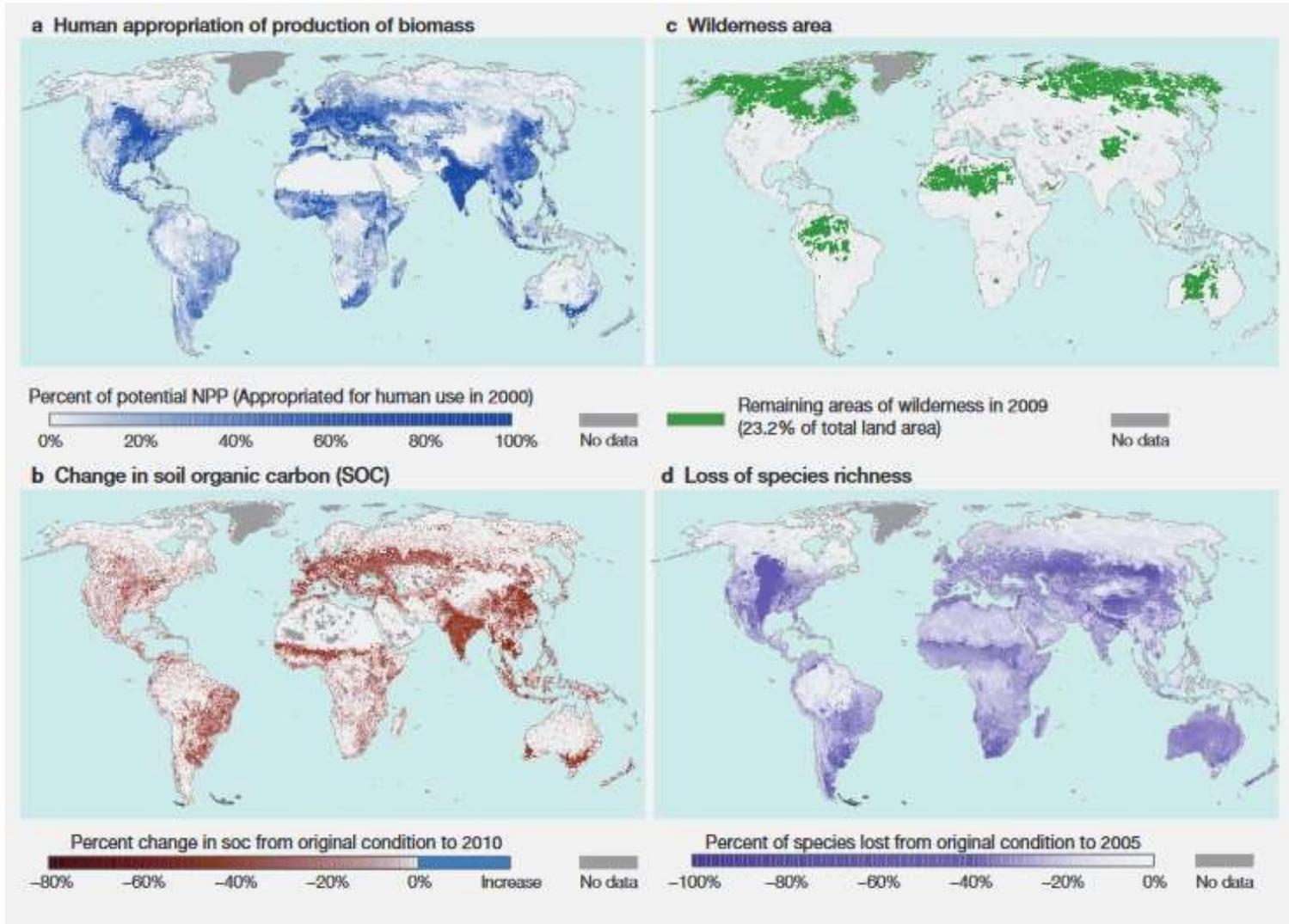
## La biodiversité s'effondre



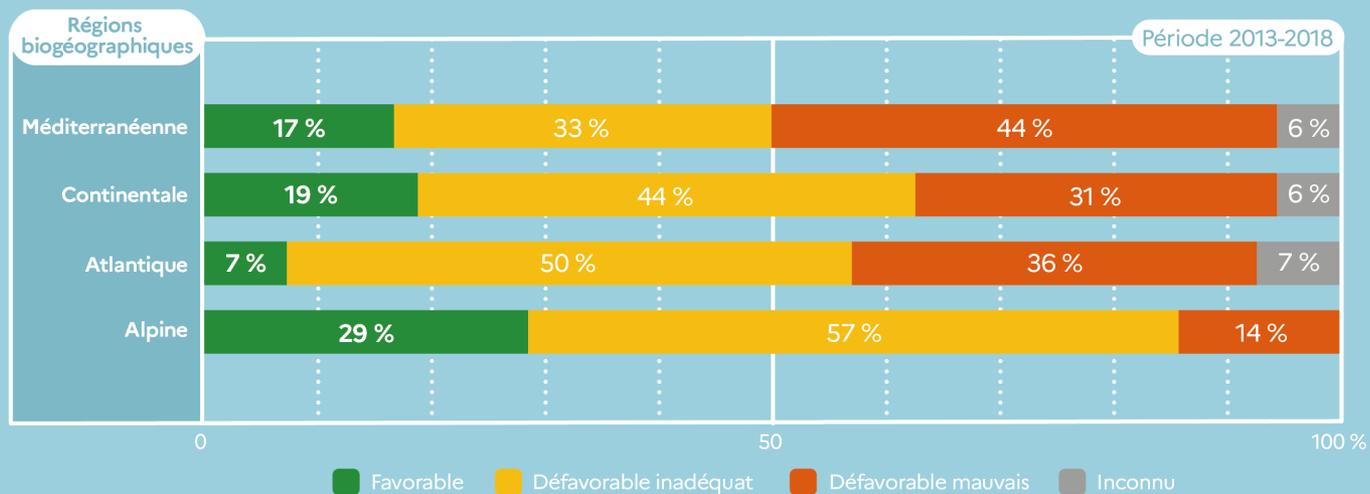
## La biodiversité s'effondre



# La biodiversité s'effondre

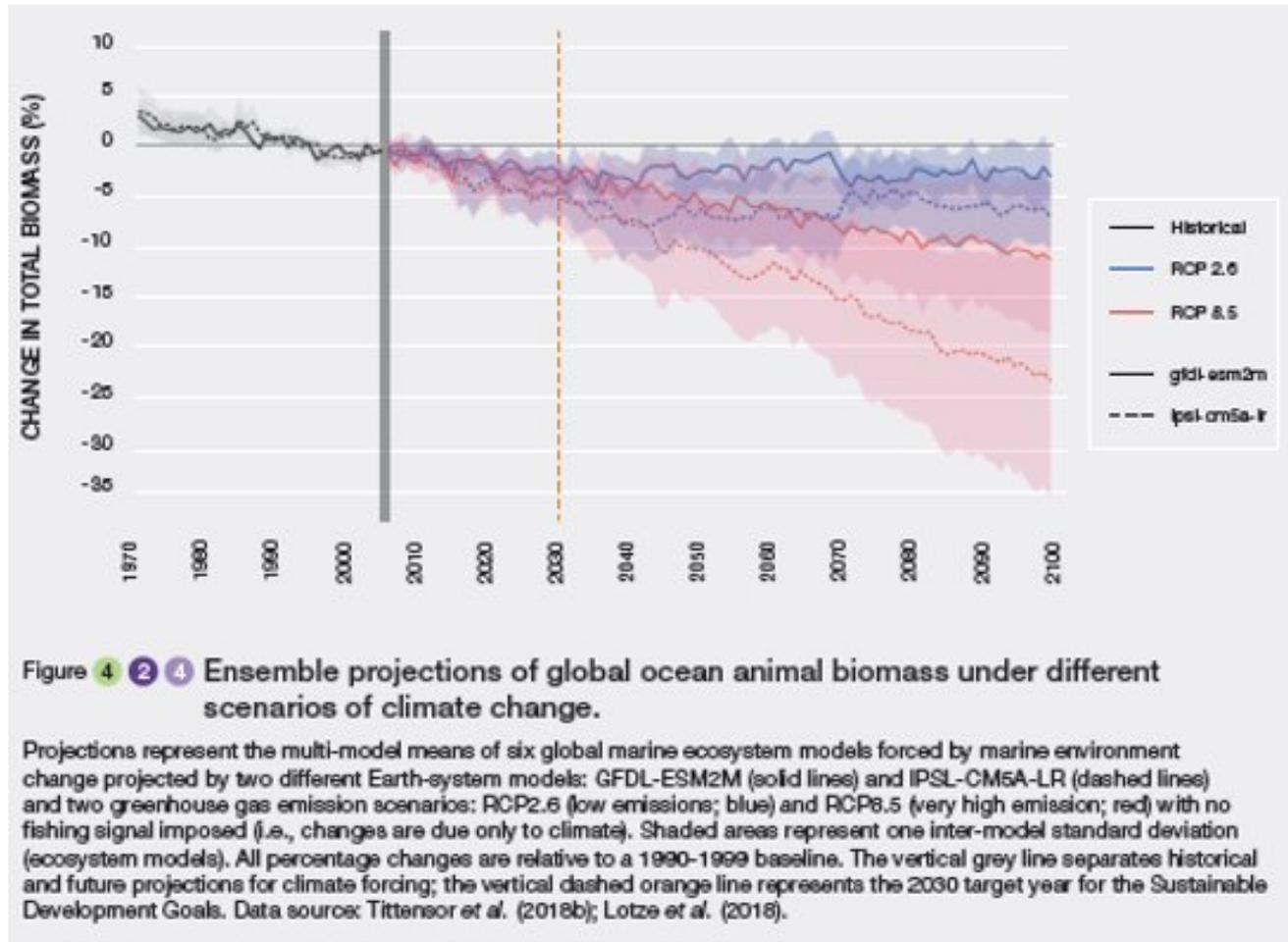


## État de conservation des habitats forestiers d'intérêt communautaire

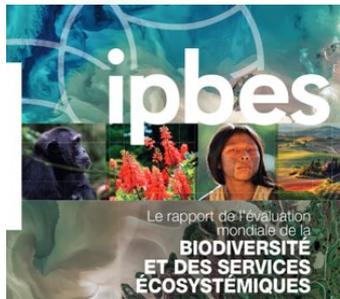


Source : Rapportage DHFF, UMS Patrinat (OFB-CNRS-MNHN), janvier 2020  
 Traitements statistiques : UMS Patrinat - SDES, 2020  
 Réalisation : Olivier Debuf  
 © OFB, 2020

