Un aperçu - subjectif - de la recherche sur la biodiversité

Septembre 2017 – décembre 2018

Jean-François Silvain
Président de la Fondation pour la recherche sur la biodiversité

Membres Fondateurs de la FRB :

Que dit la recherche sur la biodiversité terrestre ?

WHERE HAVE ALL THE INSECTS GONE?

Surveys in German nature reserves point to a dramatic decline in insect biomass. Key members of ecosystems may be slipping away

By **Gretchen Vogel**, *in Krefeld, Germany*

Science 12 MAY 2017 • VOL 356 ISSUE 6338

RESEARCH ARTICLE

More than 75 percent decline over 27 years in total flying insect biomass in protected areas

Caspar A. Hallmann[1]*, Martin Sorg[2], Eelke Jongejans[1], Henk Siepel[1], Nick Hofland[1], Heinz Schwan[2], Werner Stenmans[2], Andreas Müller[2], Hubert Sumser[2], Thomas Hörren[2], Dave Goulson[3], Hans de Kroon[1]

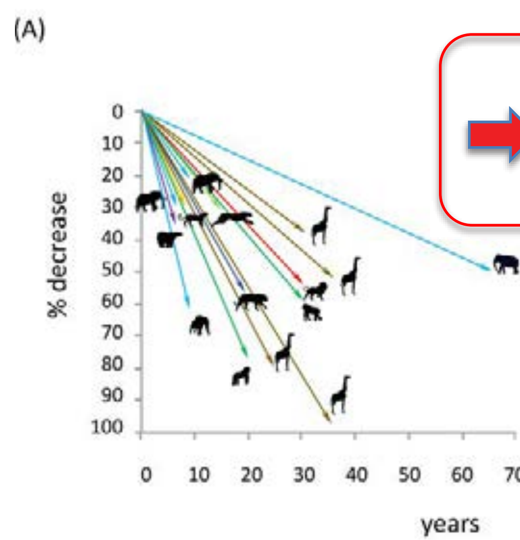
PLOS ONE | https://doi.org/10.1371/journal.pone.0185809 October 18, 2017

PERSPECTIVE

The paradoxical extinction of the most charismatic animals

Franck Courchamp[1,2,3]*, Ivan Jaric[4,5,6], Céline Albert[1], Yves Meinard[7], William J. Ripple[8], Guillaume Chapron[9]

PLOS Biology | https://doi.org/10.1371/journal.pbio.2003997 April 12, 2018



http://www.fondationbiodiversite.fr/images/documents/Syntheses/2018-09_Synthese_Biomasse_EspecesEmblematiques.pdf

Que dit la recherche sur la biodiversité terrestre ?

Opinion

Quantifying Temporal Genomic Erosion in Endangered Species

David Díez-del-Molino,[1] Fatima Sánchez-Barreiro,[2] Ian Barnes,[3] M. Thomas P. Gilbert,[2,4] and Love Dalén[1,*]

Trends in Ecology & Evolution, March 2018, Vol. 33, No. 3 https://doi.org/10.1016/j.tree.2017.12.002

Phylogenetic homogenization of amphibian assemblages in human-altered habitats across the globe

A. Justin Nowakowski[a,1,2], Luke O. Frishkoff[b,1,2], Michelle E. Thompson[c], Tatiana M. Smith[a], and Brian D. Todd[a]

E3454–E3462 | PNAS | vol. 115 | no. 15

Global hidden harvest of freshwater fish revealed by household surveys

Etienne Fluet-Chouinard[a,1], Simon Funge-Smith[b], and Peter B. McIntyre[a]

PNAS | July 17, 2018 | vol. 115 | no. 29 | 7623–7628

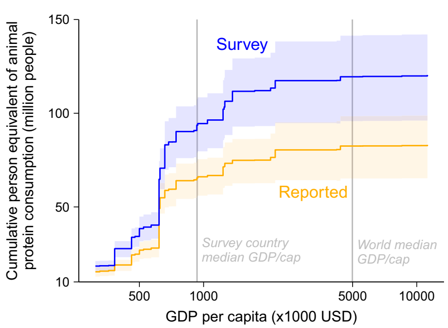


Fig. 4. Nutritional equivalence of the inland fish harvest as number of people meeting their total animal protein consumption. The hidden harvest revealed by the survey-estimated catch is equivalent to the entire animal protein intake of an additional 36.9 (CI, 30.8–43.4) million people, and most of the increase is found in countries below the median GDP per capita of countries surveyed (vertical line). The largest national increases in nutritional equivalence come from Zambia, Mali, and Tanzania. The bands represent the uncertainty from the provenance of the fish consumed (freshwater or marine) as used in the calculation of HCES catch.

Review

Movers and Stayers: Novel Assemblages in Changing Environments

Richard J. Hobbs,[1,*] Leonie E. Valentine,[1] Rachel J. Standish,[2] and Stephen T. Jackson[3,4]

Trends in Ecology & Evolution, February 2018, Vol. 33, No. 2

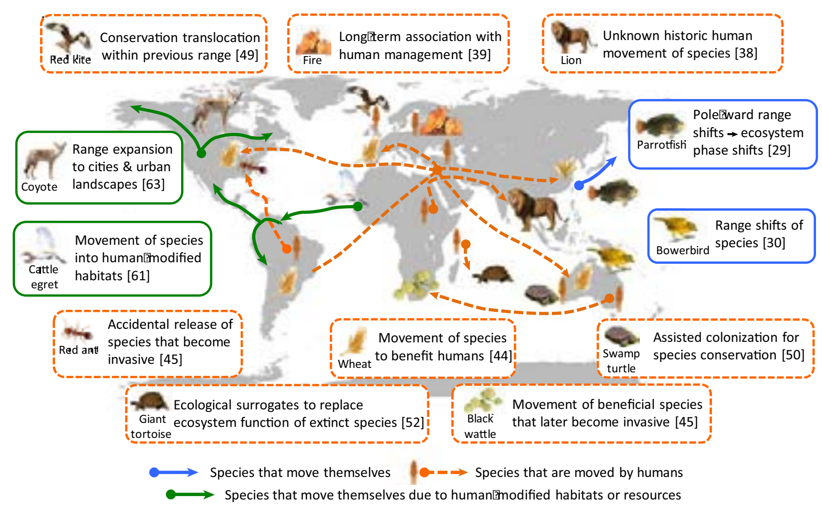


Figure 2. Examples of the Methods of Movement That Species Can Display in Response to Environmental and Human-Mediated Changes. Species

Que dit la recherche sur la biodiversité terrestre ?

FOREST ECOLOGY

Classifying drivers of global forest loss

Philip G. Curtis[1]*, Christy M. Slay[1], Nancy L. Harris[2], Alexandra Tyukavina[3], Matthew C. Hansen[3]

Global maps of forest loss depict the scale and magnitude of forest disturbance, yet companies, governments, and nongovernmental organizations need to distinguish permanent conversion (i.e., deforestation) from temporary loss from forestry or wildfire. Using satellite imagery, we developed a forest loss classification model to determine a spatial attribution of forest disturbance to the dominant drivers of land cover and land use change over the period 2001 to 2015. Our results indicate that 27% of global forest loss can be attributed to deforestation through permanent land use change for commodity production. The remaining areas maintained the same land use over 15 years; in those areas, loss was attributed to forestry (26%), shifting agriculture (24%), and wildfire (23%). Despite corporate commitments, the rate of commodity-driven deforestation has not declined. To end deforestation, companies must eliminate 5 million hectares of conversion from supply chains each year.

Curtis *et al.*, *Science* **361**, 1108–1111 (2018)   14 September 2018

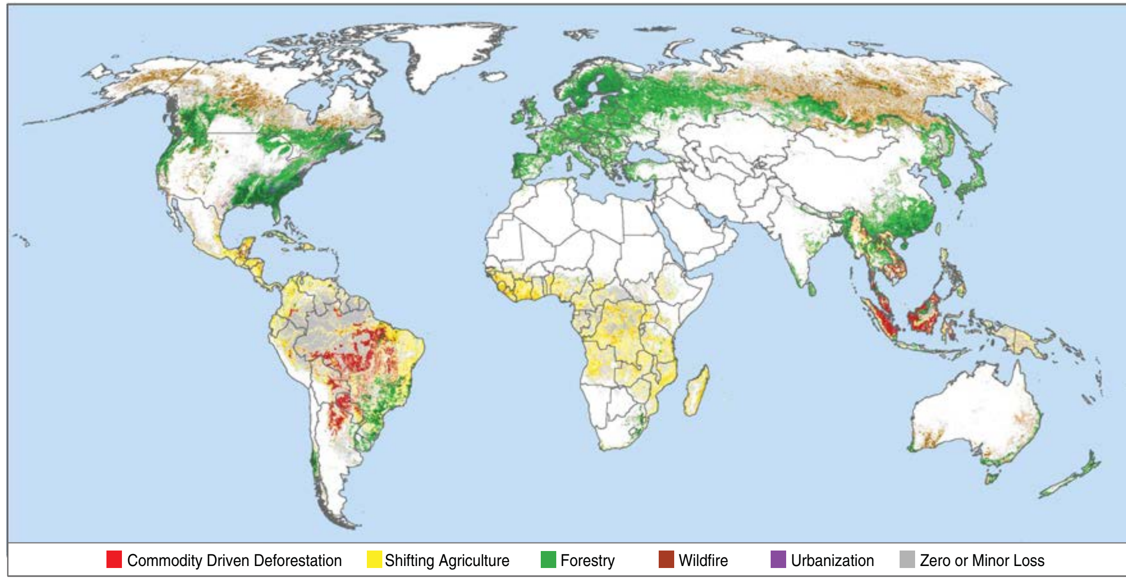


Fig. 2. Primary drivers of forest cover loss for the period 2001 to 2015. Darker color intensity indicates greater total quantity of forest cover loss.

RESEARCH ARTICLE

Factors affecting forest area change in Southeast Asia during 1980-2010

Nobuo Imai[1]*, Takuya Furukawa[2], Riyou Tsujino[3], Shumpei Kitamura[4], Takakazu Yumoto[5]

PLOS ONE | https://doi.org/10.1371/journal.pone.0197391   May 15, 2018

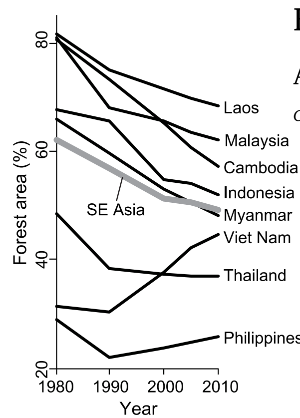


Fig 1. Changes in percentage forest area of the eight SE Asian countries during 1980–2010.

https://doi.org/10.1371/journal.pone.0197391.g001

Have Indo-Malaysian forests reached the end of the road?

Alice C. Hughes

Centre for Integrative Conservation, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, P.R. China

Biological Conservation 223 (2018) 129–137

Que dit la recherche sur la biodiversité terrestre ?

HUMAN IMPACTS

Moving in the Anthropocene: Global reductions in terrestrial mammalian movements

Marlee A. Tucker,[1,2]* Katrin Böhning-Gaese,[1,2] William F. Fagan,[3,4] John M. Fryxell,[5] Bram Van Moorter,[6] Susan C. Alberts,[7] Abdullahi H. Ali,[8] Andrew M. Allen,[9,10]

Tucker *et al.*, *Science* **359**, 466–469 (2018) 26 January 2018

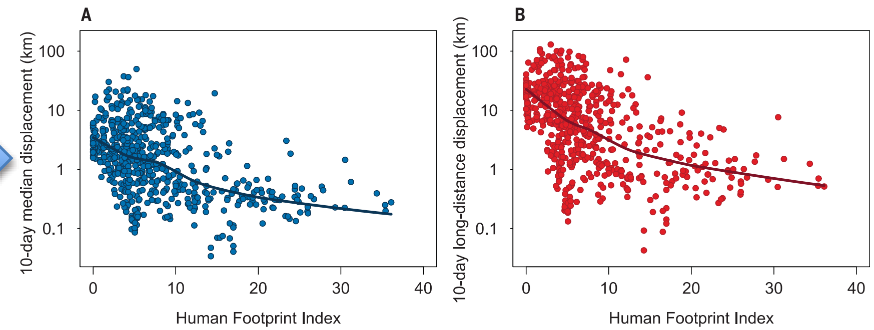


Fig. 2. Mammalian displacement in relation to the Human Footprint Index. (**A**) Median displacements; (**B**) long-distance (0.95 quantile) displacements. Both displacements decline with increasing HFI at the 10-day scale (*n* = 48 species and 624 individuals). Plots include a smoothing line from a locally weighted polynomial regression. An HFI value of 0 indicates areas of low human footprint; a value of 40 represents areas of high human footprint.

CONSERVATION

Lighting up the nighttime

Artificial light at night needs to be reduced to limit negative environmental impacts

By **Kevin J. Gaston**

SCIENCE 16 NOVEMBER 2018 • VOL 362 ISSUE 6416

Conservatively, the overall coverage by skyglow is now nearly one-fourth of global land area, with 83% of the human population estimated to be living under light-polluted skies (*7*). Skyglow can extend

HUMAN IMPACTS

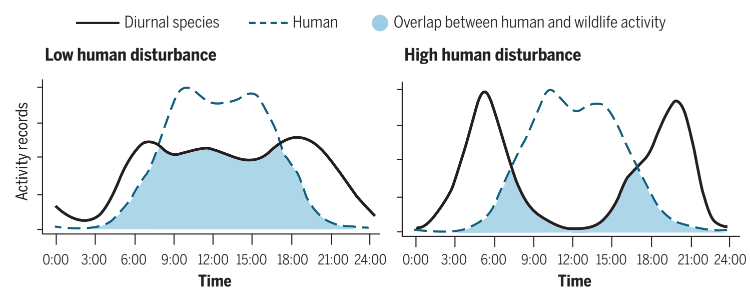
The influence of human disturbance on wildlife nocturnality

Kaitlyn M. Gaynor[1]*, Cheryl E. Hojnowski[1], Neil H. Carter[2], Justin S. Brashares[1]

Gaynor *et al.*, *Science* **360**, 1232–1235 (2018) 15 June 2018

Human disturbance shifts animal activity into the night

Animals that are active during the day in areas with low human disturbance (left) change their activity patterns in areas with high human disturbance (right). Instead of a broad distribution of activity throughout the day, their activity peaks in the early morning and again in the early evening.



ECOLOGY

Animals feel safer from humans in the dark

Mammals shift their activities to twilight and night hours in response to human disturbance

By **Ana Benítez-López**

SCIENCE 1 JUNE 2018 • VOL 360 ISSUE 6394

Mammal diversity w ll take millions of years to recover from the current biodiversity crisis

Matt Davis[a,b,1], Søren Faurby[c,d], and Jens-Christian Svenning[a,b]

11262–11267 | PNAS | October 30, 2018 | vol. 115 | no. 44

The incipient sixth mass extinction that started in the Late Pleistocene has already erased over 300 mammal species and, with them, more than 2.5 billion y of unique evolutionary history. At the global scale, this lost phylogenetic diversity (PD) can only be restored with time as lineages evolve and create new evolutionary history. Given the increasing rate of extinctions however, can mammals evolve fast enough to recover their lost PD on a human time scale? We use a birth–death tree framework to show that even if extinction rates slow to preanthropogenic background levels, recovery of lost PD will likely take millions of years. These findings emphasize the severity of the potential sixth mass extinction and the need to avoid the loss of unique evolutionary history now.

Significance

Biodiversity is more than the number of species on Earth. It is also the amount of unique evolutionary history in the tree of life. We find that losses of this phylogenetic diversity (PD) are disproportionally large in mammals compared with the number of species that have recently gone extinct. This lost PD can only be restored with time as lineages evolve and create new evolutionary history. Without coordinated conservation, it will likely take millions of years for mammals to naturally recover from the biodiversity losses they are predicted to endure over the next 50 y. However, by prioritizing PD in conservation, we could potentially save billions of years of unique evolutionary history and the important ecological functions they may represent.

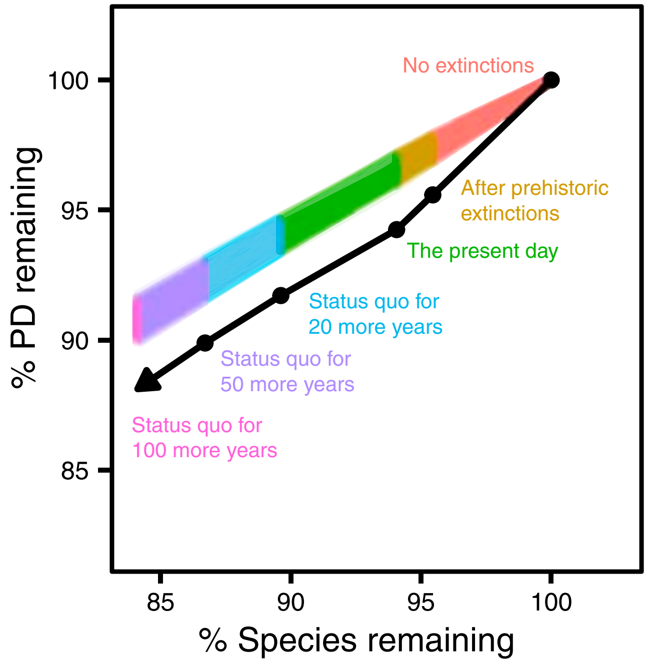


Fig. 2. Projected extinctions show a greater loss of PD in mammals than expected, given species loss. The black line shows the percentage of PD and SR remaining compared with a preanthropogenic baseline (130,000 y ago). Colored lines show 250 null simulations where extinctions are of equal magnitude, but random with respect to phylogeny. Lines correspond to the extinction scenarios labeled with the same color. Results from one randomly selected phylogenetic tree are shown. Summary results for all trees are shown in *SI Appendix*, Table S1, and results using the present day as a baseline are shown in *SI Appendix*, Table S5.

Que dit la recherche sur la biodiversité marine ?

A floating forest of Sargassum seaweed in the Sargasso Sea provides food and shelter for hatchling loggerhead sea turtles in the Atlantic Ocean.

Protect the neglected half of our blue planet

Maintaining momentum is crucial as nations build a treaty to safeguard the high seas, argue **Glen Wright**, **Julien Rochette**, **Kristina M. Gjerde** and **Lisa A. Levin**.

Science & Society

Microplastics: No Small Problem for Filter-Feeding Megafauna

Elitza S. Germanov,[1,2,*,@]
Andrea D. Marshall,[2,@]
Lars Bejder,[3,4,@]
Maria Cristina Fossi,[5] and
Neil R. Loneragan[1,@]

Trends in Ecology & Evolution, April 2018, Vol. 33, No. 4

PERSPECTIVES

POLLUTION

Microplastics research–from sink to source

Microplastics are ubiquitous not just in the ocean but also on land and in freshwater systems

By **Chelsea M. Rochman**

| nyls (PCBs), microplastics are now recog-

REPLY TO DEES ET AL.:

Ocean warming promotes species-specific increases in the cellular growth rates of harmful algal blooms

Christopher J. Gobler[a,1], Theresa K. Hattenrath-Lehmann[a], Owen M. Doherty[b], Andrew W. Griffith[a], Yoonja Kang[a], and R. Wayne Litaker[c]

PNAS | **November 14, 2017** | vol. 114 | no. 46 | **E9765–E9766**

CORAL REEFS

Plastic waste associated with disease on coral reefs

Joleah B. Lamb,[1,2,3*] Bette L. Willis,[2,3] Evan A. Fiorenza,[1,4] Courtney S. Couch,[1,5,6] Robert Howard,[7] Douglas N. Rader,[8] James D. True,[9] Lisa A. Kelly,[3,10] Awaludinnoer Ahmad,[11,12] Jamaluddin Jompa,[12] C. Drew Harvell[1]

Lamb *et al.*, *Science* **359**, 460–462 (2018) 26 January 2018

Why we need an international agreement on marine plastic pollution

Stephanie B. Borrelle[a,1], Chelsea M. Rochman[b,1,2], Max Liboiron[c], Alexander L. Bond[d], Amy Lusher[e], Hillary Bradshaw[c], and Jennifer F. Provencher[f]

9994–9997 | PNAS | **September 19, 2017** | vol. 114 | no. 38

Que dit la recherche sur la biodiversité marine ?

Marine mammal population decline linked to obscured by-catch

Stefan Meyer[a,1], Bruce C. Robertson[a], B. Louise Chilvers[b], and Martin Krkošek[c]

PNAS | **October 31, 2017** | vol. 114 | no. 44 | **11781–11786**

Habitat degradation negatively affects auditory settlement behavior of coral reef fishes

Timothy A. C. Gordon[a,1], Harry R. Harding[b], Kathryn E. Wong[c], Nathan D. Merchant[d], Mark G. Meekan[e], Mark I. McCormick[f,g], Andrew N. Radford[b], and Stephen D. Simpson[a]

PNAS | **May 15, 2018** | vol. 115 | no. 20 | **5193–5198**

CORAL REEFS

Mesophotic coral ecosystems are threatened and ecologically distinct from shallow water reefs

Lu z A. Rocha[1*], Hd son T. Pinheiro[1], Bart Shepherd[1], Yannis P. Papastamatiou[2], Osmar J. Lu z[3], Richard L. Pyle[4], Pim Bongaerts[1,5]

Rocha *et al.*, *Science* **361**, 281–284 (2018)   20 July 2018

Gravity of human impacts mediates coral reef conservation gains

Joshua E. Cinner[a,1], Eva Maire[a,b], Cindy Huchery[a], M. Aaron MacNeil[c,d], Nicholas A. J. Graham[a,e], Camilo Mora[f], Tim R. McClanahan[g], Michele L. Barnes[a,h], John N. Kittinger[i,j], Christina C. Hicks[a,e], Stephanie D'Agata[b,g,k], Andrew S. Hoey[a], Georgina G. Gurney[a], David A. Feary[l], Ivor D. Williams[m], Michel Kulbicki[n], Laurent Vigliola[k], Laurent Wantiez[o], Graham J. Edgar[p], Rick D. Stuart-Smith[p], Stuart A. Sandin[q], Alison Green[r], Marah J. Hardt[s], Maria Beger[t,u], Alan M. Friedlander[v,w], Shaun K. Wilson[x,y], Eran Brokovich[z], Andrew J. Brooks[aa], Juan J. Cruz-Motta[bb], David J. Booth[cc], Pascale Chabanet[dd], Charlotte Gough[ee], Mark Tupper[ff], Sebastian C. A. Ferse[gg], U. Rashid Sumaila[hh], Shinta Pardede[g], and David Mouillot[a,b]

E6116–E6125 | PNAS | vol. 115 | no. 27

A dynamic ocean management tool to reduce bycatch and support sustainable fisheries

Elliott L. Hazen,[1,2,3]* Kylie L. Scales,[2,4] Sara M. Maxwell,[5] Dana K. Briscoe,[2] Heather Welch,[2] Steven J. Bograd,[1,2] Helen Bailey,[6] Scott R. Benson,[1,7] Tomo Eguchi,[1] Heidi Dewar,[1] Suzy Kohin,[1] Daniel P. Costa,[2] Larry B. Crowder,[8] Rebecca L. Lewison[9]

Hazen *et al.*, *Sci. Adv.* 2018;**4**:eaar3001   30 May 2018

OCEANOGRAPHY

A strategy for the conservation of biodiversity on mid-ocean ridges from deep-sea mining

Daniel C. Dunn[1*†], Cindy L. Van Dover[2*†], Ron J. Etter[3], Craig R. Smith[4], Lisa A. Levin[5,6], Telmo Morato[7], Ana Colaço[7], Andrew C. Dale[8], Andrey V. Gebruk[9], Kristina M. Gjerde[10,11], Patrick N. Halpin[1], Kerry L. Howell[12], David Johnson[13], José Angel A. Perez[14], Marta Chantal Ribeiro[15], Heiko Stuckas[16], Philip Weaver[13], SEMPIA Workshop Participants[‡]

Dunn *et al.*, *Sci. Adv.* 2018;**4**:eaar4313   4 July 2018

FISHERIES

Protecting marine mammals, turtles, and birds by rebuilding global fisheries

Matthew G. Burgess,[1,2]*† Grant R. McDermott,[3,1]† Brandon Owashi,[1,2] Lindsey E. Peavey Reeves,[1,4] Tyler Clavelle,[1,2] Daniel Ovando,[1,2] Bryan P. Wallace,[5,6] Rebecca L. Lewison,[7] Steven D. Gaines,[1,2] Christopher Costello[1,2]

Burgess *et al.*, *Science* **359**, 1255–1258 (2018)   16 March 2018

Opinion

Securing a Long-term Future for Coral Reefs

Ove Hoegh-Guldberg,[1,2,3,*] Emma V. Kennedy,[1] Hawthorne L. Beyer,[1,4] Caleb McClennen,[5] and Hugh P. Possingham[1,4,6]

Rapid ocean warming as a result of climate change poses a key risk for coral reefs. Even if the goals of the Paris Climate Agreement are achieved, coral reefs are likely to decline by 70–90% relative to their current abundance by mid-century. Although alarming, coral communities that survive will play a key role in the regeneration of reefs by mid-to-late century. Here, we argue for a coordinated, global coral reef conservation strategy that is centred on 50 large (500 km^2) regions that are the least vulnerable to climate change and which are positioned to facilitate future coral reef regeneration. The proposed strategy and actions should strengthen and expand existing conservation efforts for coral reefs as we face the long-term consequences of intensifying climate change.

Trends in Ecology & Evolution, December 2018, Vol. 33, No. 12

Highlights

Severe degradation of coral reefs in recent decades has been driven by a range of threatening processes including climate change. Ocean warming is expected to have further severe impacts on reefs unless global warming is restrained well below 2°C (the goals of the Paris Agreement).

Not all coral reefs are equally at risk from climate change, however, suggesting the potential for identifying reefs for conservation action that are less vulnerable to climate change and which may be best positioned for regenerating other degraded reefs in the future.

There is uncertainty in future conditions. Variance reduction methods from finance (e.g., modern portfolio theory) can be applied to conservation planning to identify a portfolio of coral reefs for which the risk of widespread failure across the portfolio is minimised.

Long-term, risk-sensitive planning in the context of the uncertainty of projected climate impacts complements existing conservation strategies.

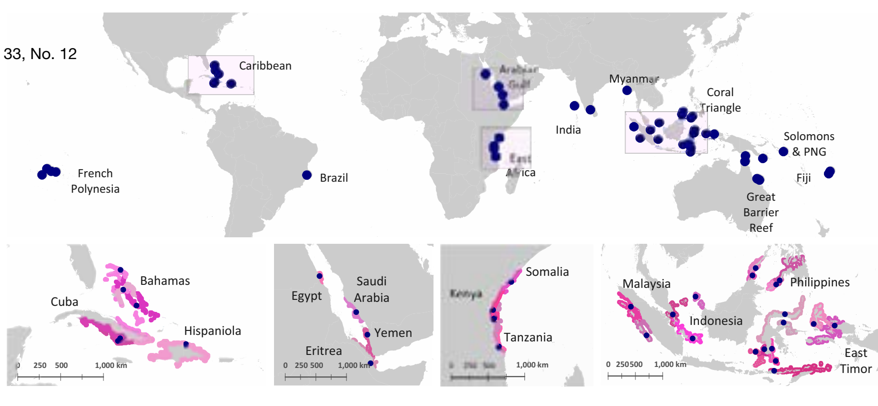


Figure 1. A Global Coral Reef Conservation Portfolio. Location of the 50 coral reef regions or bioclimatic units (BCUs) identified using a modern portfolio theory approach to balance expected conservation returns and risk of poor performance across the portfolio (Box 1). Reef symbol sizes have been exaggerated to improve visibility. The 'Coral Triangle' consists of locations primarily falling with the waters of Indonesia, the Philippines, Malaysia, Papua New Guinea, Solomon Islands, and East Timor. The Red Sea includes reefs falling primarily within the waters of Egypt, Sudan, Saudi Arabia, Eritrea, and Yemen. Further details and on-line resources around the portfolio of BCUs are provided by Beyer *et al.* [21].

Que dit la recherche sur la biodiversité marine ?

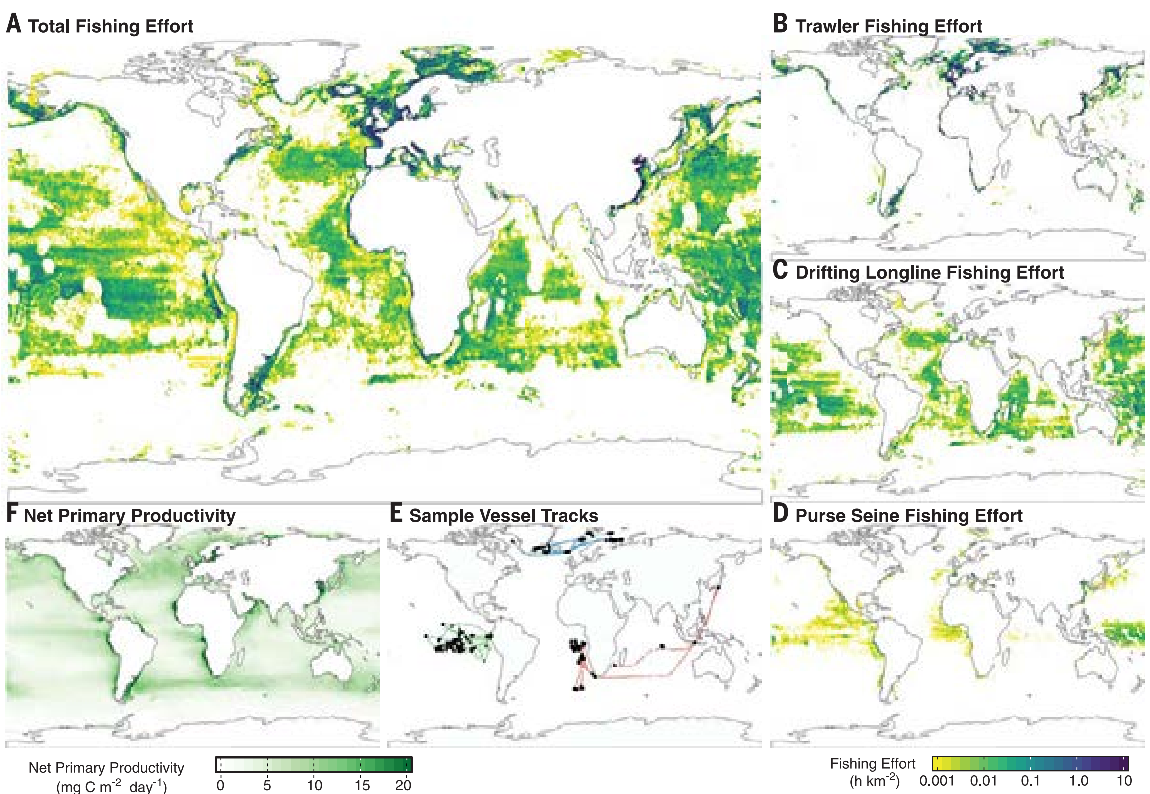
FISHERIES

Tracking the global footprint of fisheries

David A. Kroodsma,[1*] Juan Mayorga,[2,3] Timothy Hochberg,[1] Nathan A. Miller,[4] Kristina Boerder,[5] Francesco Ferretti,[6] Alex Wilson,[7] Bjorn Bergman,[4] Timothy D. White,[6] Barbara A. Block,[6] Paul Woods,[1] Brian Sullivan,[7] Christopher Costello,[2] Boris Worm[5]

Kroodsma *et al.*, *Science* **359**, 904–908 (2018) 23 February 2018

Fig. 1. The spatial footprint of fishing. (**A** to **D**) Total fishing effort [hours fished per square kilometer (h km^{-2})] in 2016 by all vessels with AIS systems (A), trawlers (B), drifting longliners (C), and purse seiners (D). (**E**) Examples of individual tracks of a trawler (blue), a longliner (red), and a purse seiner (green). Black symbols show fishing locations for these vessels, as detected by the neural network, and colored lines are AIS tracks. (**F**) Global patterns of average annual NPP [expressed as milligrams of carbon uptake per square meter per day (mg C m^{-2} day^{-1})] are shown for reference.



Que dit la recherche sur la biodiversité marine ?