# La biodiversité s'effondre



## Pourquoi ?



[https://ipbes.net/sites/default/files/2020-02/ipbes\\_global\\_assessment\\_report\\_summary\\_for\\_policymakers\\_fr.pdf](https://ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_fr.pdf)

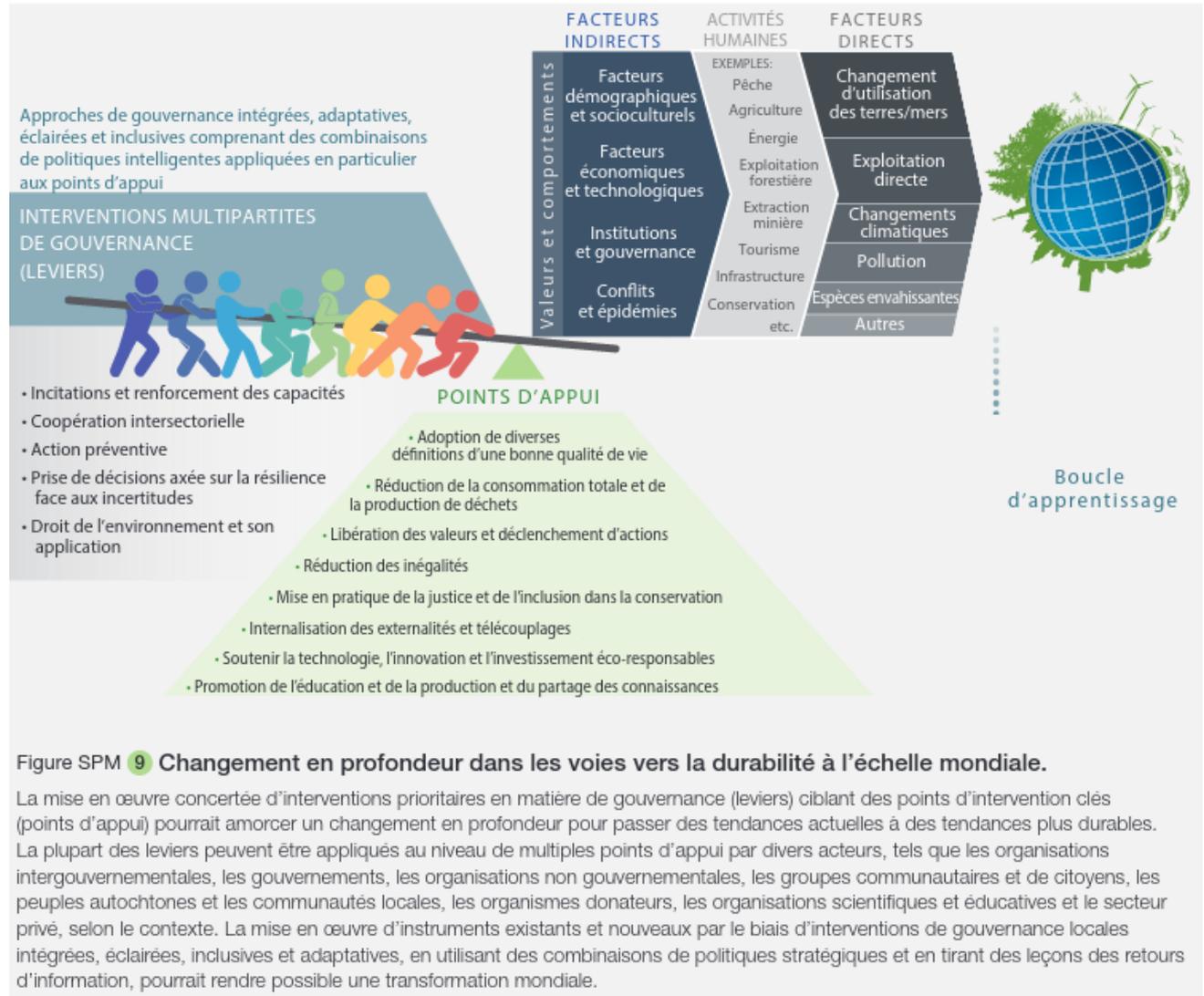
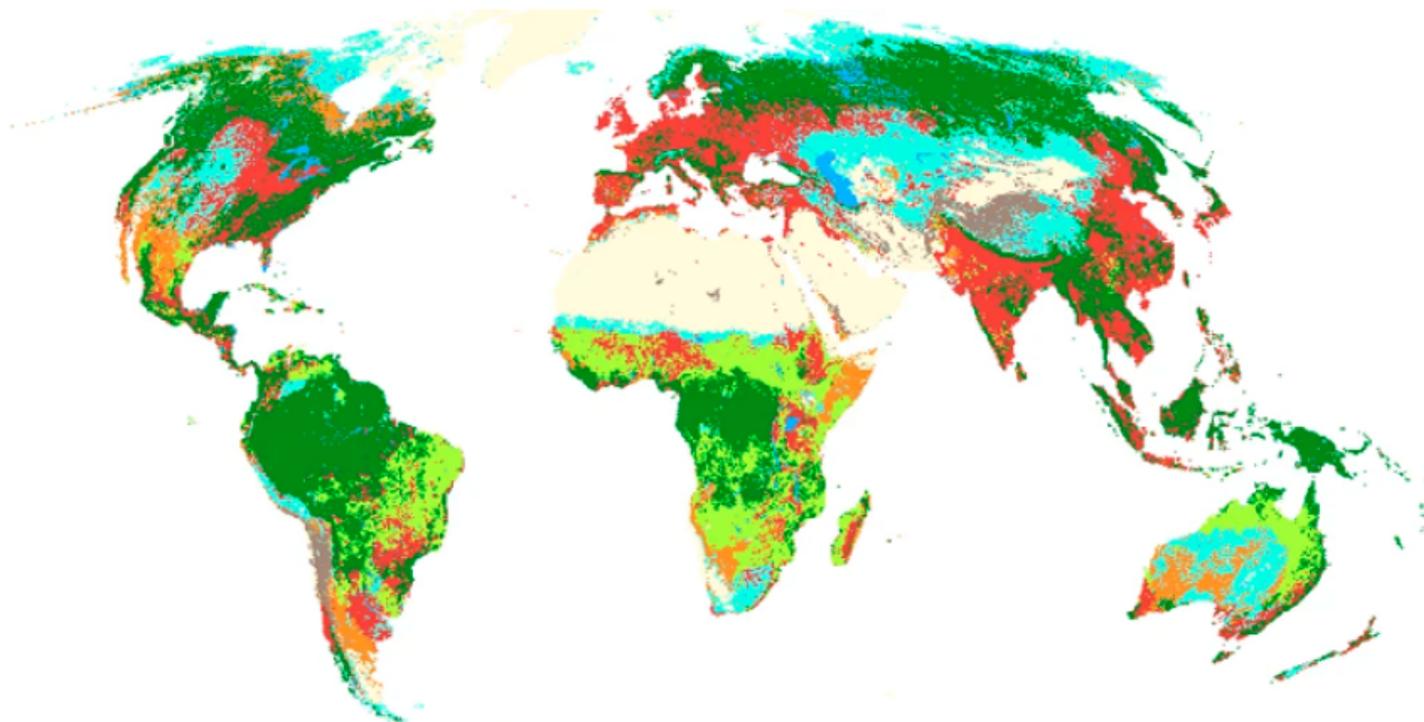


Figure SPM 9 **Changement en profondeur dans les voies vers la durabilité à l'échelle mondiale.**

La mise en œuvre concertée d'interventions prioritaires en matière de gouvernance (leviers) ciblant des points d'intervention clés (points d'appui) pourrait amorcer un changement en profondeur pour passer des tendances actuelles à des tendances plus durables. La plupart des leviers peuvent être appliqués au niveau de multiples points d'appui par divers acteurs, tels que les organisations intergouvernementales, les gouvernements, les organisations non gouvernementales, les groupes communautaires et de citoyens, les peuples autochtones et les communautés locales, les organismes donateurs, les organisations scientifiques et éducatives et le secteur privé, selon le contexte. La mise en œuvre d'instruments existants et nouveaux par le biais d'interventions de gouvernance locales intégrées, éclairées, inclusives et adaptatives, en utilisant des combinaisons de politiques stratégiques et en tirant des leçons des retours d'information, pourrait rendre possible une transformation mondiale.