Bottom trawl fishing footprints on the world's continental shelves

Ricardo O. Amoroso[a,1], C. Roland Pitcher[b], Adriaan D. Rijnsdorp[c], Robert A. McConnaughey[d], Ana M. Parma[e], Petri Suuronen[f,g], Ole R. Eigaard[h], Francois Bastardie[h], Niels T. Hintzen[c], Franziska Althaus[i], Susan Jane Baird[j], Jenny Black[k], Lene Buhl-Mortensen[l], Alexander B. Campbell[m], Rui Catarino[n,o], Jeremy Collie[p], James H. Cowan Jr.[q], Deon Durholtz[r], Nadia Engstrom[s], Tracey P. Fairweather[r], Heino O. Fock[t], Richard Ford[u], Patricio A. Gálvez[v], Hans Gerritsen[w], María Eva Góngora[x], Jessica A. González[v], Jan G. Hiddink[y], Kathryn M. Hughes[y], Steven S. Intelmann[d], Chris Jenkins[z], Patrik Jonsson[aa], Paulus Kainge[bb], Mervi Kangas[cc], Johannes N. Kathena[bb], Stefanos Kavadas[dd], Rob W. Leslie[r], Steve G. Lewis[ee], Mathieu Lundy[ff], David Makin[gg], Julie Martin[hh], Tessa Mazor[b], Genoveva Gonzalez-Mirelis[l], Stephen J. Newman[cc], Nadia Papadopoulou[ii], Paulette E. Posen[jj], Wayne Rochester[b], Tommaso Russo[kk], Antonello Sala[ll], Jayson M. Semmens[mm], Cristina Silva[nn], Angelo Tsolos[oo], Bart Vanelslander[pp], Corey B. Wakefield[cc], Brent A. Wood[j], Ray Hilborn[a], Michel J. Kaiser[y,qq], and Simon Jennings[o,jj,rr]

PNAS | vol. 115 | no. 43 | E10275–E10282

ENVIRONMENTAL STUDIES

The economics of fishing the high seas

Enric Sala[1]*, Juan Mayorga[1,2], Christopher Costello[2], David Kroodsma[3], Maria L. D. Palomares[4], Daniel Pauly[4], U. Rashid Sumaila[4], Dirk Zeller[5]

While the ecological impacts of fishing the waters beyond national jurisdiction (the "high seas") have been widely studied, the economic rationale is more difficult to ascertain because of scarce data on the costs and revenues of the fleets that fish there. Newly compiled satellite data and machine learning now allow us to track individual fishing vessels on the high seas in near real time. These technological advances help us quantify high-seas fishing effort, costs, and benefits, and assess whether, where, and when high-seas fishing makes economic sense. We characterize the global high-seas fishing fleet and report the economic benefits of fishing the high seas globally, nationally, and at the scale of individual fleets. Our results suggest that fishing at the current scale is enabled by large government subsidies, without which as much as 54% of the present high-seas fishing grounds would be unprofitable at current fishing rates. The patterns of fishing profitability vary widely between countries, types of fishing, and distance to port. Deep-sea bottom trawling often produces net economic benefits only thanks to subsidies, and much fishing by the world's largest fishing fleets would largely be unprofitable without subsidies and low labor costs. These results support recent calls for subsidy and fishery management reforms on the high seas.

Sala *et al.*, *Sci. Adv.* 2018; **4** : eaat2504 6 June 2018

OCEAN POLICY

Preparing ocean governance for species on the move

Policy must anticipate conflict over geographic shifts

By Malin L. Pinsky[1], Gabriel Reygondeau[2], Richard Caddell[3,4], Juliano Palacios-Abrantes[2], Jessica Spijkers[5,6], William W. L. Cheung[2]

SCIENCE 15 JUNE 2018 • VOL 360 ISSUE 6394

ENVIRONMENTAL STUDIES

Wealthy countries dominate industrial fishing

Douglas J. McCauley[1,2,3]*, Caroline Jablonicky[2,3], Edward H. Allison[4,5], Christopher D. Golden[6], Francis H. Joyce[2,3], Juan Mayorga[3,7,8], David Kroodsma[9]

McCauley *et al.*, *Sci. Adv.* 2018; **4** : eaau2161 1 August 2018

Three pillars of sustainability in fisheries

Frank Asche[a,b,c,1], Taryn M. Garlock[b], James L. Anderson[b,d], Simon R. Bush[e], Martin D. Smith[f], Christopher M. Anderson[g], Jingjie Chu[h], Karen A. Garrett[b,i], Audun Lem[j], Kai Lorenzen[a], Atle Oglend[c], Sigbjørn Tveteras[c], and Stefania Vannuccini[j]

PNAS | October 30, 2018 | vol. 115 | no. 44 | 11221–11225

ENVIRONMENTAL STUDIES

High seas fisheries play a negligible role in addressing global food security

Laurenne Schiller[1,2]*, Megan Bailey[1], Jennifer Jacquet[3], Enric Sala[4]

Recent international negotiations have highlighted the need to protect marine diversity on the high seas—the ocean area beyond national jurisdiction. However, restricting fishing access on the high seas raises many concerns, including how such restrictions would affect food security. We analyze high seas catches and trade data to determine the contribution of the high seas catch to global seafood production, the main species caught on the high seas, and the primary markets where these species are sold. By volume, the total catch from the high seas accounts for 4.2% of annual marine capture fisheries production and 2.4% of total seafood production, including freshwater fisheries and aquaculture. Thirty-nine fish and invertebrate species account for 99.5% of the high seas targeted catch, but only one species, Antarctic toothfish, is caught exclusively on the high seas. The remaining catch, which is caught both on the high seas and in national jurisdictions, is made up primarily of tunas, billfishes, small pelagic fishes, pelagic squids, toothfish, and krill. Most high seas species are destined for upscale food and supplement markets in developed, food-secure countries, such as Japan, the European Union, and the United States, suggesting that, in aggregate, high seas fisheries play a negligible role in ensuring global food security.

Schiller *et al.*, *Sci. Adv.* 2018; **4** : eaat8351 8 August 2018

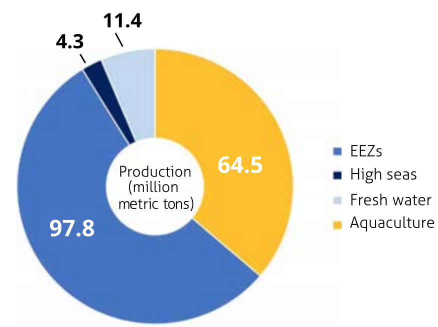


Fig. 1. Average contribution (million metric tons) of seafood-producing sectors, 2009–2014. The high seas catch represents 2.4% of total global production. Data: FAO 2016 and Sea Around Us.

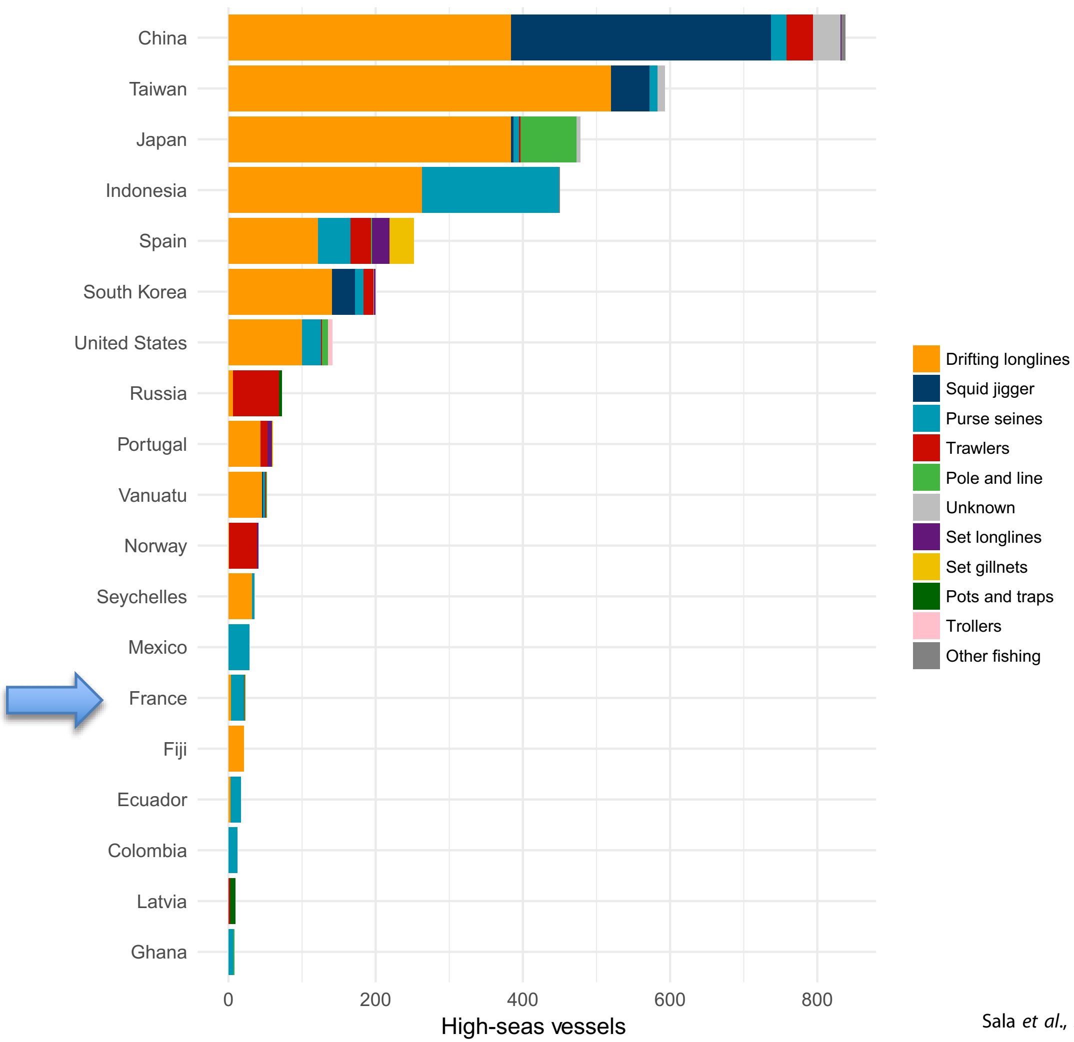
ECOLOGY

Improved fisheries management could offset many negative effects of climate change

Steven D. Gaines[1]*, Christopher Costello[1], Brandon Owashi[1], Tracey Mangin[1], Jennifer Bone[1], Jorge García Molinos[2,3,4], Merrick Burden[5], Heather Dennis[6], Benjamin S. Halpern[1,7,8], Carrie V. Kappel[7], Kristin M. Kleisner[5], Daniel Ovando[1]

Gaines *et al.*, *Sci. Adv.* 2018; **4** : eaao1378 29 August 2018

Que dit la recherche sur la biodiversité marine ?



Sala *et al.*, *Sci. Adv.* 2018; **4**:eaat2504 6 June 2018

Fig. 1. The high-seas fishing fleet. High-seas vessels by flag state and gear type, as detected by GFW in 2016.

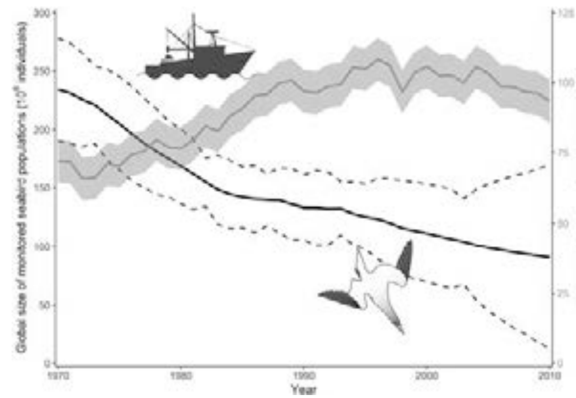
Current Biology
Report

Persisting Worldwide Seabird-Fishery Competition Despite Seabird Community Decline

David Grémillet,[1,2,5,6,*] Aurore Ponchon,[3,1,5] Michelle Paleczny,[4,5] Maria-Lourdes D. Palomares,[4] Vasiliki Karpouzi,[4] and Daniel Pauly[4]

Current Biology *28*, 1–5, December 17, 2018

Fisheries transform marine ecosystems and compete with predators [1], but temporal trends in seabird-fishery competition had never been assessed on a worldwide scale. Using catch reconstructions [2] for all fisheries targeting taxa that are also seabird prey, we demonstrated that average annual fishery catch increased from 59 to 65 million metric tons between 1970–1989 and 1990–2010. For the same periods, we estimated that global annual seabird food consumption decreased from 70 to 57 million metric tons. Despite this decrease, we found sustained global seabird-fishery food competition between 1970–1989 and 1990–2010. Enhanced competition was identified in 48% of all areas, notably the Southern Ocean, Asian shelves, Mediterranean Sea, Norwegian Sea, and Californian coast. Fisheries generate severe constraints for seabird populations on a worldwide scale, and those need to be addressed urgently. Indeed, seabirds are the most threatened bird group, with a 70% community-level population decline across 1950–2010 [3].



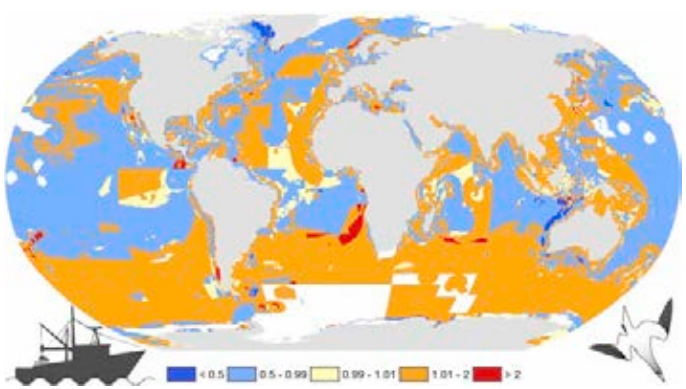


Figure 4. Persisting Worldwide Seabird-Fishery Competition
Distribution (0.5° cells) of the ratio of resource overlap indexes (seabird-fishery competition) between 1990–2010 (era 2) and 1970–1989 (era 1). Areas in orange and red denote marine regions in which seabird-fishery competition has increased (see also Table S1).

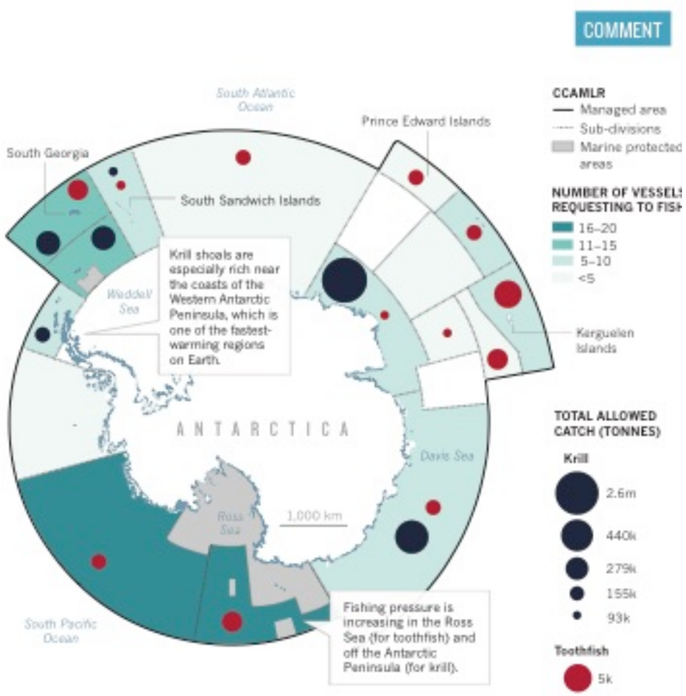
Que dit la recherche sur la biodiversité marine ?

Exploitation drives an ontogenetic-like deepening in marine fish

Kenneth T. F ank[a,1], Brian Petrie[a], William C. Leggett[b], and Daniel G. Boyce[a,2]

6422–6427 | PNAS | June 19, 2018 | vol. 115 | no. 25

COMMENT



ANTARCTIC FISHERIES

Krill and toothfish received the largest catch allowances in the Southern Ocean in 2017–18. They are increasingly exploited in spite of tight management by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

PAUL SUTHERLAND/NATIONAL GEOGRAPHIC/GETTY

Wandering albatrosses follow a vessel as it fishes for toothfish.