## Pourquoi ?

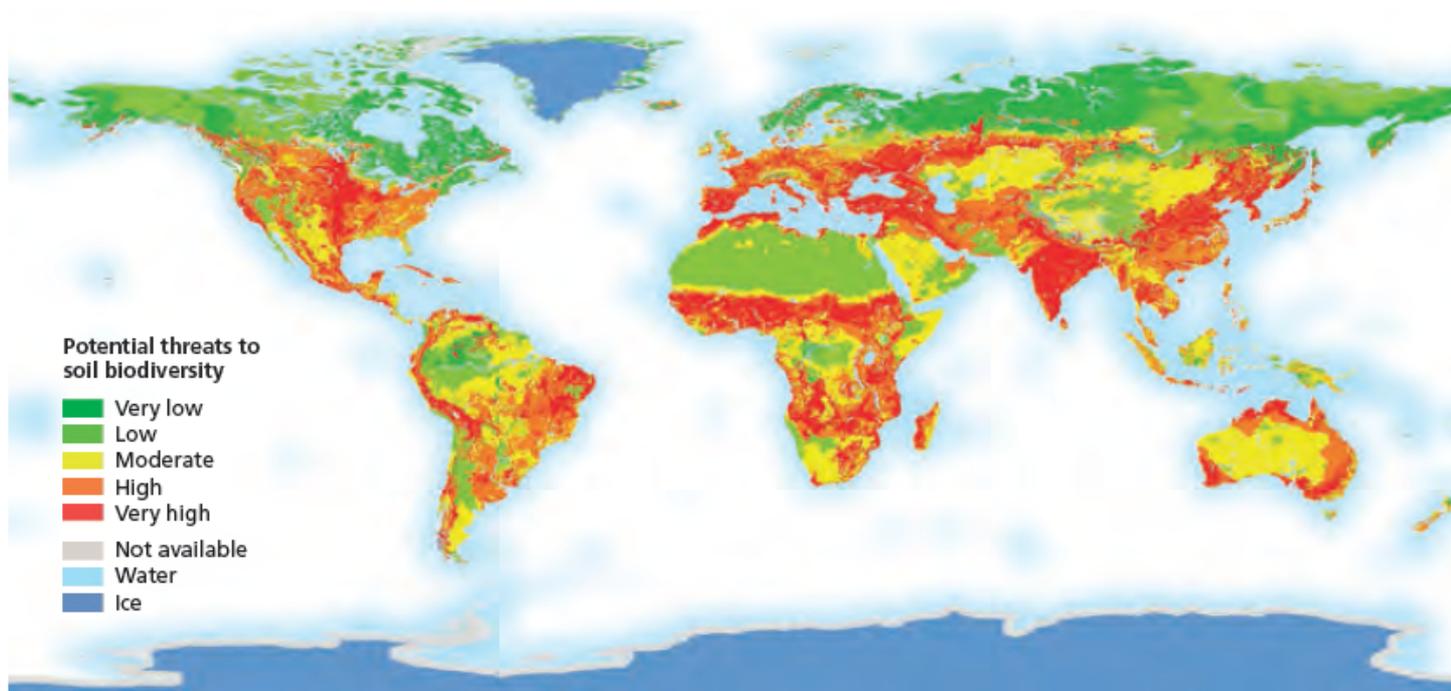
a



## Pourquoi ?

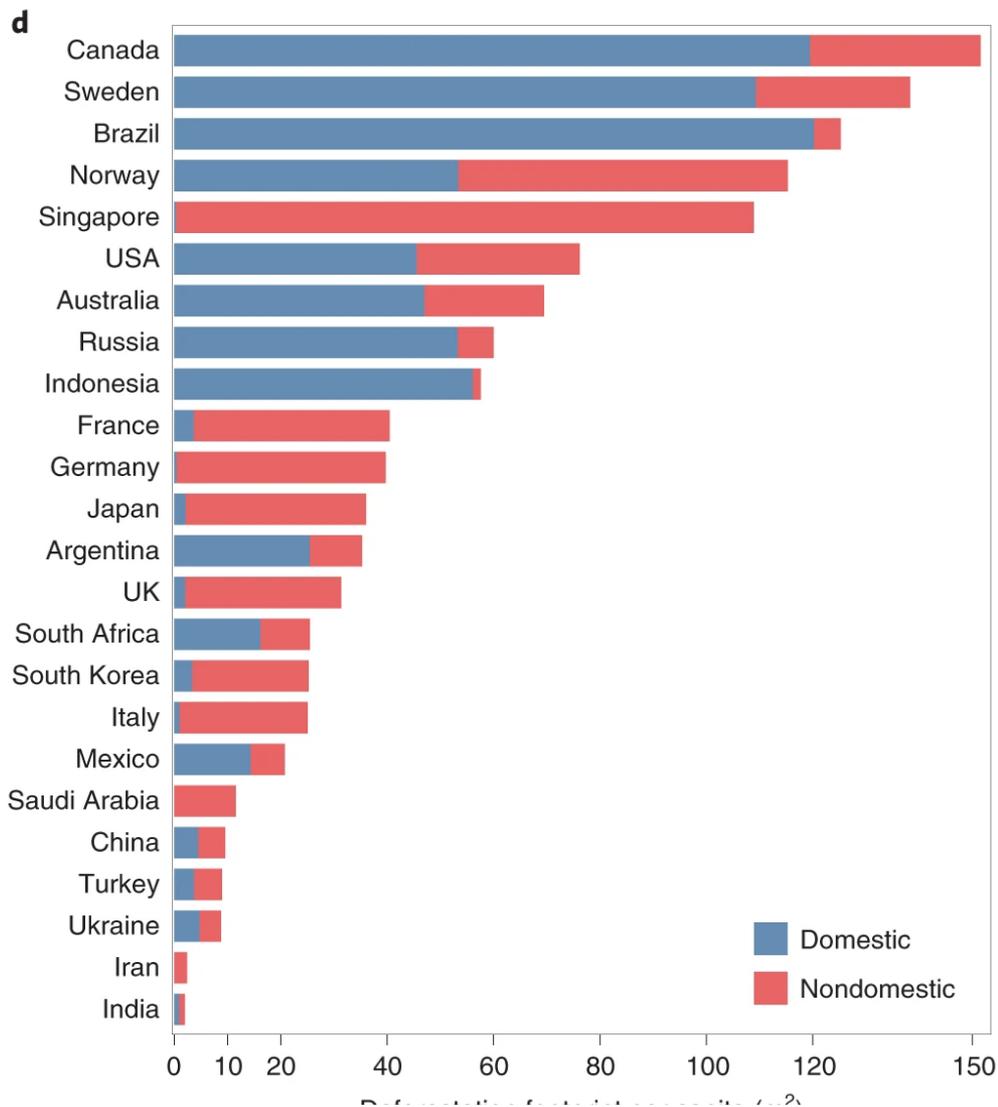
### Map of potential threats to soil biodiversity

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Source: Orgiazzi *et al.*, eds., 2016. © European Union, 2016.

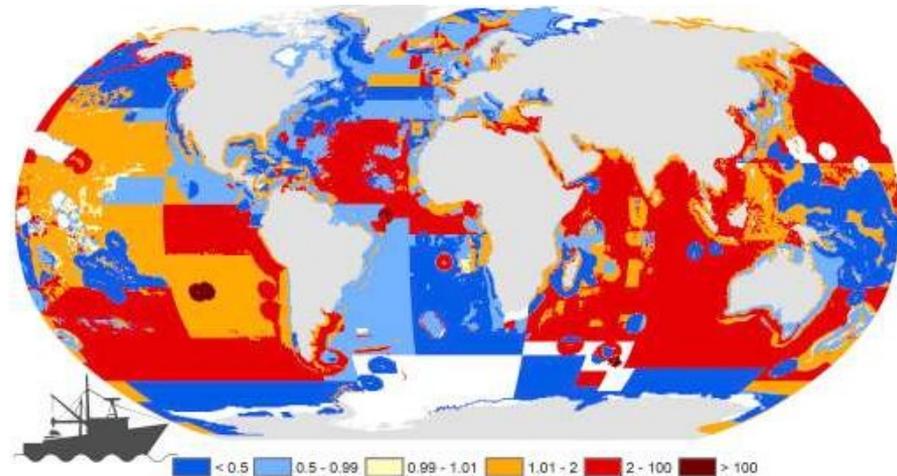
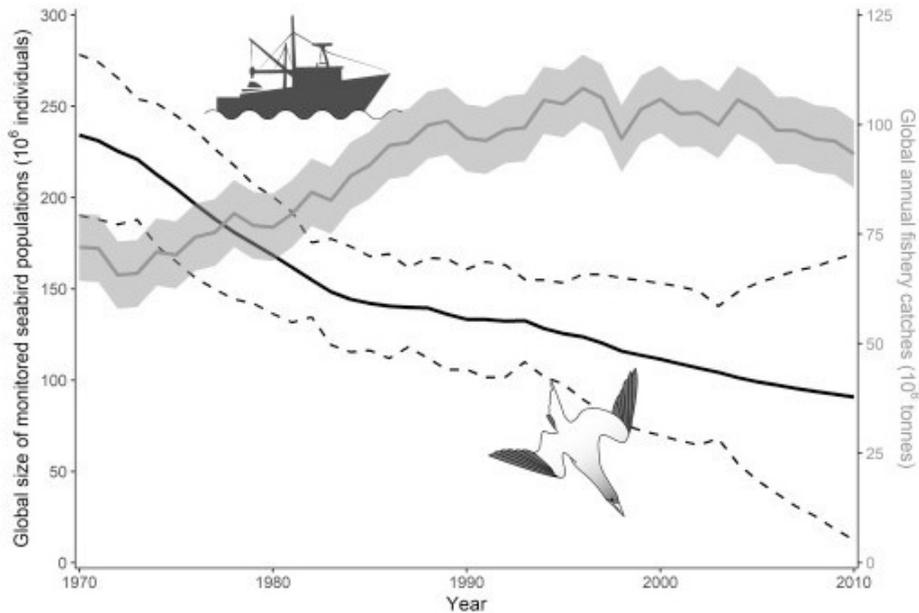
## Pourquoi ?