Watch over Antarctic waters

In a rapidly changing climate, fisheries in the Southern Ocean must be managed cautiously in response to data, warn **Cassandra Brooks** and colleagues.

14 JUNE 2018 | VOL 558 | NATURE | 177

Que dit la recherche sur l'incidence des pollutions chimiques ?

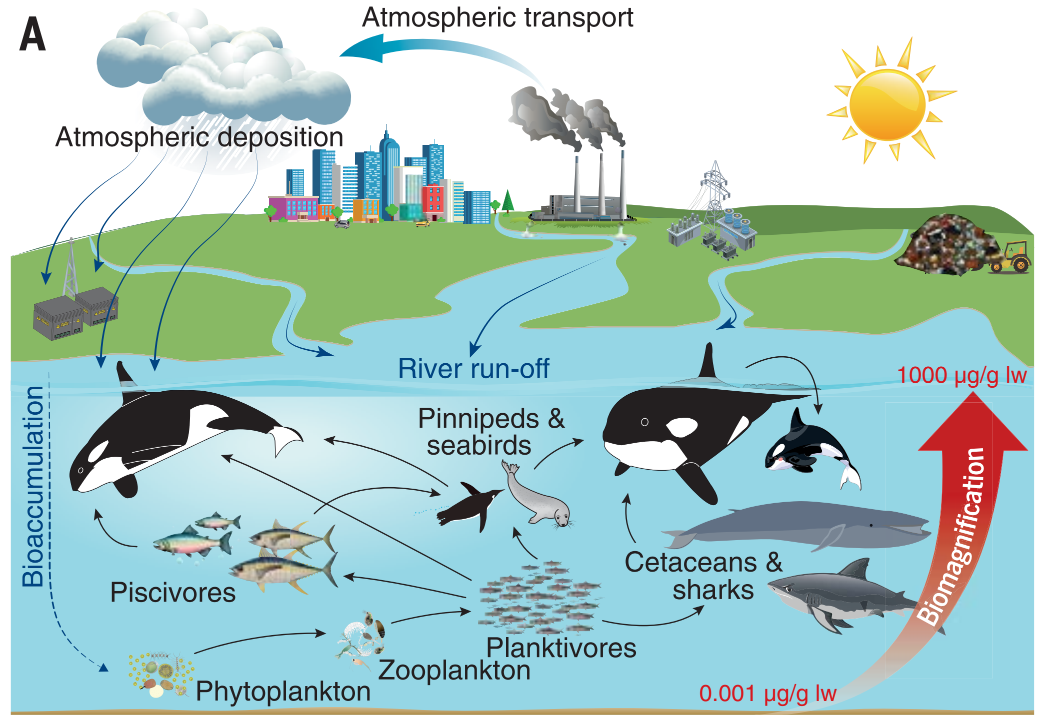
PERSISTENT CHEMICALS

Predicting global killer whale population collapse from PCB pollution

Jean-Pierre Desforges[1*], Ailsa Hall[2*], Bernie McConnell[2], Aqqalu Rosing-Asvid[3], Jonathan L. Barber[4], Andrew Brownlow[5], Sylvain De Guise[6,7], Igor Eulaers[1], Paul D. Jepson[8], Robert J. Leth er[9], Milton Levin[6], Peter S. Ross[10], Filipa Samarra[11], Gísli Víkingson[11], Christian Sonne[1], Rune Dietz[1*]

Killer whales (*Orcinus orca*) are among the most highly polychlorinated biphenyl (PCB)–contaminated mammals in the world, raising concern about the health consequences of current PCB exposures. Using an individual-based model framework and globally available data on PCB concentrations in killer whale tissues, we show that PCB-mediated effects on reproduction and immune function threaten the long-term viability of >50% of the world's killer whale populations. PCB-mediated effects over the coming 100 years predicted that killer whale populations near industrialized regions, and those feeding at high trophic levels regardless of location, are at high risk of population collapse. Despite a near-global ban of PCBs more than 30 years ago, the world's killer whales illustrate the troubling persistence of this chemical class.

Desforges *et al.*, *Science* **361**, 1373–1376 (2018)   28 September 2018



ECOLOGY

Pesticide affects social behavior of bees

Neonicotinoid exposure impairs the social dynamics of bumblebees inside the nest

9 NOVEMBER 2018 • VOL 362 ISSUE 6415

Glyphosate perturbs the gut microbiota of honey bees

Erick V. S. Motta[a,1], Kasie Raymann[a,2], and Nancy A. Moran[a,1]

www.pnas.org/cgi/doi/10.1073/pnas.1803880115

Sulfoxaflor exposure reduces bumblebee reproductive success

Harry Siviter[1*], Mark J. F. Brown[1] & Ellouise Leadbeater[1]

6 SEPTEMBER 2018 | VOL 561 | NATURE | 109

Que dit la recherche sur l'incidence du changement climatique sur la biodiversité ?

CLIMATE CHANGE

Past and future global transformation of terrestrial ecosystems under climate change

Connor Nolan[1], Jonathan T. Overpeck[2,1], Judy R. M. Allen[3], Patricia M. Anderson[4],

Nolan *et al.*, *Science* **361**, 920–923 (2018) 31 August 2018

Global shifts in the phenological synchrony of species interactions over recent decades

Heather M. Kharouba[a,b,1], Johan Ehrlén[c], Andrew Gelman[d], Kjell Bolmgren[e], Jenica M. Allen[f], Steve E. Travers[g], and Elizabeth M. Wolkovich[h,i]

PNAS | **May 15, 2018** | vol. 115 | no. 20 | **5211–5216**

Collapse of a desert bird community over the past century driven by climate change

Kelly J. Iknayan[a,b,1] and Steven R. Beissinger[a,b]

[a]Department of Environmental Science, Policy & Management, University of California, Berkeley, CA 94720; and [b]Museum of Vertebrate Zoology, University of California, Berkeley, CA 94720

PNAS | **August 21, 2018** | vol. 115 | no. 34 | **8597–8602**

Ecosystem warming extends vegetation activity but heightens vulnerability to cold temperatures

Andrew D. Richardson[1,2,3]*, Koen Hufkens[1], Thomas Milliman[4], Donald M. Aubrecht[1], Morgan E. Furze[1], Bijan Seyednasrollah[1,2,3], Misha B. Krassovski[5], John M. Latimer[5], W. Robert Nettles[5], Ryan R. Heiderman[5], Jeffrey M. Warren[5] & Paul J. Hanson[5]

368 | NATURE | VOL 560 | 16 AUGUST 2018

Changes in temperature alter the relationship between biodiversity and ecosystem functioning

Francisca C. García[a,1], Elvire Bestion[a,2], Ruth Warfield[a], and Gabriel Yvon-Durocher[a,1]

PNAS | **October 23, 2018** | vol. 115 | no. 43 | **10989–10994**

LETTER

https://doi.org/10.1038/s41586-018-0005-6

Accelerated increase in plant species richness on mountain summits is linked to warming

Manuel J. Steinbauer[1,2]*, John-Arvid Grytnes[3], Gerald Jurasinski[4], Aino Kulonen[3,5], Jonathan Lenoir[6], Harald Pauli[7,8], Christian Rixen[5], Manuela Winkler[7,8], Manfred Bardy-Durchhalter[7,8], Elena Barni[9], Anne D. Bjorkman[1,10,11], Frank T. Breiner[12,13], Sarah Burg[5], Patryk Czortek[14], Melissa A. Dawes[5,13], Anna Delimat[15], Stefan Dullinger[16], Brigitta Erschbamer[17], Vivian A. Felde[3], Olatz Fern· ndez-Arberas[18], Kjetil F. Fossheim[3], Daniel GÛmez-GarcÌa[18], Damien Georges[1,19], Erlend T. Grindrud[20], Sylvia Haider[11,21], Siri V. Haugum[3], Hanne Henriksen[20], MarÌa J. Herreros[18], Bogdan Jaroszewicz[14], Francesca Jaroszynska[3,22], Robert Kanka[23], Jutta Kapfer[24], Kari Klanderud[20], Ingolf K hn[11,21,25], Andrea Lamprecht[7,8], Magali Matteodo[5,26], Umberto Morra di Cella[27], Signe Normand[1,28], Arvid Odland[29], Siri L. Olsen[30], Sara Palacio[18], Martina Petey[27], Veronika Piscov· [23], Blazena Sedlakova[31], Klaus Steinbauer[7,8], Veronika Stˆckli[5,32], Jens-Christian Svenning[1,28], Guido Teppa[9], Jean-Paul Theurillat[33,34], Pascal Vittoz[26], Sarah J. Woodin[22], Niklaus E. Zimmermann[13,35] & Sonja Wipf[5]*

12 APRIL 2018 | VOL 556 | NATURE | 231

CLIMATE CHANGE

Increase in crop losses to insect pests in a warming climate

Curtis A. Deutsch[1,2]*†, Joshua J. Tewksbury[3,4,5]†, Michelle Tigchelaar[6], David S. Battisti[6], Scott C. Merrill[7], Raymond B. Huey[2], Rosamond L. Naylor[8]

Deutsch *et al.*, *Science* **361**, 916–919 (2018) 31 August 2018

APPLIED ECOLOGY

Parasite biodiversity faces extinction and redistribution in a changing climate

Colin J. Carlson,[1]* Kevin R. Burgio,[2†] Eric R. Dougherty,[1†] Anna J. Phillips,[3†] Veronica M. Bueno,[2] Christopher F. Clements,[4] Giovanni Castaldo,[1] Tad A. Dallas,[5] Carrie A. Cizauskas,[1] Graeme S. Cumming,[6] Jorge Doña,[7] Nyeema C. Harris,[8] Roger Jovani,[7] Sergey Mironov,[9] Oliver C. Muellerklein,[1] Heather C. Proctor,[10] Wayne M. Getz[1,11]

Carlson *et al.*, *Sci. Adv.* 2017;**3**:e1602422 6 September 2017

Que dit la recherche sur l'incidence du changement climatique sur la biodiversité ?

Review

Cracking the Code of Biodiversity Responses to Past Climate Change

David Nogués-Bravo,[1,*] Francisco Rodríguez-Sánchez,[2] Luisa Orsini,[3] Erik de Boer,[4] Roland Jansson,[5] Helene Morlon,[6] Damien A. Fordham,[1,7] and Stephen T. Jackson[8,9,*]

Trends in Ecology & Evolution, October 2018, Vol. 33, No. 10

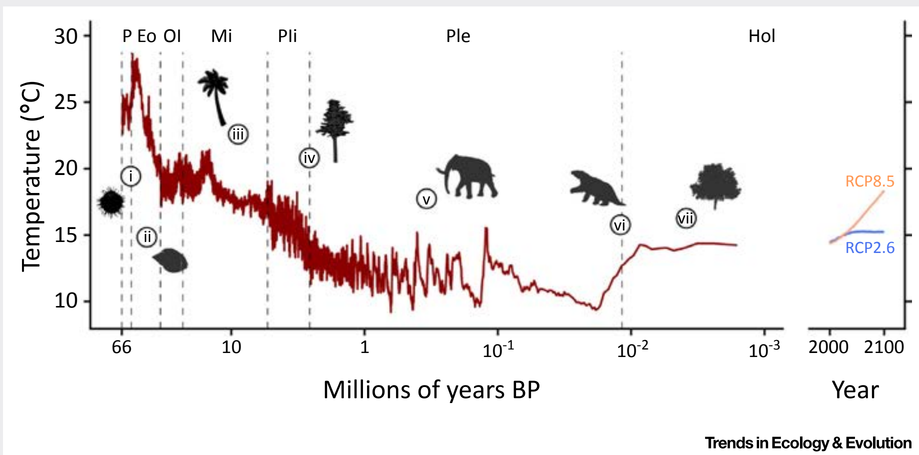


Figure I. Future Climate Forcing will Surpass those of the Previous Several Million Years [2]. Abbreviations: Eo, Eocene, Hol, Holocene; Mi, Miocene, Ol, Oligocene, P, Palaeocene, Pli, Pliocene, Ple, Pleistocene.

Outstanding Questions

How far can plasticity enable persistence *in situ*? Most organisms can tolerate changes in the environment by accommodating their morphology, behaviour, and ecophysiology to new environmental conditions. But where is the limit when phenotypic plasticity can no longer sustain real populations under other biotic and abiotic constraints?

Does plasticity evolve under climate change? The evolution of phenotypic plasticity is an important factor for population persistence in a variety of natural systems, but whether selection for increased plasticity is the result of climate change or an emergent trait from selection at shorter scale needs further research. In particular, additional research on the genetic basis and heritability of plasticity is needed so that we can gain a better understanding of conditions under which plasticity is expected to evolve.

How frequent and strong are adaptive responses to climate change? We still lack more evidences of evolutionary changes driven by climate change. Our ability to detect confidently bottlenecks or adaptive changes embedded in genomic signals in response to climatic or anthropogenic changes depends on the ability to sample before and after a drastic environmental change took place. Long-term monitoring and resurrection ecology approaches can greatly help obtain more information about adaptive responses.

Will species be able to move fast enough? Dispersal has always been a key response of organisms exposed to changing climates. But given the unprecedented rates and magnitude of ongoing climate change, will species be able to shift ranges at the required pace? In a human-dominated world, what factors determine the variation in effective migration rates?

How well can we predict future extinctions with our current data? Spatially-explicit mechanistic population models that include traits such as morphology, physiology, phenology, evolutionary adaptive potential, species behaviour, and species interactions are a promising route to improve biodiversity forecasts. These types of models are still in their infancy due to limitations in the available data to calibrate them. More biological and paleobiological data are thus strongly needed, including unrepresented taxa and regions across large climatic and anthropogenic pressure gradients, which highlights the key role of fieldwork, expeditions, biological collections in natural history museums, herbarium, and museum archives, to resolve the relevant societal challenges of the biodiversity crisis.

FRB FONDATION POUR LA RECHERCHE SUR LA BIODIVERSITÉ

Que dit la recherche sur l'incidence du changement climatique sur la biodiversité ?

Additive effects of climate and fisheries drive ongoing declines in multiple albatross species

PNAS, December 12, 2017, 114, E10829-E10837

Deborah Pardo[a,1], Jaume Forcada[a], Andrew G. Wood[a], Geoff N. Tuck[b], Louise Ireland[a], Roger Pradel[c], John P. Croxall[d], and Richard A. Phillips[a]

Ecosystem restructuring along the Great Barrier Reef following mass coral bleaching

Rick D. Stuart-Smith[1]*, Christopher J. Brown[2], Daniela M. Ceccarelli[3] & Graham J. Edgar[1]

92 | NATURE | VOL 560 | 2 AUGUST 2018

OCEAN ACIDIFICATION

Coral reefs will transition to net dissolving before end of century

Bradley D. Eyre,[1]* Tyler Cyronak,[2] Patrick Drupp,[3] Eric Heinen De Carlo,[3] Julian P. Sachs,[4] Andreas J. Andersson[2]

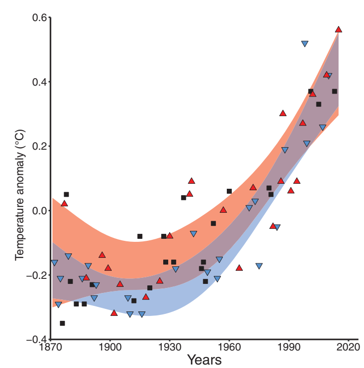
Eyre *et al.*, *Science* **359**, 908–911 (2018) 23 February 2018

Biologists ignore ocean weather at their peril

Ecologists must understand how marine life responds to changing local conditions, rather than to overall global temperature rise, say **Amanda E. Bates** and 16 colleagues.

16 AUGUST 2018 | VOL 560 | NATURE | 299

Fig. 1. Global warming throughout ENSO cycles. Sea surface temperature anomalies from 1871 to 2016, relative to a 1961–1990 baseline, averaged across 1670 1° latitude–by–1° longitude boxes containing coral reefs between latitudes of 31°N and 31°S. Data points differentiate El Niño (red triangles), La Niña (blue triangles), and ENSO neutral periods (black squares). Ninety-five percent confidence intervals are shown for nonlinear regression fits for years with El Niño and La Niña conditions (red and blue shading, respectively; overlap is shown in purple).



CORAL REEFS

Spatial and temporal patterns of mass bleaching of corals in the Anthropocene

Terry P. Hughes,[1]* Kristen D. Anderson,[1] Sean R. Connolly,[1,2] Scott F. Heron[3,4] James T. Kerry,[1] Janice M. Lough,[1,5] Andrew H. Baird,[1] Julia K. Baum,[6] Michael L. Berumen[7] Tom C. Bridge,[1,8] Danielle C. Claar,[6] C. Mark Eakin[3] James P. Gilmour,[9] Nicholas A. J. Graham,[1,10] Hugo Harrison[1] Jean Paul A. Hobbs,[11] Andrew S. Hoey,[1] Mia Hoogenboom,[1,2] Ryan J. Lowe,[12] Malcolm T. McCulloch,[12] John M. Pandolfi,[13] Morgan Pratchett,[1] Verena Schoepf,[12] Gergely Torda,[1,5] Shaun K. Wilson[14]

Hughes *et al.*, *Science* **359**, 80–83 (2018) 5 January 2018

PREDATION

Global pattern of nest predation is disrupted by climate change in shorebirds

Vojtěch Kubelka[1,2]*, Miroslav Šálek[3], Pavel Tomkovich[4], Zsolt Végvári[5,6], Robert P. Freckleton[7], Tamás Székely[2,8,9,10]*

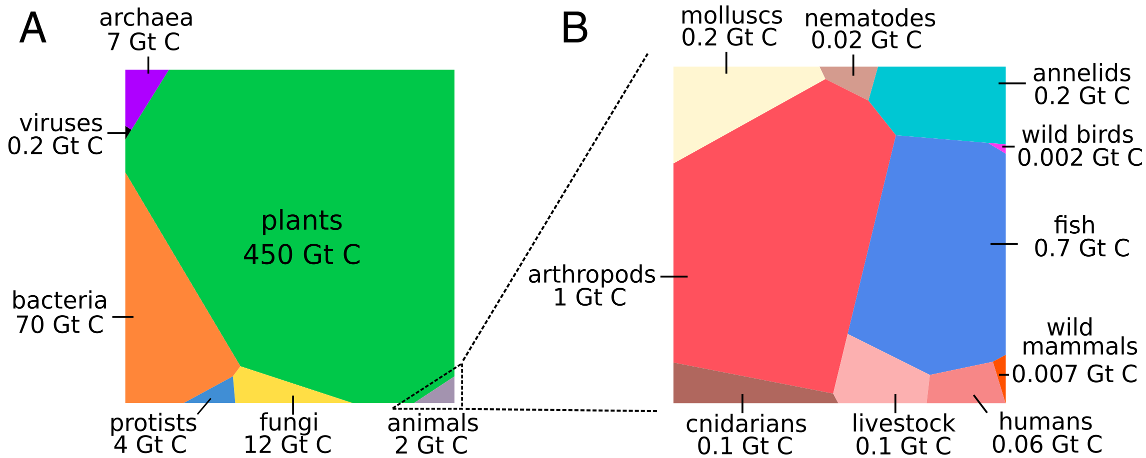
Kubelka *et al.*, *Science* **362**, 680–683 (2018)

Climate-driven declines in arthropod abundance restructure a rainforest food web

Bradford C. Lister[a,1] and Andres Garcia[b]

PNAS | vol. 115 | no. 44 | E10397–E10406

Que dit la recherche sur l'incidence de l'empreinte écologique humaine sur la biodiversité ?



Soit 11,6% de la biomasse humaine, ou 4,4% de la biomasse des Hommes et des animaux domestiques

F g. 1. Graphical representation of the global biomass distribution by taxa. (*A*) Absolute biomasses of different taxa are represented using a Voronoi diagram, with the area of each cell being proportional to that taxa global biomass (the specific shape of each polygon carries no meaning). This type of visualization is similar to pie charts but has a much higher dynamic range (a comparison is shown in *SI Appendix*, Fig. S4). Values are based on the estimates presented in Table 1 and detailed in the *SI Appendix*. A visual depiction without components with very slow metabolic activity, such as plant stems and tree trunks, is shown in *SI Appendix*, Fig. S1. (*B*) Absolute biomass of different animal taxa. Related groups such as vertebrates are located next to each other. We estimate that the contribution of reptiles and amphibians to the total animal biomass is negligible, as we discuss in the *SI Appendix*. Visualization performed using the online tool at bionic-vis.biologie.uni-greifswald.de/.

The biomass distribution on Earth

Yinon M. Bar-On[a], Rob Phillips[b,c], and Ron Milo[a,1]

PNAS May 21, 2018

http://www.fondationbiodiversite.fr/images/documents/Syntheses/2018-07_FRB_Synthese_RepartitionBiomasse.pdf

Que dit la recherche sur l'incidence de l'empreinte écologique humaine sur la biodiversité ?

PALEOECOLOGY

The decline of Africa's largest mammals

Did hominins play a role in the loss of megaherbivores?

PALEOECOLOGY

Plio-Pleistocene decline of African megaherbivores: No evidence for ancient hominin impacts

J. Tyler Faith[1,2]*, John Rowan[3,4], Andrew Du[5], Paul L. Koch[6]

It has long been proposed that pre-modern hominin impacts drove extinctions and shaped the evolutionary history of Africa's exceptionally diverse large mammal communities, but this hypothesis has yet to be rigorously tested. We analyzed eastern African herbivore communities spanning the past 7 million years—encompassing the entirety of hominin evolutionary history—to test the hypothesis that top-down impacts of tool-bearing, meat-eating hominins contributed to the demise of megaherbivores prior to the emergence of *Homo sapiens*. We document a steady, long-term decline of megaherbivores beginning ~4.6 million years ago, long before the appearance of hominin species capable of exerting top-down control of large mammal communities and predating evidence for hominin interactions with megaherbivore prey. Expansion of C_4 grasslands can account for the loss of megaherbivore diversity.

Faith *et al.*, *Science* **362**, 938–941 (2018)   23 November 2018

EXTINCTION

Body size downgrading of mammals over the late Quaternary

Felisa A. Smith,[1]* Rosemary E. Elliott Smith,[2] S. Kathleen Lyons,[3] Jonathan L. Payne[4]

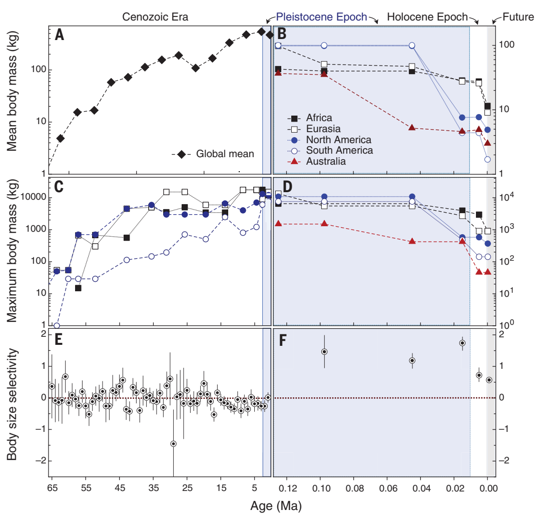
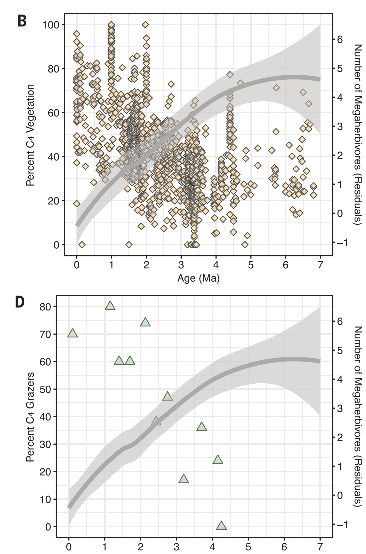


Fig. 3. Body size and its influence on extinction risk. (**A**) Global mean body size over the Cenozoic

Smith *et al.*, *Science* **360**, 310–313 (2018)   20 April 2018



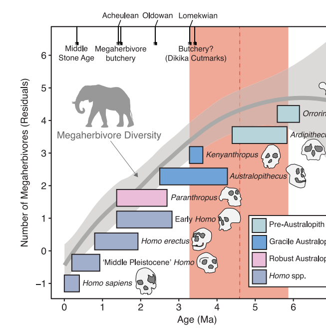


Fig. 3. The decline of megaherbivore richness relative to milestones in hominin evolution. These include the appearance of novel technologies and behaviors, as well as the observed temporal ranges of eastern African hominin taxa. The vertical dashed line indicates the breakpoint denoting onset of megaherbivore decline (4.6 Ma ago), with red shading representing the 95% confidence interval (3.3 to 5.9 Ma ago).

Data Descriptor: Global terrestrial Human Footprint maps for 1993 and 2009

Oscar Venter[1,2,3], Eric W. Sanderson[4], Ainhoa Magrach[5,6], James R. Allan[2,7], Jutta Beher[2], Kendall R. Jones[2,7], Hugh P. Possingham[2,8], William F. Laurance[3], Peter Wood[3], Balázs M. Fekete[9], Marc A. Levy[10] & James E.M. Watson[4,7]

SCIENTIFIC DATA | 3:160067 | DOI: 10.1038/sdata.2016.67

Que dit la recherche sur l'incidence de l'empreinte écologique humaine sur la biodiversité ?

Global land change from 1982 to 2016

Xiao-Peng Song[1]*, Matthew C. Hansen[1], Stephen V. Stehman[2], Peter V. Potapov[1], Alexandra Tyukavina[1], Eric F. Vermote[3] & John R. Townshend[1]

Land change is a cause and consequence of global environmental change[1,2]. Changes in land use and land cover considerably alter the Earth's energy balance and biogeochemical cycles, which contributes to climate change and—in turn—affects land surface properties and the provision of ecosystem services[1–4]. However, quantification of global land change is lacking. Here we analyse 35 years' worth of satellite data and provide a comprehensive record of global land-change dynamics during the period 1982–2016. We show that—contrary to the prevailing view that forest area has declined globally[5]—tree cover has increased by 2.24 million km^2 (+7.1% relative to the 1982 level). This overall net gain is the result of a net loss in the tropics being outweighed by a net gain in the extratropics. Global bare ground cover has decreased by 1.16 million km^2 (−3.1%), most notably in agricultural regions in Asia. Of all land changes, 60% are associated with direct human activities and 40% with indirect drivers such as climate change. Land-use change exhibits regional dominance, including tropical deforestation and agricultural expansion, temperate reforestation or afforestation, cropland intensification and urbanization. Consistently across all climate domains, montane systems have gained tree cover and many arid and semi-arid ecosystems have lost vegetation cover. The mapped land changes and the driver attributions reflect a human-dominated Earth system. The dataset we developed may be used to improve the modelling of land-use changes, biogeochemical cycles and vegetation–climate interactions to advance our understanding of global environmental change[1–4,6].

30 AUGUST 2018 | VOL 560 | NATURE | 639

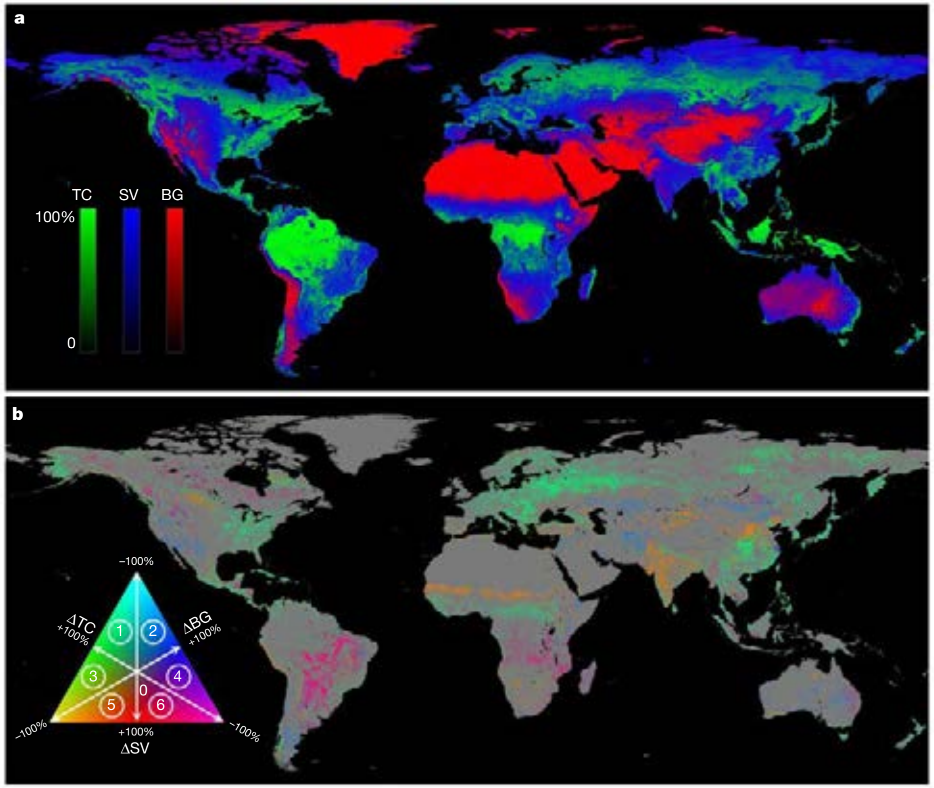


Fig. 1 | A satellite-based record of global TC, SV and BG cover from 1982 to 2016. a, Mean annual estimates. **b**, Long-term change estimates. Both mean and change estimates are expressed as per cent of pixel area at 0.05° × 0.05° spatial resolution. Pixels showing a statistically significant trend ($n = 35$, two-sided Mann–Kendall test, $P < 0.05$) in either TC, SV or BG are depicted on the change map. Circled numbers in the colour legend denote dominant change directions: 1, TC gain with SV loss; 2, BG gain with SV loss; 3, TC gain with BG loss; 4, BG gain with TC loss; 5, SV gain with BG loss; and 6, SV gain with TC loss.

TC : canopée forestière, SV : végétation courte, BG : sols nus

Que dit la recherche sur l'incidence de l'empreinte écologique humaine sur la biodiversité ?

SCIENCE ADVANCES | RESEARCH ARTICLE

ENVIRONMENTAL STUDIES

Congo Basin forest loss dominated by increasing smallholder clearing

Alexandra Tyukavina[1]*, Matthew C. Hansen[1], Peter Potapov[1], Diana Parker[1], Chima Okpa[1], Stephen V. Stehman[2], Indrani Kommareddy[1], Svetlana Turubanova[1]

A regional assessment of forest disturbance dynamics from 2000 to 2014 was performed for the Congo Basin countries using time-series satellite data. Area of forest loss was estimated and disaggregated by predisturbance forest type and direct disturbance driver. An estimated 84% of forest disturbance area in the region is due to small-scale, nonmechanized forest clearing for agriculture. Annual rates of small-scale clearing for agriculture in primary forests and woodlands doubled between 2000 and 2014, mirroring increasing population growth. Smallholder clearing in the Democratic Republic of the Congo alone accounted for nearly two-thirds of total forest loss in the basin. Selective logging is the second most significant disturbance driver, contributing roughly 10% of regional gross forest disturbance area and more than 60% of disturbance area in Gabon. Forest loss due to agro-industrial clearing along the Gulf of Guinea coast more than doubled in the last half of the study period. Maintaining natural forest cover in the Congo Basin into the future will be challenged by an expected fivefold population growth by 2100 and allocation of industrial timber harvesting and large-scale agricultural development inside remaining old-growth forests.