*Contributions à la déforestation, par pays, en m<sup>2</sup> par habitant : Ten Hoang and Kanemoto (Nature Ecology and Evolution, 2021)*

## Pourquoi ?

**55% de l'océan est exploité par les pêcheries industrielles**  
**33% des stocks de poissons sont pêchés à des niveaux non durables**

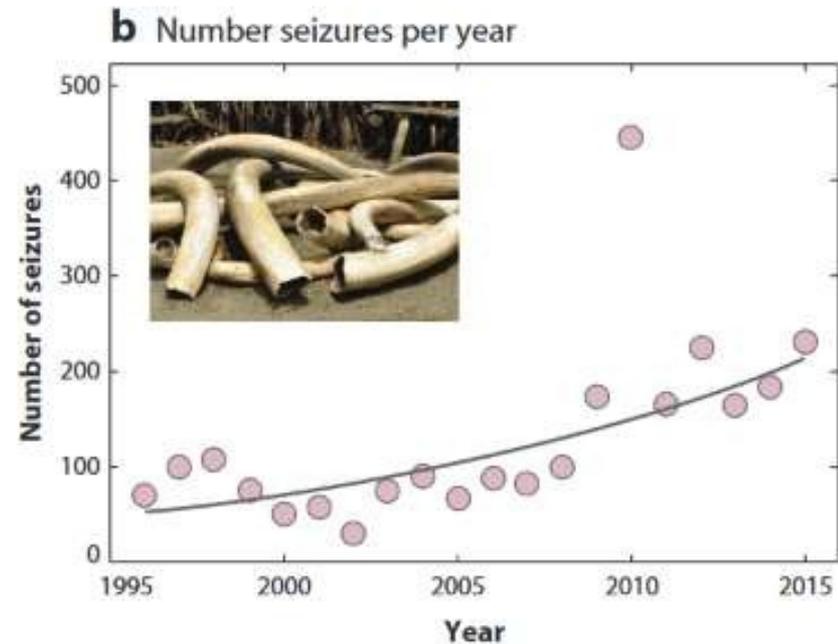
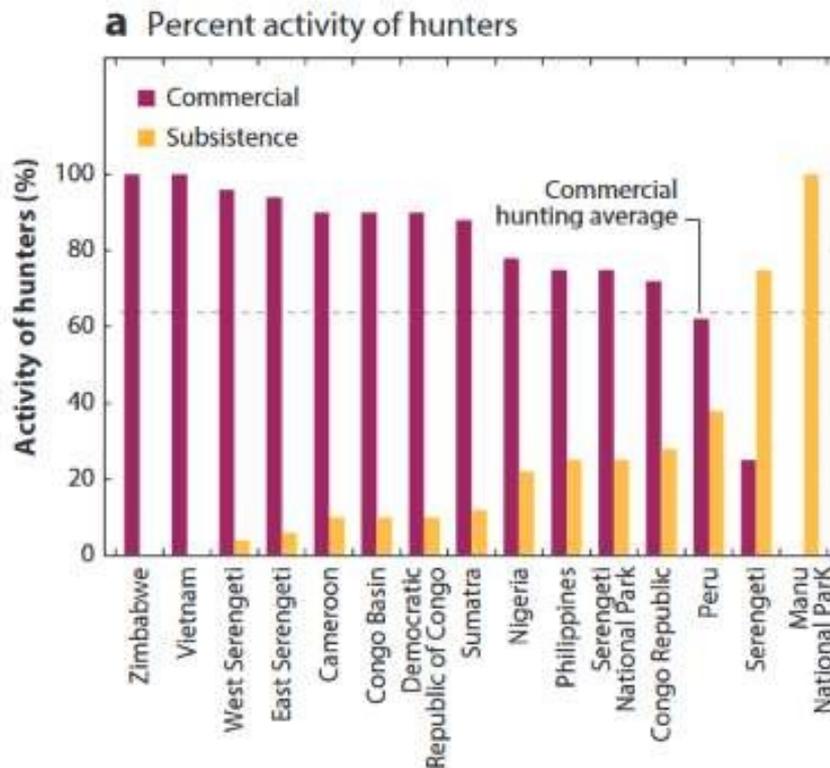


Gremillet *et al.* dec 2018

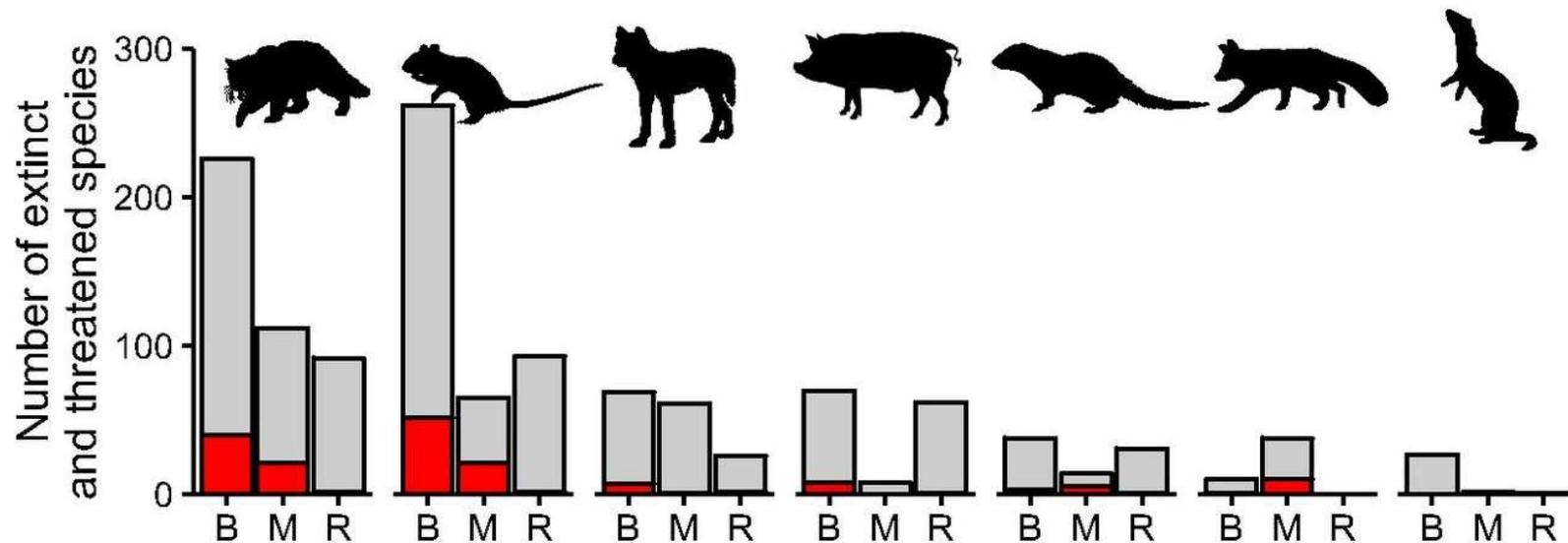
## Les causes

500 millions d'animaux sont capturés ou tués illégalement tous les ans pour des sommes avoisinant 14,5 milliards d'euros [7-23 milliards de dollars US].

Le commerce legal représente 107 milliards de dollars US



# Les causes



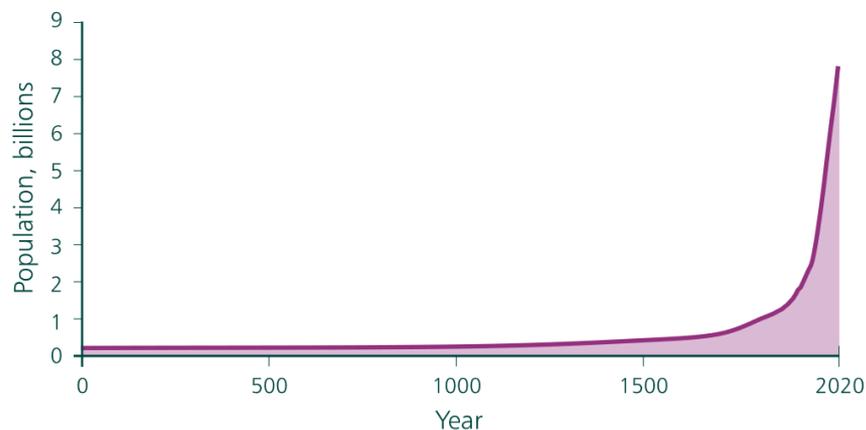
2 of 9

## Invasive predators and global biodiversity loss

Tim S. Doherty, Alistair S. Glen, Dale G. Nimmo, Euan G. Ritchie, and Chris R. Dickman  
 PNAS October 4, 2016 113 (40) 11261-11265; first published September 16, 2016; <https://doi.org/10.1073/pnas.1602480113>

## Pourquoi ?

Figure 0.2 Global Population from Year 0 CE



Source: Maddison (2001), UNPD (2019a).

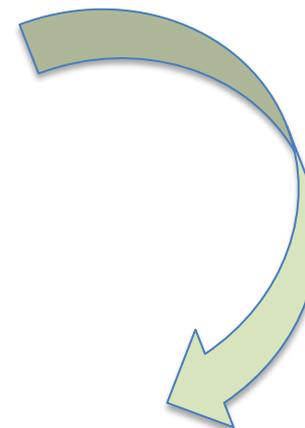


Table 0.2 Deep History, 2 – Global Health and Numbers

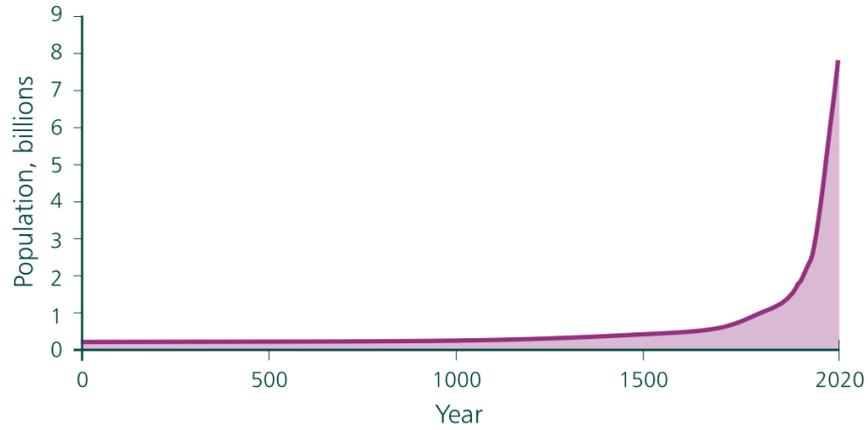
Year	0 CE	1000	1820	1900	1950	2000	2020
Life expectancy at birth (years)	24	24	29	31	46	66	73
Population size, rounded figures (million)	230	270	1,000	1,600	2,500	6,100	7,800

Source: Maddison (2001), Tables 1-5b and B-10, for columns 1-5; UNPD (2019a), for columns 6 and 7. See also the table of life expectancy at birth since 1800 in Riley (2005), which reports that global life expectancy at birth in 1800 was 29 years.

Note: Life expectancy at birth for 1 CE is Roman Egypt, 33-258, estimate. Data from 1950 to 2020 from UN Population Division.

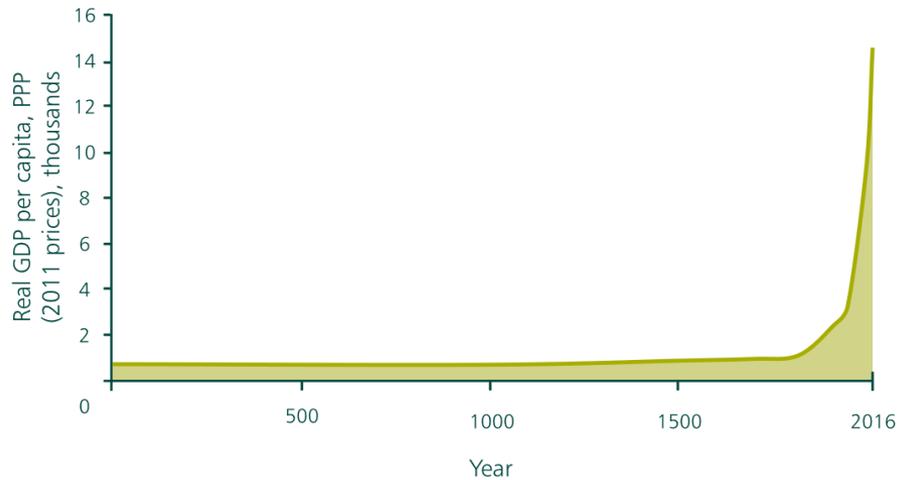
# Pourquoi ?

Figure 0.2 Global Population from Year 0 CE

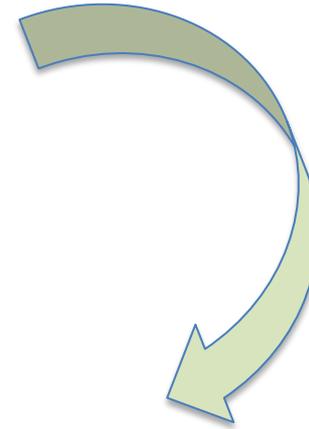


Source: Maddison (2001), UNPD (2019a).

Figure 0.1 GDP Per Capita from Year 0 to 2016 CE



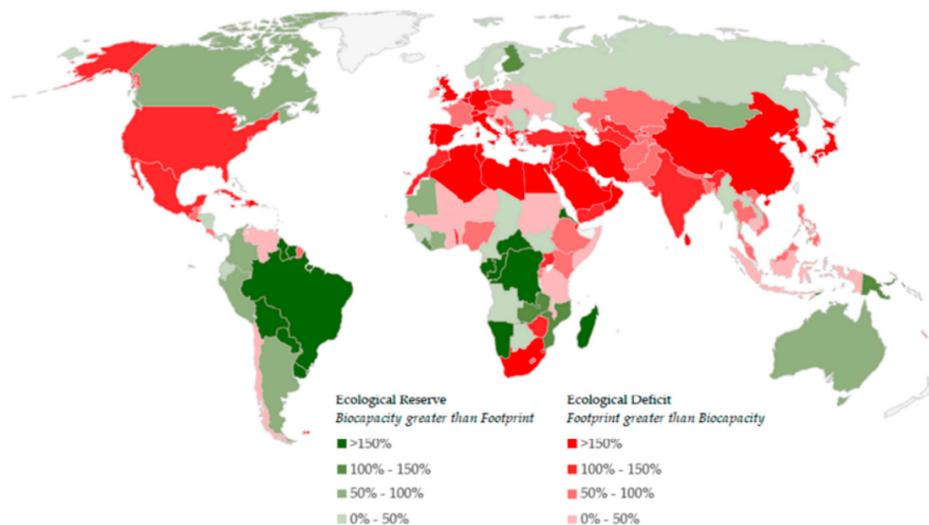
Source: Maddison (2018), Bolt et al. (2018).



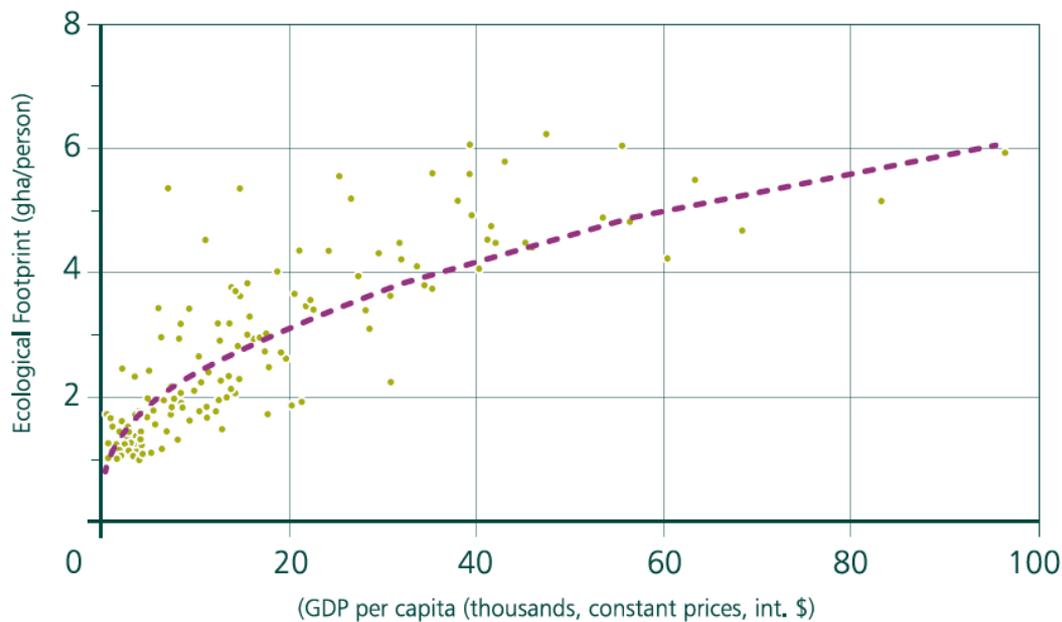
**Table 1 | Evidence for increase in global measures of mobility during the Anthropocene.**

Time period	Variable	Increase (total amount and percentage <sup>§</sup> )	References
1950-2010	Traffic vehicles for transportation	< 200 to > 1200 million motor vehicles (> 600%)	(Steffen et al., 2015a)
1950-2010	International tourism	< 100 to > 900 million arrivals (> 900%)	(Steffen et al., 2015a)
1950-2016	International tourism	25 to 1400 million arrivals (5600%)	(UNWTO, 2017; UNWTO, 2019)
1950-2008	Seaborne trade	0.5 to 11.0 billion MT of seaborne cargo (2200%)	(Stopford, 2009; Yercan and Yildiz, 2012; UNCTAD, 2019b)
1950-2005	Global merchant fleet	84.6 to 652.5 million MT (771%)	(Stopford, 2009)
1950s-2000s	World trade	- (> 300%)	(World Ocean Review, 2010)
1950s-2000s	World trade of goods destined for the processing industry	- (> 400%)	(World Ocean Review, 2010)
1970-2017	Air travel	0.33 to 4.00 billion passengers (1212%)	Figure 1A (World Bank, 2020a)
1970-2017	Air freight	15660 to 220707 million MT/km (1409%)	Figure 1B (World Bank, 2020b)
1980-2004	Global value of trade (exports and imports)	2033075 to 8975589 million dollars (441%)	(UNCTAD, 2005)
1980-2009	Global merchant ship fleet	683 to 1192 capacity in million MT (174%)	(World Ocean Review, 2010)
1980-2018	Containers	34.9 to 680.8 million TEU containers (1951%)	Institute of Shipping Economics and Logistics (in litt., 2020)
1980-2018	International maritime trade	2605 to 11005 million MT loaded (422%)	(UNCTAD, 2019a)
1990-2017	International migrants	152.5 to 257.7 million (169%)	(UN, 2017)
1992-2018	Total ship number	28666 to 98755 ships (344%)	(Tournadre, 2014); Jean Tournadre (in litt.,
1997-2017	Global merchant fleet tonnage	~ 723 to ~ 1765 million DWT (244%)	(ISL, 2017)
2013-2019	Containers	141.7 to 169.1 million full TEU containers (119%)	Container Trade Statistics (in litt., 2020)