Tyukavina *et al.*, *Sci. Adv.* 2018; **4**:eaat2993

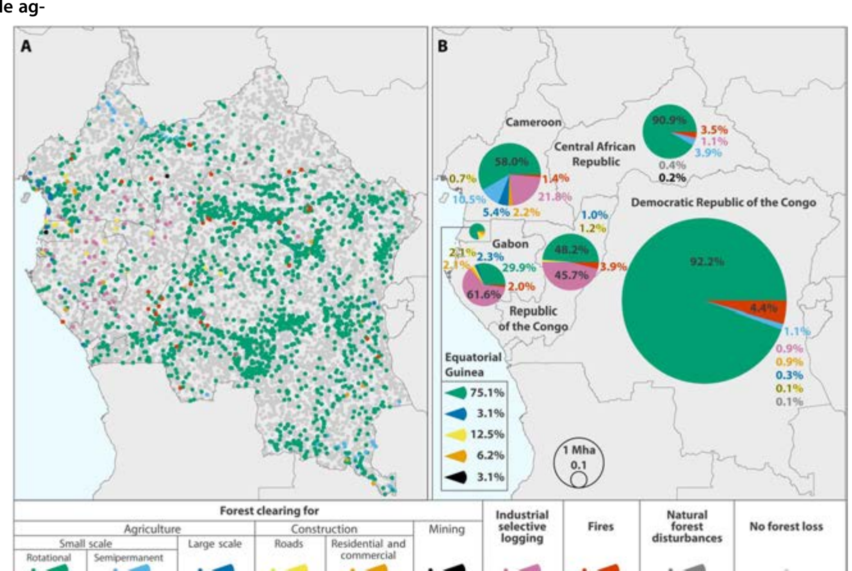


Fig. 1. Forest disturbance driver. (**A**) Reference disturbance driver for each sampled pixel. (**B**) National estimates of 2000 to 2014 forest loss area by disturbance driver. Area estimates along with SEs are presented in table S2A. Forest clearing for small-scale rotational agriculture includes clearing for charcoal production, the contribution of which does not exceed 10% of the class area (*42*).

Que dit la recherche sur l'incidence des invasions biologiques sur la biodiversité ?

DNA SEQUENCING

Super-invasive crayfish revealed to be a genetic hybrid

Scientists examine DNA of a marbled crayfish that is spreading ferociously.

EWEN CALLAWAY

8 FEBRUARY 2018 | VOL 554 | NATURE | 157

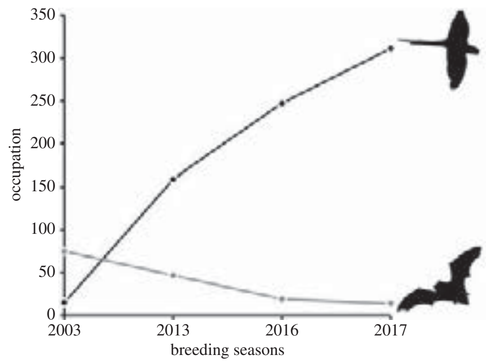


Figure 2. Changes in the number of nests of rose-ringed parakeets and trees occupied by greater noctules across years in María Luisa Park.

Nest-site competition and killing by invasive parakeets cause the decline of a threatened bat population

Dailos Hernández-Brito[1], Martina Carrete[1,3], Carlos Ibáñez[2], Javier Juste[2,4] and José L. Tella[1]

R. Soc. open sci. **5**: 172477.

ECOLOGY

South Africa's invasive species guzzle water and cost US$450 million a year

The country's first report on its biological invaders is pioneering in scope, and paints a dire picture for resources and biodiversity.

164 | NATURE | VOL 563 | 8 NOVEMBER 2018

Remoteness promotes biological invasions on islands worldwide

Dietmar Moser[a,1], Bernd Lenzner[a,1,2], Patrick Weigelt[b], Wayne Dawson[c], Holger Kreft[b], Jan Pergl[d], Petr Pyšek[d,e,f], Mark van Kleunen[g,h], Marten Winter[i], César Capinha[j,k], Phillip Cassey[l], Stefan Dullinger[a], Evan P. Economo[m], Pablo García-Díaz[l,n], Benoit Guénard[m,o], Florian Hofhansl[a,p], Thomas Mang[a], Hanno Seebens[q], and Franz Essl[a]

9270–9275 | PNAS | September 11, 2018 | vol. 115 | no. 37

Global rise in emerging alien species results from increased accessibility of new source pools

Hanno Seebens[a,b,1], Tim M. Blackburn[c,d,e], Ellie E. Dyer[c,d], Piero Genovesi[f,g], Philip E. Hulme[h], Jonathan M. Jeschke[i,j,k], Shyama Pagad[l], Petr Pyšek[m,n], Mark van Kleunen[o,p], Marten Winter[q], Michael Ansong[r], Margarita Arianoutsou[s], Sven Bacher[t], Bernd Blasius[u], Eckehard G. Brockerhoff[v], Giuseppe Brundu[w], César Capinha[x,y], Charlotte E. Causton[z], Laura Celesti-Grapow[aa], Wayne Dawson[bb], Stefan Dullinger[b], Evan P. Economo[cc], Nicol Fuentes[dd], Benoit Guénard[ee], Heinke Jäger[z], John Kartesz[ff], Marc Kenis[gg], Ingolf Kühn[g,hh,ii], Bernd Lenzner[b], Andrew M. Liebhold[jj], Alexander Mosena[kk,ll], Dietmar Moser[b], Wolfgang Nentwig[mm], Misako Nishino[ff], David Pearman[nn], Jan Pergl[nn], Wolfgang Rabitsch[oo], Julissa Rojas-Sandoval[pp], Alain Roques[qq], Stephanie Rorke[rr], Silvia Rossinelli[t], Helen E. Roy[rr], Riccardo Scalera[g], Stefan Schindler[b], Kateřina Štajerová[m,n], Barbara Tokarska-Guzik[ss], Kevin Walker[nn], Darren F. Ward[tt,uu], Takehiko Yamanaka[vv], and Franz Essl[b,e,1]

PNAS March 6, 2018 115 (10) E2264-E2273;

RESEARCH ARTICLE

AMPHIBIAN DECLINE

Recent Asian origin of chytrid fungi causing global amphibian declines

Simon J. O'Hanlon,[1,2]* Adrien Rieux,[3] Rhys A. Farrer,[1] Gonçalo M. Rosa,[2,4,5] Brue Waldman,[6] Arnaud Bataille,[6,7] Tiffany A. Kosch,[6,8] Kris A. Murray,[1] Balázs Brankovics,[9,10] Matteo Fumagalli,[11,12] Michael D. Martin,[13,14] Nathan Wales,[14] Mario Alvarado-Rybak,[15] Kieran A. Bates,[1,2] Lee Berger,[8] Susanne Böll,[16] Lola Brookes,[2] Frane s Clare,[1,2] Elodie A. Courtois,[17] Andrew A. Cunningham,[2] Thomas M. Doherty-Bone,[18] Pria Ghosh,[1,19] David J. Gower,[20] William E. Hintz,[21] Jao b Höglund,[22] Thomas S. Jenkinson,[23] Chun-Fu Lin,[24] Anssi Laurila,[22] Adeline Loyau,[25,26] An Martel,[27] Sara Meurling,[22] Claude Miaud,[28] Pete Minting,[29] Frank Pasmans,[27] Dirk S. Schmeller,[25,26] Benedikt R. Schmidt,[30] Jennifer M. G. Shelton,[1] Lee F. Skerratt,[8] Freya Smith,[2,31] Claudio Soto-Azat,[15] Matteo Spagnoletti,[12] Giulia Tessa,[32] Luís Felipe Toledo,[33] Andrés Valenzuela-Sánchez,[15,34] Ruhan Verster,[19] Judit Vörös,[35] Rebecca J. Webb,[8] Claudia Wierzbicki,[1] Emma Wombwell,[2] Kelly R. Zamudio,[36] David M. Aanensen,[1,37] Timothy Y. James,[23] M. Thomas P. Gilbert,[13,14] Ché Weldon,[19] Jaime Bosch,[38] Franę is Balloux,[12]† Trenton W. J. Garner,[2,19,32]† Matthew C. Fisher[1]*

O'Hanlon *et al.*, *Science* **360**, 621–627 (2018) 11 May 2018

Que dit la recherche sur l’incidence des invasions biologiques sur la biodiversité ?

Review

Bridgehead Effects and Role of Adaptive Evolution in Invasive Populations

Cleo Bertelsmeier[1,*] and Laurent Keller[1,*]

Trends in Ecology & Evolution, July 2018, Vol. 33, No. 7

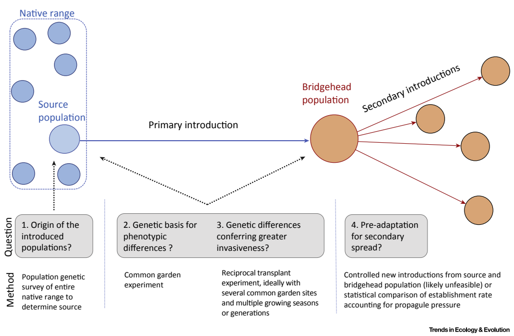


Figure 1. Evidence Needed to Demonstrate That Adaptive Evolution Is an Important Driver of Secondary Introductions.

Opinion

Community Assembly Theory as a Framework for Biological Invasions

Dean E. Pearson,[1,2,*] Yvette K. Ortega,[1] Özkan Eren,[3] and José L. Hierro[4,5]

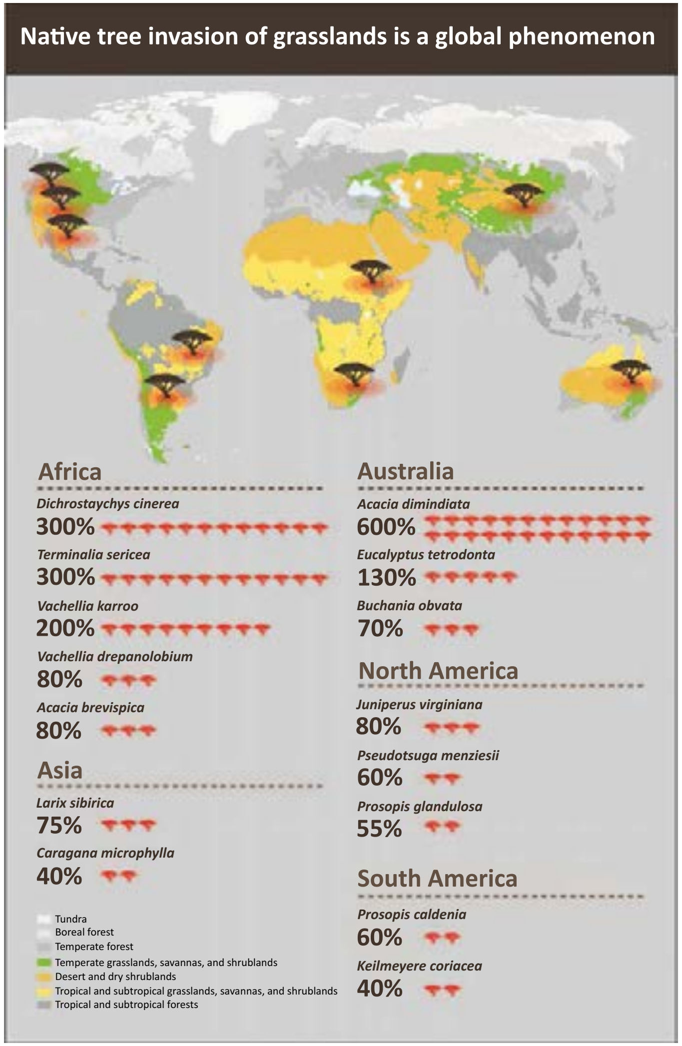
Trends in Ecology & Evolution, May 2018, Vol. 33, No. 5

Opinion

The Nebulous Ecology of Native Invasions

Lloyd L. Nackley,[1,2,*] Adam G. West,[2] Andrew L. Skowno,[3,4] and William J. Bond[2,5]

Trends in Ecology & Evolution, November 2017, Vol. 32, No. 11



Trends in Ecology & Evolution

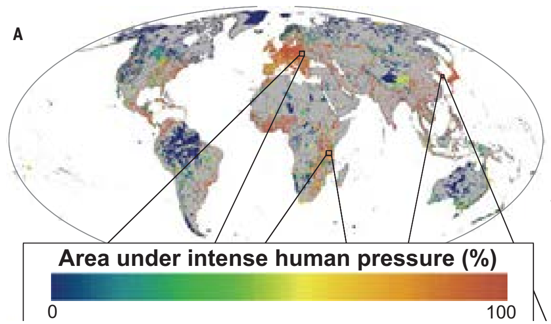
Figure 1. Evidence of Native Tree Invasions into Grass Ecosystems from Around the World. Percentage

La protection de la biodiversité

Warfare and wildlife declines in Africaís protected areas

Joshua H. Daskin[1] & Robert M. Pringle[1]

328 | NATURE | VOL 553 | 18 JANUARY 2018



PROTECTED AREAS

One-third of global protected land is under intense human pressure

Kendall R. Jones,[1,2]* Oscar Venter,[3] Richard A. Fuller,[2,4] James R. Allan,[1,2]
Sean L. Maxwell,[1,2] Pablo Jose Negret,[1,2] James E. M. Watson[1,2,5]

Jones *et al.*, *Science* **360**, 788–791 (2018) 18 May 2018

MARINE ECOLOGY

A call for seagrass protection

Seagrass conservation is crucial for climate mitigation, biodiversity protection, and food security

SCIENCE 3 AUGUST 2018 • VOL 361 ISSUE 6401

Reductions in global biodiversity loss predicted from conservation spending

Anthony Waldron[1,2], Daniel C. Miller[2], Dave Redding[3], Arne Mooers[4], Tyler S. Kuhn[5], Nate Nibbelink[6], J. Timmons Roberts[7], Joseph A. Tobias[1,8] & John L. Gittleman[9]

RESEARCH ARTICLE

Aligning nature conservation and agriculture: the search for new regimes

Henny J. van der Windt[1,2], Jac. A.A. Swart[1]

Restoration Ecology Vol. 26, No. S1, pp. S54–S62 April 2018

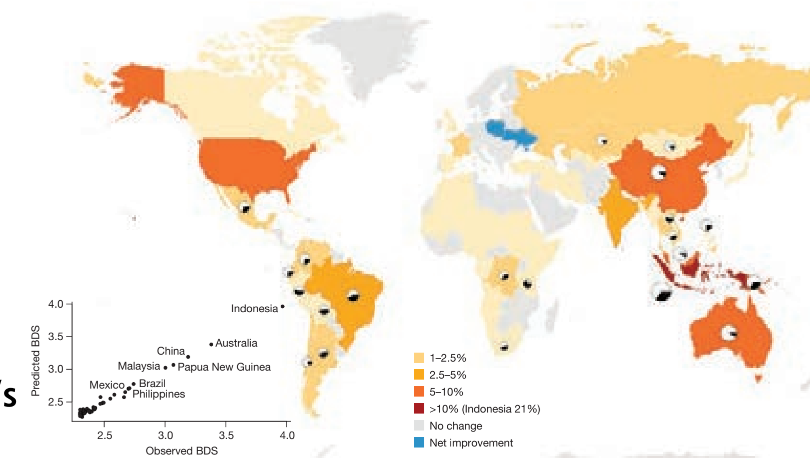


Figure 1 | Global biodiversity declines and the effects of conservation spending. Colours show percentage of all global declines (total BDS) associated with each country. Pie charts show the predicted reduction in decline (in black) if spending had been I$5 million higher (for selected countries); pie size represents the square root of the BDS. Inset shows predicted versus observed BDS (log-transformed) for the continuous model (see also Extended Data Fig. 4). Country outlines supplied by esri_dm (https://www.arcgis.com/home/item.html?id=d86e32ea12a64727b9e94d6f820123a2#overview).

364 | NATURE | VOL 551 | 16 NOVEMBER 2017

COMMENT

DOI: 10.1038/s41467-018-03622-0 OPEN

Strategically growing the urban forest will improve our world

Theodore A. Endreny[1] NATURE COMMUNICATIONS | (2018)9:1160

More than $1 billion needed annually to secure Africa’s protected areas with lions

Peter A. Lindsey[a,b,c,1,2], Jennifer R. B. Miller[a,d,1], Lisanne S. Petracca[a,e,1], Lauren Coad[f], Amy J. Dickman[g], Kathleen H. Fitzgerald[h], Michael V. Flyman[i], Paul J. Funston[a], Philipp Henschel[a], Samuel Kasiki[j], Kathryn Knights[k], Andrew J. Loveridge[g], David W. Macdonald[g], Roseline L. Mandisodza-Chikerema[l], Sean Nazerali[m], Andrew J. Plumptre[n,o], Riko Stevens[a], Hugo W. Van Zyl[p], and Luke T. B. Hunter[a,q]

E10788–E10796 | PNAS | vol. 115 | no. 45

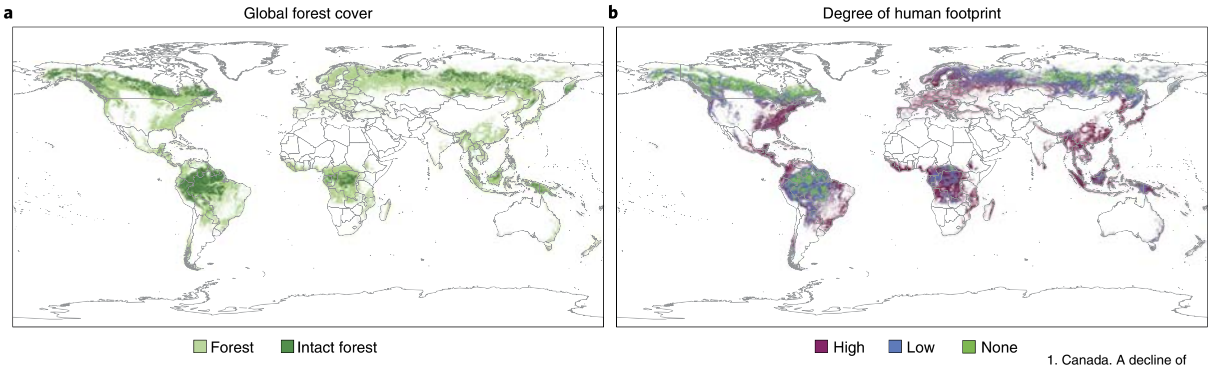
La protection de la biodiversité

Que dit la recherche sur les aires protégées ?

The exceptional value of intact forest ecosystems

James E. M. Watson[1,2,15]*, Tom Evans[2,15], Oscar Venter[3], Brooke Williams[1,2], Ayesha Tulloch[1,2], Claire Stewart[1], Ian Thompson[4], Justina C. Ray[5], Kris Murray[6], Alvaro Salazar[1], Clive McAlpine[1], Peter Potapov[7], Joe Walston[2], John G Robinson[2], Michael Painter[2], David Wilkie[2], Christopher Filardi[8], William F. Laurance[9], Richard A. Houghton[10], Sean Maxwell[1], Hedley Grantham[1,2], Cristi· n Samper[2], Stephanie Wang[2], Lars Laestadius[11], Rebecca K. Runting[1], Gustavo A. Silva-Ch· vez[12], Jamison Ervin[13] and David Lindenmayer[14]

NATURE ECOLOGY & EVOLUTION | www.nature.com/natecolevol



Schematic representation of the transition (from left to right) of a non-hunted, faunally intact tropical forest to an overhunted, defaunated forest. Shown is the degree to which large arboreal or terrestrial forest frugivores such as elephants and apes decline in abundance and, with these declines, the associated replacement of large-fruited high-biomass trees by smaller-fruited and wind-dispersed trees that have lower biomass and carbon storage. Credit: Blake Alexander Simmons.

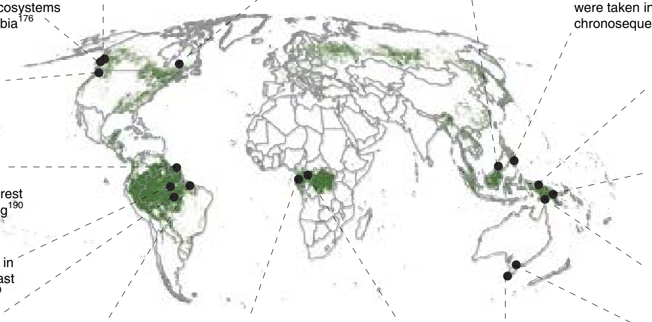


Fig. 2 | Forest degradation and carbon loss. Examples of published case studies that have examined the effects of forest degradation on carbon loss[23,117,176–191]. Supplementary Table 1 provides in-depth summaries of each of the 15 case studies.

Opinion

What Conservation Does

Laurent Godet[1,3,*] and Vincent Devictor[2,3]

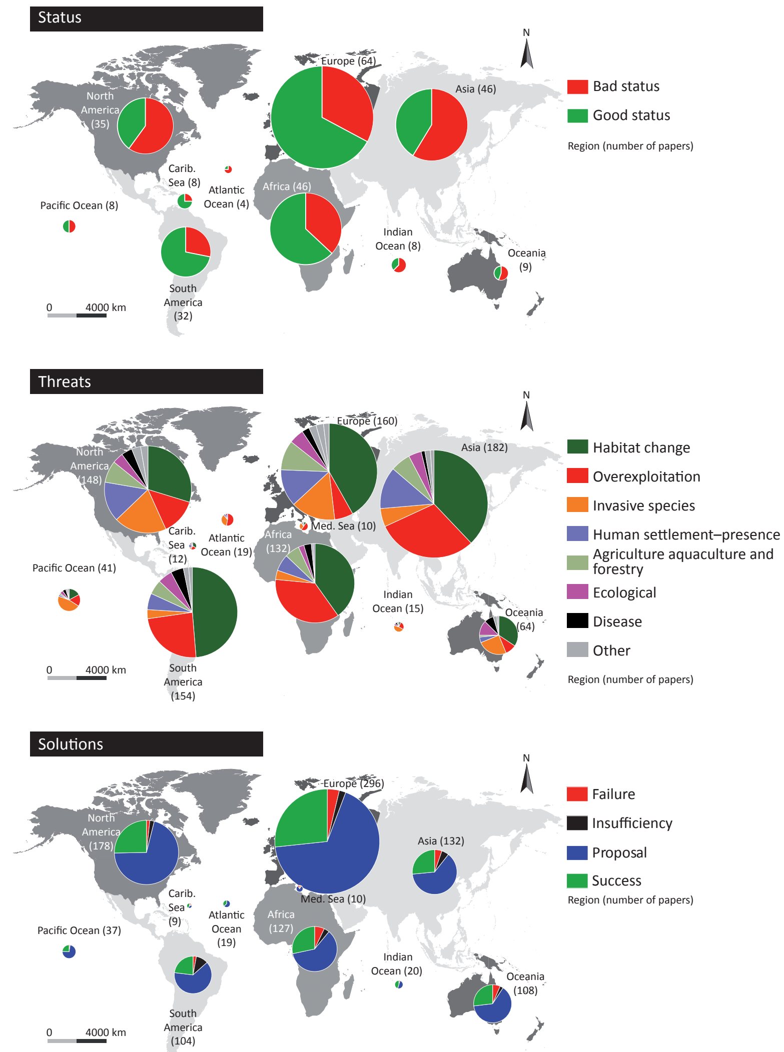
New agendas for conservation are regularly proposed based on the ground that existing strategies are overly pessimistic, restricted to biodiversity hotspots, and inappropriate to halt biodiversity loss. However, little empirical evidence supports such claims. Here we review the 12 971 papers published in the leading conservation journals during the last 15 years to assess what conservation actually does. Although conservation research is affected by specific bias, conservation is playing a major role in providing empirical evidence of human impacts on biodiversity. Encouraging biodiversity comebacks are also published and a wide range of conservation tools, beyond the development of protected areas in wilderness areas, are promoted. We argue that finding new routes to conservation is neither necessary nor sufficient to halt biodiversity loss.

Trends in Ecology & Evolution, October 2018, Vol. 33, No. 10

La recherche constante de plus en plus de compromis lorsque la protection de la nature est en jeu fait partie des obstacles majeurs et non des solutions

Outstanding Questions

The difficulty to address conservation challenges does not result from the conservation agenda itself. The new conservation debate should focus on what is working or not and why, rather than proposing new directions for the discipline. Recognizing the existence of several biases in the distribution of research studies among countries, taxonomic groups, or topics should motivate even higher conservation efforts. In the future, the success stories of conservation actions and the effectiveness of existing conservation tools should be better investigated.



La protection de la biodiversité

PERSPECTIVES

BEHAVIOR

How behavioral science can help conservation

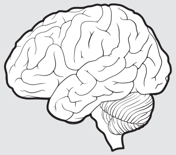
Leveraging cognitive biases and social influence can make conservation efforts more effective

By **Joshua Cinner**

23 NOVEMBER 2018 • VOL 362 ISSUE 6417 **889**

Leveraging behavioral insights for conservation

Cognitive biases



The status quo bias
Most people prefer to maintain the status quo. This can be addressed by setting the default option so that people need to "opt out" rather than "opt in" to sustainable options.

Anchoring
People tend to rely on initial information. This bias can be leveraged by setting cognitive anchors early and far from critical thresholds.

Issue framing
People have a strong aversion to losses. Highlighting what they stand to lose by unsustainable practices and policies helps to catalyze action.

Decoys
When people have trouble making decisions, the desirability of sustainable options can be emphasized with the use of less desirable "decoy" options.

Social influences

Social norms
People want to fit in with what "most people do" and what "should be done." Communicating social norms about conservation can help to encourage sustainable behaviors.

Observability
People behave more prosocially when they think others know what they are doing. Increasing observability can promote sustainable behaviors.

Block leaders
Whom we receive information from can be as powerful as what we receive. Trusted messengers and block leaders can amplify uptake.

Public commitments
People want to maintain prestige and reputation, which can be leveraged through public commitments or pledges to change behavior.

Que dit la recherche sur l'incidence de la transition énergétique sur la biodiversité ?

CLIMATE

Are wood pellets a green fuel?

A return to firewood is bad for forests and for the climate

By **William H. Schlesinger**

Science, 359, 2018

Oiseaux

Martinets, Colibris

Pluviers, Avocettes, Goélands

Aigles, Pygargues, Vautours

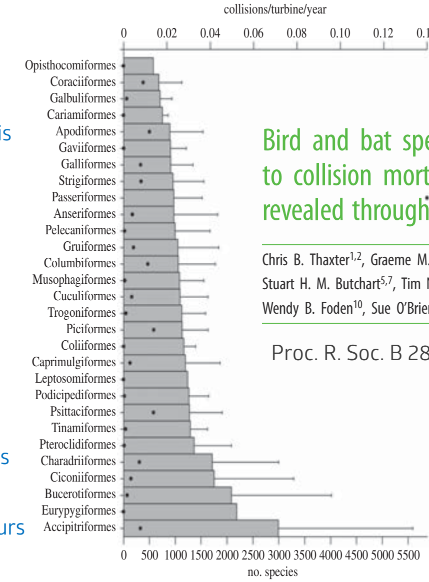


Figure 2. Predictions of mean collisions per turbine (per year) (±s.d.) for bird orders (9568 species) from the posterior distributions of MCMCglmm models, ordered by mean predictions; numbers of species per order are shown by black dots.

Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment

Chris B. Thaxter[1,2], Graeme M. Buchanan[3], Jamie Carr[4], Stuart H. M. Butchart[5,7], Tim Newbold[6], Rhys E. Green[7,8], Joseph A. Tobias[9], Wendy B. Foden[10], Sue O'Brien[11] and James W. Pearce-Higgins[1,2,7]

Proc. R. Soc. B 284: 20170829. 2018

Chauves souris

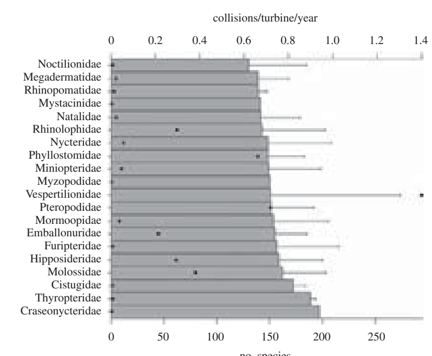


Figure 3. Predictions of mean collisions per turbine (per year) (±s.d.) for bat families (888 species) from the posterior distributions of MCMCglmm models, ordered by mean predictions; numbers of species per family are shown by black dots.

Que dit la recherche sur l'incidence de la transition énergétique sur la biodiversité ?

http://www.fondationbiodiversite.fr/images/documents/Evenements/CR_JFRB.pdf

Compte rendu

OCTOBRE 2017

Journées FRB 2017
Biodiversité et transition énergétique : enquêtes sur des liaisons dangereuses

La journée annuelle de la FRB, qui avait pour thème « Biodiversité et transition énergétique, enquêtes sur des liaisons dangereuses », a connu cette année un très grand succès. Tout d'abord par le nombre de participants, qui a largement dépassé les 300 personnes, et ensuite par la mobilisation des chercheurs, acteurs et partenaires de la Fondation pour réfléchir à cette question intéressante et novatrice.

Iddri, LIFTI, Orée, EDF, Engie, Suez, Total, IUCN, Enecis, RTE, GRT gaz, CCI France, Séché environnement, LPO, EPE, Icare & consult, AFB, ce ne sont en effet pas moins de 16 structures, en majorité membres du Conseil d'orientation stratégique de la FRB, qui sont venues apporter leur témoignage sur les actions ou les réflexions déjà engagées dans leurs entreprises, aux côtés des instituts de recherche comme l'IRD, le Cirad, l'Inra, le MNHN ou encore l'IIASA.

Enfin, en complément du soutien à la recherche sur la biodiversité, réaffirmé par Elisabeth Vergès, représentant la ministre de la recherche, le ministre de la transition écologique et solidaire, Nicolas Hulot, est venu y faire des annonces majeures. Il a notamment annoncé qu'il ferait de la protection de la biodiversité une priorité de son action à parité avec la lutte contre le changement climatique. Dans le même temps, le ministre a appelé les chercheurs à guider l'action publique, orienter ses choix et l'appuyer dans la reconquête de biodiversité. Cette mobilisation et les engagements politiques qui en découlent constitue une parfaite illustration du rôle d'interface innovante entre la science et l'action que joue la FRB.

1

Que dit la recherche sur la transition alimentaire et les changements de pratiques agricoles ?

RESEARCH

SUSTAINABILITY

Reducing food's environmental impacts through producers and consumers

J. Poore[1,2]* and T. Nemecek[3]

Opinion Paper

Intensify production, transform biomass to energy and novel goods and protect soils in Europe A vision how to mobilize marginal lands

P. Schröder[a,*], B. Beckers[b], S. Daniels[b], F. Gnädinger[a], E. Maestri[c], N. Marmiroli[c], M. Mench[d], R. Millan[e], M.M. Obermeier[a], N. Oustriere[d], T. Persson[f], C. Poschenrieder[g], F. Rineau[b], B. Rutkowska[h], T. Schmid[e], W. Szulc[h], N. Witters[b], A. Sæbø[f]

Modulating plant growthñmetabolism coordination for sustainable agriculture

Shan Li[1,2], Yonghang Tian[1], Kun Wu[1], Yafeng Ye[1], Jianping Yu[1], Jianqing Zhang[1], Qian Liu[1], Mengyun Hu[3], Hui Li[3], Yiping Tong[1], Nicholas P. Harberd[4] & Xiangdong Fu[1,2]*

Feature Review

Diversifying Food Systems in the Pursuit of Sustainable Food Production and Healthy Diets

Sangam L. Dwivedi,[1] Edith T. Lammerts van Bueren,[2,3] Salvatore Ceccarelli,[4] Stefania Grando,[1] Hari D. Upadhyaya,[1] and Rodomiro Ortiz[5,*]

RESEARCH ARTICLE

Temporal trends in arthropod abundances after the transition to organic farming in paddy fields

Masaru H. Tsutsui[1], Kazuhiko Kobayashi[2], Tadashi Miyashita[1]*

Opinion

Reframing the Food–Biodiversity Challenge

Joern Fischer,[1,*] David J. Abson,[1] Arvid Bergsten,[1] Neil French Collier,[1] Ine Dorresteijn,[1] Jan Hanspach,[1] Kristoffer Hylander,[2] Jannik Schultner,[1] and Feyera Senbeta[3]

Nutritional and greenhouse gas impacts of removing animals from US agriculture

Robin R. White[a,1,2] and Mary Beth Hall[b,1,2]

Review

Winners and losers of organic cereal farming in animal communities across Central and Northern Europe

K. Birkhofer[a,*], J. Ekroos[b], E.B. Corlett[a], H.G. Smith[a,b]

[a] Department of Biology, Lund University, S lvegatan 37, 22362 Lund, Sweden
[b] Centre for Environmental and Climate Research, Lund University, S lvegatan 37, 22362 Lund, Sweden