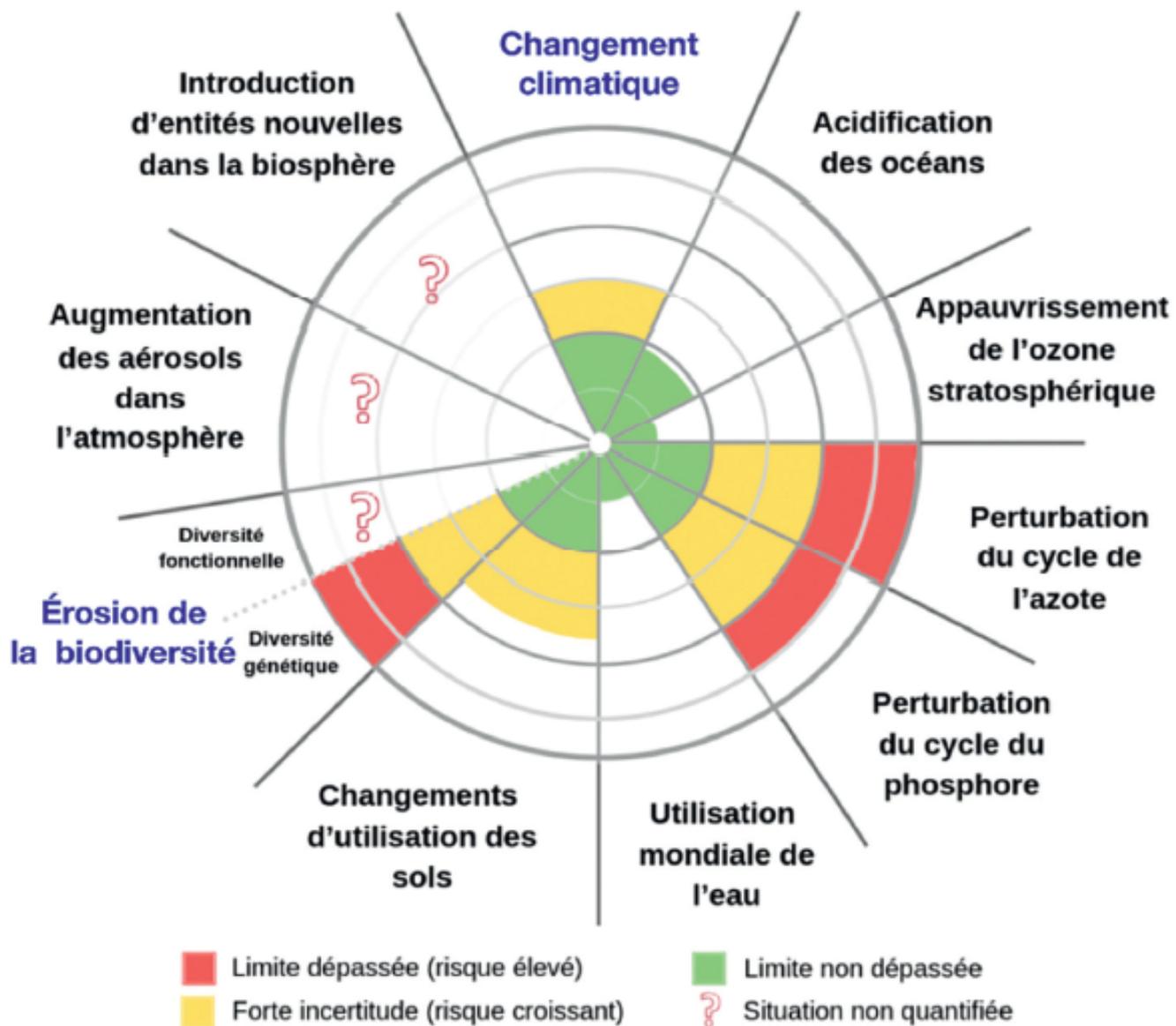
# Pourquoi ?



Source: York University Ecological Footprint Initiative and Global Footprint Network (2020)

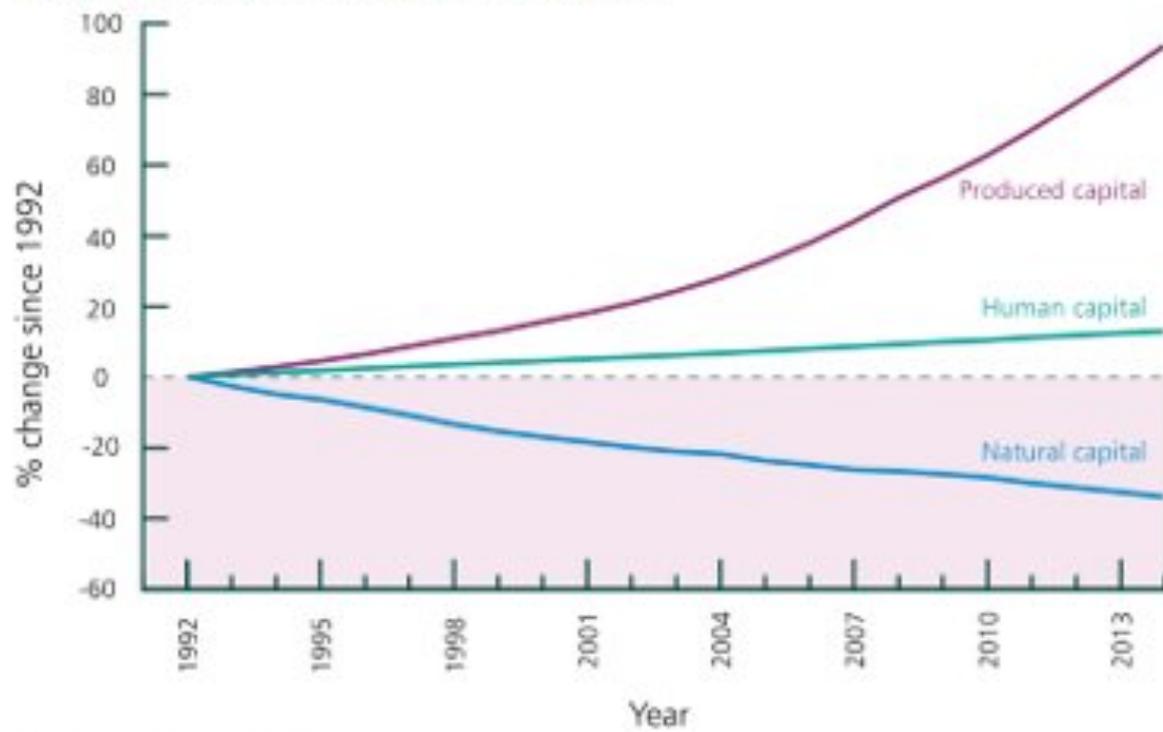


## Les conséquences



## Les conséquences

Figure 4.8 Global Wealth Per Capita, 1992 to 2014



Source: Managi and Kumar (2018).



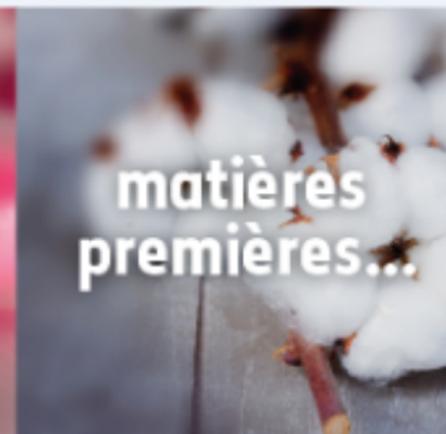
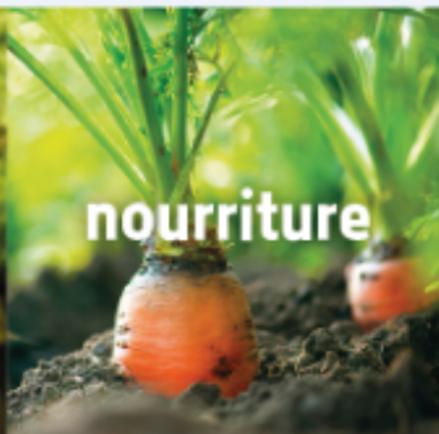
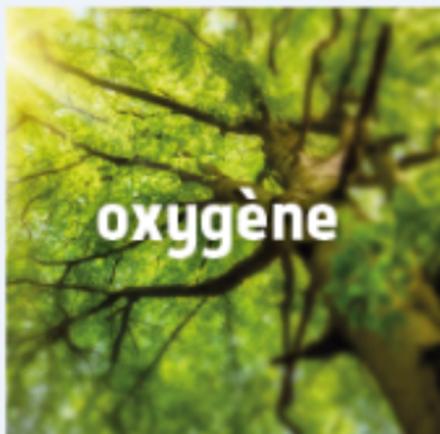
# La BIODIVERSITÉ c'est la vie !



MINISTÈRE  
DE LA TRANSITION  
ÉCOLOGIQUE

*Liberté  
Égalité  
Fraternité*

## ▶ ELLE EST SOURCE DE BIENS ET DE SERVICES



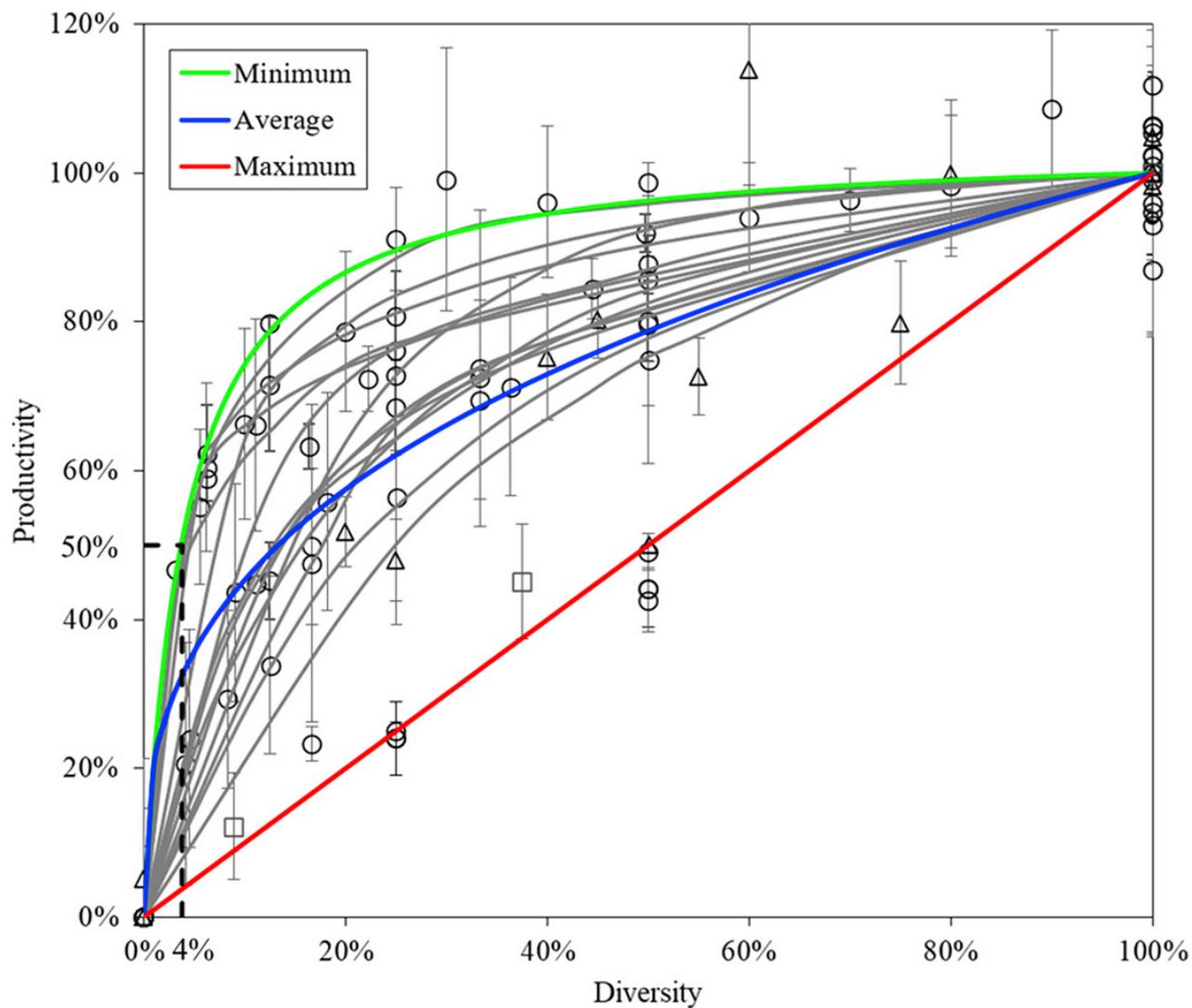
## Les services écosystémiques

Trois services, fournis par la biodiversité, augmentent...



... mais au prix de la diminution de tous les autres

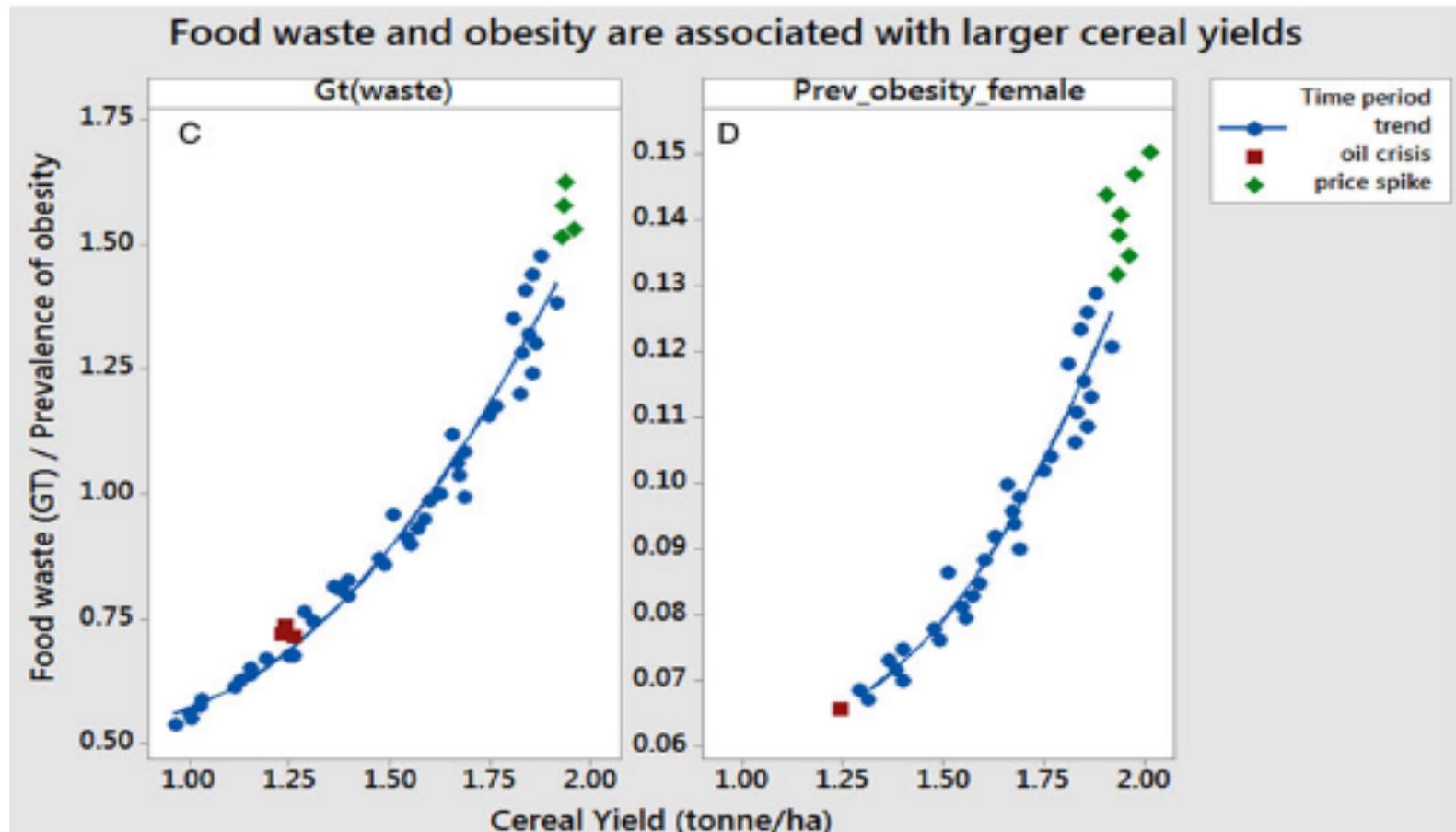
# La production alimentaire



## The paradox of productivity: agricultural productivity promotes food system inefficiency

Tim G. Benton<sup>1,2</sup> and Rob Bailey<sup>1</sup>

<sup>1</sup>Energy, Environment and Resources Department, The Royal Institute of International Affairs, Chatham House, 10 St James's Square, London SW1Y 4LE, UK and <sup>2</sup>School of Biology, University of Leeds, Leeds, LS2 9JT, UK



## Les services culturels et patrimoniaux

APPORTS IMMATÉRIELS		15 Apprentissage et inspiration		.	.	.	.	.	.
		16 Expériences physiques et psychologiques			.	.	.	.	.
		17 Soutien identitaire		.	.	.	.	.	.

# La santé physique et mentale



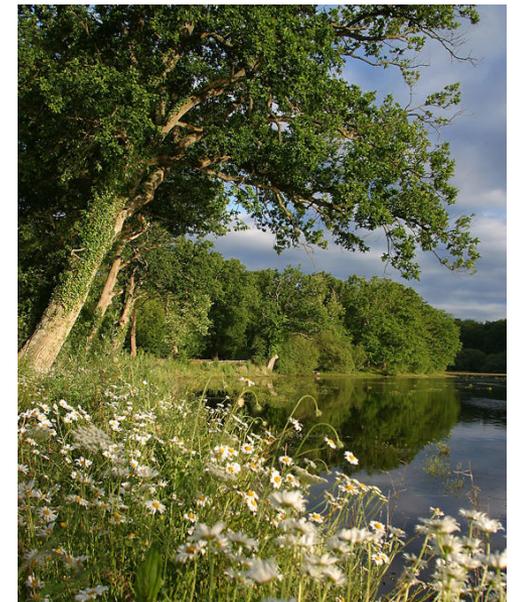
Types and characteristics of urban and peri-urban green spaces having an impact on human mental health and wellbeing: a systematic review



Types and characteristics of urban and peri-urban blue spaces having an impact on human mental health and wellbeing: a systematic review

	Mental health			Severity mental disorder			Prevalence mental disorder			Satisfaction with life			Quality of life			Subjective wellbeing			Affect			Vitality			Restorative outcomes			Perceived stress			Physiological stress			Problem behaviour			Brain activity					
	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-	+	□	-
UGS																			4	2	1				1	1		2														
Park	1			4						1						1	1		13	2		2			4			3	2		8	11										
Garden				4	2	1							1						2	2								1			3	3		3	1	1				1		
Forest				1															18	8	3	4			4			2	1		12	12	1									
Grassland															1				2		1							1	1			2										
Trees & p				1									1						3	1		1			2						1		1									
Biodiversity																				1					1	1					1	1										

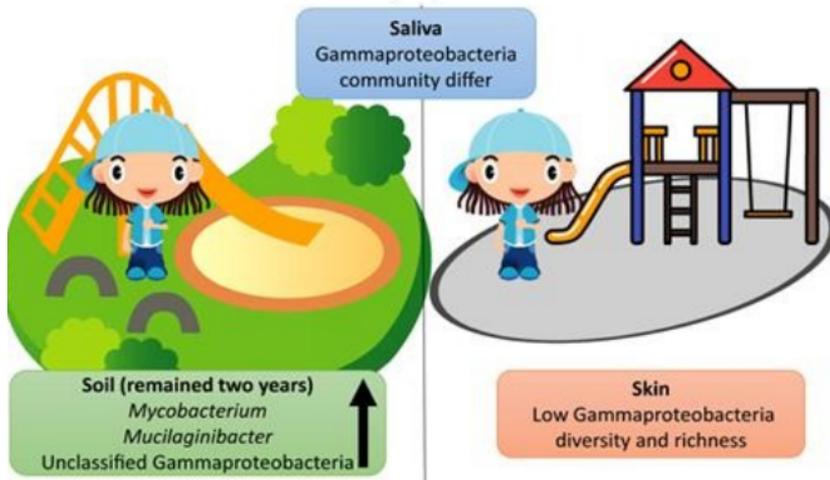
## Les services culturels et patrimoniaux



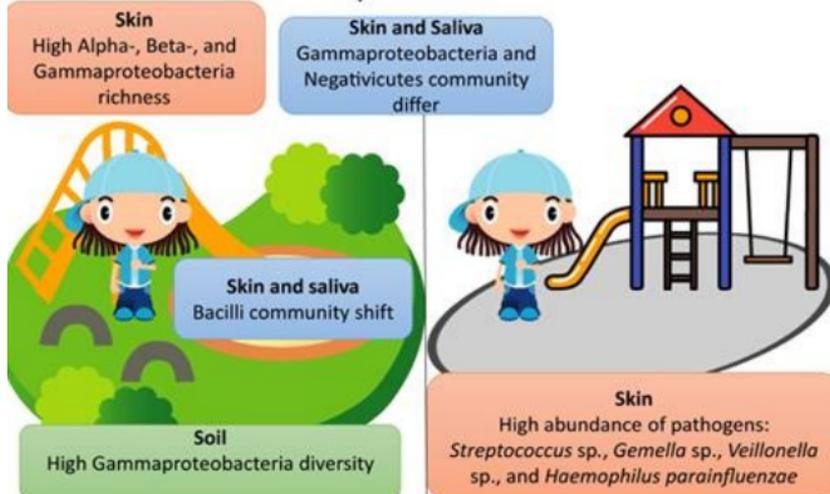
## Biodiversity intervention day-cares

## Standard day-cares

### A) Day 28



### B) Year one



## Long-term biodiversity intervention shapes health-associated commensal microbiota among urban day-care children

Marja I. Roslund <sup>a</sup>, Riikka Puhakka <sup>a</sup>, Noora Nurminen <sup>b</sup>, Sami Oikarinen <sup>b</sup>, Nathan Siter <sup>c</sup>, Mira Grönroos <sup>a</sup>, Ondřej Cinek <sup>d</sup>, Lenka Kramná <sup>d</sup>, Ari Jumpponen <sup>e</sup>, Olli H. Laitinen <sup>b</sup>, Juho Rajaniemi <sup>c</sup>, Heikki Hyöty <sup>b</sup>, Aki Sinkkonen <sup>f, g, h</sup> ✉  
the ADELE research group<sup>1</sup>

## Framing the discussion of microorganisms as a facet of social equity in human health

Suzanne L. Ishaq , Maurisa Rapp, Risa Byerly, Loretta S. McClellan, Maya R. O'Boyle, Anika Nykanen, Patrick J. Fuller, Calvin Aas, Jude M. Stone, Sean Killpatrick, Manami M. Uptegrove, Alex Vischer, Hannah Wolf, [ ... ], Hannah F. Tavalire  
[ view all ]

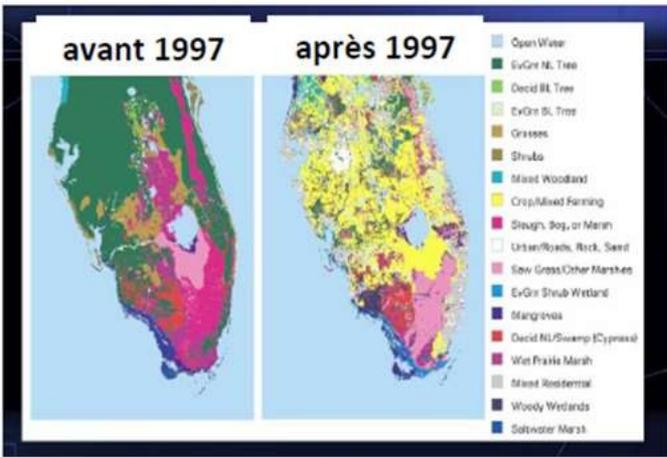
Published: November 26, 2019 • <https://doi.org/10.1371/journal.pbio.3000536>

## Les services de régulation

=> qualité de l'eau, de l'air, des pathogènes, des événements climatiques extrêmes...



# Régulation du climat local



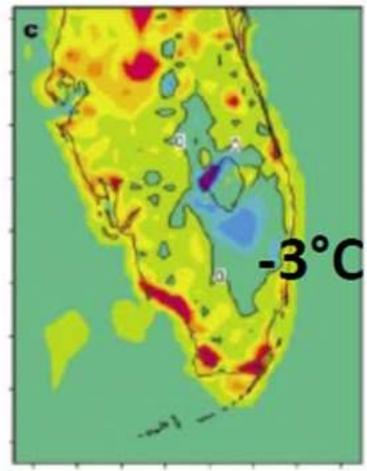
Marshall et al., Nature 2003

## Agriculture et Températures extrêmes

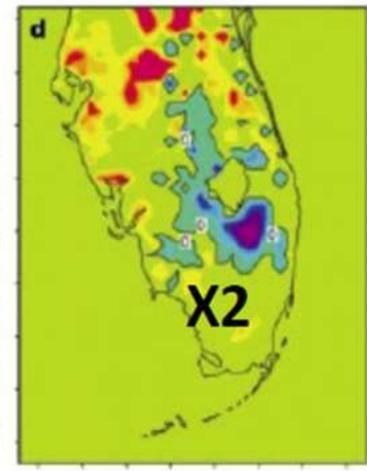
En 1997, décision politique pour diminuer les risques de pertes de récoltes dues au gel:  
 drainage des marécages au Sud de la Floride, et déplacement depuis le Nord des céréales + citronniers

en Hiver

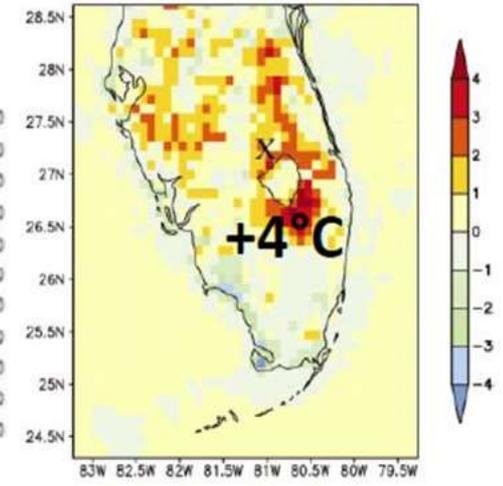
En Été



Épisodes de gel plus froids



Durée des gelées plus longue



Canicules plus intenses

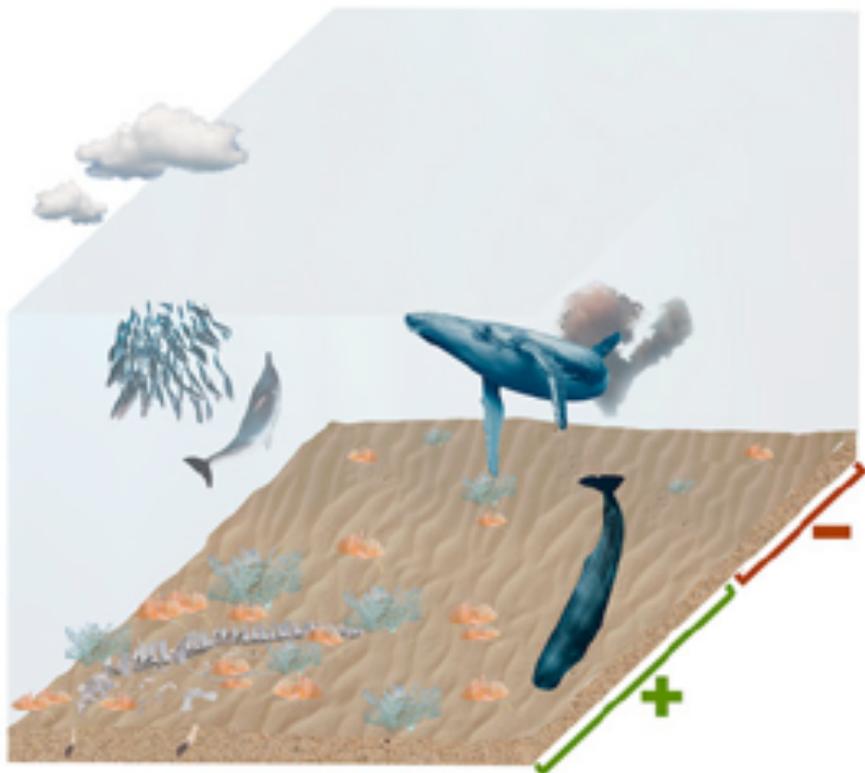
## Deep sea

### Review

## The role of large wild animals in climate change mitigation and adaptation

Yadvinder Malhi<sup>1\*</sup>, Tonya Lander<sup>2</sup>, Elizabeth le Roux<sup>1,3</sup>, Nicola Stevens<sup>1</sup>, Marc Macias-Fauria<sup>4</sup>, Lisa Wedding<sup>4</sup>, Cécile Girardin<sup>1</sup>, Jeppe Agård Kristensen<sup>1,3</sup>, Christopher J. Sandom<sup>5,6</sup>, Tom D. Evans<sup>7</sup>, Jens-Christian Svenning<sup>3</sup>, and Susan Canney<sup>5</sup>

En moyenne, une baleine stocke 9 tonnes de carbone dans leur biomasse, ce qui correspond à la séquestration de 33 tonnes de CO<sub>2</sub> pendant 60 ans (valeur basse) un arbre absorbe autour de 24 kg de CO<sub>2</sub> par an.





[Published: 28 January 2004](#)

### **Diclofenac residues as the cause of vulture population decline in Pakistan**

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## Econometric Evidence on Forest Ecosystem Services: Deforestation and Flooding in Malaysia

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