Subtle differences in birds detected between organic and nonorganic farms in Saskatchewan Prairie Parklands by farm pair and bird functional group

David Anthony Kirk[a,*], Kathryn E. Freemark Lindsay[b]

[a] Aquila Conservation & Environment Consulting, 75 Albert Street, Suite 300, Ottawa K1P 5E7, Ontario, Canada
[b] Wildlife and Landscape Science, Environment Canada, National Wildlife Research Centre, Ottawa K1A 0H3, Canada

ORIGINAL RESEARCH

WILEY Ecology and Evolution

Tillage and herbicide reduction mitigate the gap between conventional and organic farming effects on foraging activity of insectivorous bats

Kévin Barré[1,2] | Isabelle Le Viol[1,3] | Romain Julliard[1] | François Chiron[4] | Christian Kerbiriou[1,3]

REVIEW

The interaction of human population, food production, and biodiversity protection

Eileen Crist,[1]* Camilo Mora,[2] Robert Engelman[3]

PRIMARY RESEARCH ARTICLE

WILEY Global Change Biology

A global synthesis of the effects of diversified farming systems on arthropod diversity within fields and across agricultural landscapes

PeerJ

Regenerative agriculture: merging farming and natural resource conservation profitably

Claire E. LaCanne[1] and Jonathan G. Lundgren[2]

[1] Natural Resource Management Department, South Dakota State University, Brookings, SD, USA
[2] Ecdysis Foundation, Estelline, SD, USA

Research paper

Does organic farming enhance biodiversity in Mediterranean vineyards? A case study with bats and arachnids

Jérémy S.P. Froidevaux[a,*], Bastien Louboutin[b], Gareth Jones[a]

Que dit la recherche sur la transition alimentaire et les changements de pratiques agricoles ?

http://www.fondationbiodiversite.fr/images/documents/Evenements/2018-09_CR_JFRB2018.pdf


Compte rendu

Novembre 2018

Journée FRB 2018
Biodiversité, transition alimentaire et santé

Avertissement : les citations de sociétés ou de marques commerciales dans ce compte-rendu ou les commentaires faits à leurs propos n'engagent pas la FRB

La journée FRB « Biodiversité, transition alimentaire et santé » s'est tenue le 27 septembre 2018. Elle avait pour ambition de faire un point sur l'état des connaissances scientifiques sur ces enjeux mais aussi d'animer des discussions avec les parties prenantes sur les voies d'une transition alimentaire effective et partagée par le plus grand nombre. Car si les solutions existent, des questions majeures doivent encore trouver leurs réponses.

Comment faire en sorte que ces solutions pensées au niveau mondial puissent s'appliquer localement ? Et à quel prix politique et social ?

1

Options for keeping the food system within environmental limits

Marco Springmann[1,2]*, Michael Clark[3], Daniel Mason-DíCroz[4,5], Keith Wiebe[4], Benjamin Leon Bodirsky[6], Luis Lassaletta[7], Wim de Vries[8], Sonja J. Vermeulen[9,10], Mario Herrero[5], Kimberly M. Carlson[11], Malin Jonell[12], Max Troell[12,13], Fabrice DeClerck[14,15], Line J. Gordon[12], Rami Zurayk[16], Peter Scarborough[2], Mike Rayner[2], Brent Loken[12,14], Jess Fanzo[17,18], H. Charles J. Godfray[1,19], David Tilman[20,21], Johan Rockstrˆm[6,12] & Walter Willett[22]

The food system is a major driver of climate change, changes in land use, depletion of freshwater resources, and pollution of aquatic and terrestrial ecosystems through excessive nitrogen and phosphorus inputs. Here we show that between 2010 and 2050, as a result of expected changes in population and income levels, the environmental effects of the food system could increase by 50ñ90% in the absence of technological changes and dedicated mitigation measures, reaching levels that are beyond the planetary boundaries that define a safe operating space for humanity. We analyse several options for reducing the environmental effects of the food system, including dietary changes towards healthier, more plant-based diets, improvements in technologies and management, and reductions in food loss and waste. We find that no single measure is enough to keep these effects within all planetary boundaries simultaneously, and that a synergistic combination of measures will be needed to sufficiently mitigate the projected increase in environmental pressures.

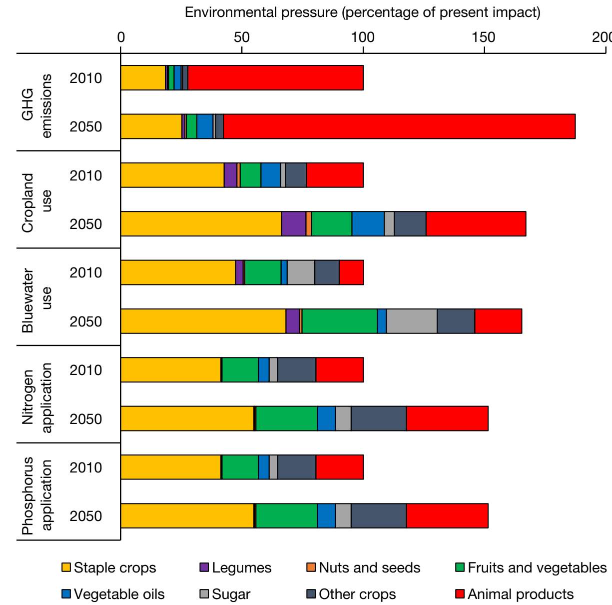


Fig. 1 | Present (2010) and projected (2050) environmental pressures on five environmental domains divided by food group. Environmental pressures are allocated to the final food product, accounting for the use and impacts of primary products in the production of vegetable oils and refined sugar, and for feed requirements in animal products. Impacts are shown as percentages of present impacts, given a baseline projection to 2050 without dedicated mitigation measures for a middle-of-the-road socioeconomic development pathway (SSP2). Absolute impacts for all socioeconomic pathways are provided in the main text and the data referred to in the 'Data availability' statement (see Methods).

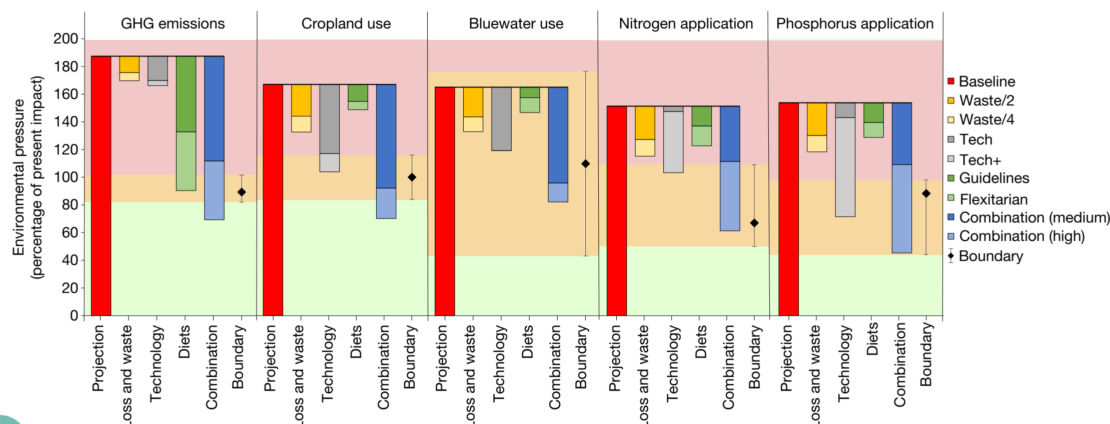


Fig. 2 | Impacts of reductions in food loss and waste, technological change, and dietary changes on global environmental pressures in 2050. These projections of environmental pressures in 2050 are baseline

520 | NATURE | VOL 562 | 25 OCTOBER 2018

REVIEW

Dietary fat: From foe to friend?

David S. Ludwig[1,2]*, Walter C. Willett[2,3], Jeff S. Volek[4], Marian L. Neuhouser[5]

For decades, dietary advice was based on the premise that high intakes of fat cause obesity, diabetes, heart disease, and possibly cancer. Recently, evidence for the adverse metabolic effects of processed carbohydrate has led to a resurgence in interest in lower-carbohydrate and ketogenic diets with high fat content. However, some argue that the relative quantity of dietary fat and carbohydrate has little relevance to health and that focus should instead be placed on which particular fat or carbohydrate sources are consumed. This review, by nutrition scientists with widely varying perspectives, summarizes existing evidence to identify areas of broad consensus amid ongoing controversy regarding macronutrients and chronic disease.

Ludwig *et al.*, *Science* **362**, 764–770 (2018)   16 November 2018

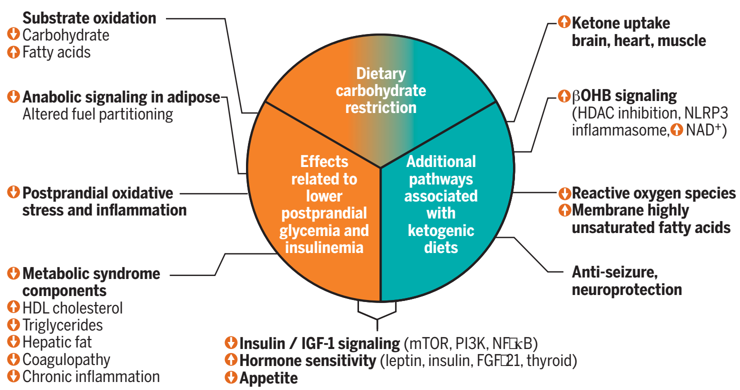


Fig. 1. Pleiotropic effects of low-carbohydrate, high-fat diets. Ketogenic diets (aqua) may enhance these effects and act through additional mechanisms. Abbreviations: βOHB, β-hydroxybutyrate; HDAC, histone deacetylase; NAD^+, nicotinamide adenine dinucleotide; mTOR, mechanistic target of rapamycin.

B x 1. Current controversies.

1. Do diets with various carbohydrate-to-fat proportions affect body composition (ratio of fat to lean tissue) independently of energy intake? Do they affect energy expenditure independently of body weight?

2. Do ketogenic diets provide metabolic benefits beyond those of moderate carbohydrate restriction? Can they help with prevention or treatment of cardiometabolic disease?

3. What are the optimal amounts of specific fatty acids (saturated, monounsaturated, polyunsaturated) in the context of a very-low-carbohydrate diet?

4. What is the relative importance for cardiovascular disease of the amounts of LDL cholesterol, HDL cholesterol, and triglycerides in the blood, or of lipoprotein particle size, for persons on diets with distinct fat-to-carbohy Are other biomarkers of equivalent or greate

5. What are the effects of dietary fat amou across the lifespan on risk of neurodegenerati nary, and other diseases that have not been

6. What are the long-term efficacies of diets carbohydrate-to-fat proportions in chronic di vention and treatment under optimal interven (designed to maximize dietary compliance)?

7. What behavioral and environmental inte maximize long-term dietary compliance?

8. What individual genetic and phenotypic fac long-term beneficial outcomes on diets with carbohydrate compositions? Can this knowledge sonalized nutrition, with translation to prevention

9. How does variation in the carbohydrate-to- sources of dietary fat affect the affordability environmental sustainability of diets?

Box 2. Points of consensus.

1. With a focus on nutrient quality, good health and low chronic disease risk can be achieved for many people on diets with a broad range of carbohydrate-to-fat ratios.

2. Replacement of saturated fat with naturally occurring unsaturated fats provides health benefits for the general population. Industrially produced trans fats are harmful and should be eliminated. The metabolism of saturated fat may differ on carbohydrate-restricted diets, an issue that requires study.

3. Replacement of highly processed carbohydrates (including refined grains, potato products, and free sugars) with unprocessed carbohydrates (nonstarchy vegetables, whole fruits, legumes, and whole or minimally processed grains) provides health benefits.

4. Biological factors appear to influence responses to diets of differing macronutrient composition. People with relatively normal insulin sensitivity and β cell function may do well on diets with a wide range of carbohydrate-to-fat ratios; those with insulin resistance, hypersecretion of insulin, or glucose intolerance may benefit from a lower-carbohydrate, higher-fat diet.

5. A ketogenic diet may confer particular metabolic benefits for some people with abnormal carbohydrate metabolism, a possibility that requires long-term study.

6. Well-formulated low-carbohydrate, high-fat diets do not require high intakes of protein or animal products. Reduced carbohydrate consumption can be achieved by substituting grains, starchy vegetables, and sugars with nonhydrogenated plant oils, nuts, seeds, avocado, and other high-fat plant foods.

7. There is broad agreement regarding the fundamental components of a healthful diet that can serve to inform policy, clinical management, and individual dietary choice. Nonetheless, important questions relevant to the epidemics of diet-related chronic disease remain. Greater investment in nutrition research should assume a high priority.

Que dit la recherche sur la transition alimentaire et les changements de pratiques agricoles ?

LETTER

https://doi.org/10.1038/s41586-018-0747-1

Industrial and agricultural ammonia point sources exposed

Martin Van Damme[1,3]*, Lieven Clarisse[1,3]*, Simon Whitburn[1], Juliette Hadji-Lazaro[2], Daniel Hurtmans[1], Cathy Clerbaux[1,2] & Pierre-FranÁois Coheur[1]

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ENVIRONMENTAL SCIENCE

Ammonia maps make history

Ammonia emissions harm humans and the environment. An analysis shows that satellites can locate sources precisely, and could thus help to monitor compliance with international agreements to limit such emissions. SEE LETTER P.99

MARK A. SUTTON & CLARE M. HOWARD

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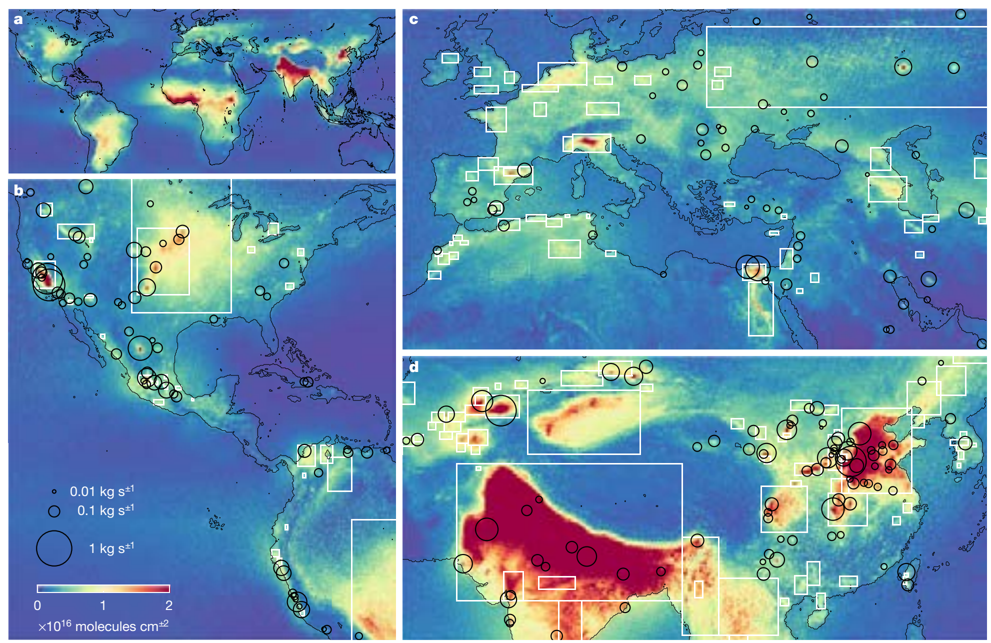


Fig. 1 | IASI nine-year oversampled average, hotspots and source regions. a, Nine-year global IASI average NH_3 distribution (in molecules per square centimetre). **b–d**, Zoom-ins over South and North America (**b**), Europe, northern Africa and the Middle East (**c**) and Asia (**d**). Hotspots are indicated with black circles; their size quantifies the satellite-based emission fluxes (in kilograms per second). Source regions are delineated in white. The largest average NH_3 column is found over the Indus Valley (Pakistan) with a value of 1.1×10^{17} molecules cm^{-2}.

Landscapes that work for biodiversity and people

C. Kremen* and A. M. Merenlender

How can we manage farmlands, forests, and rangelands to respond to the triple challenge of the Anthropocene—biodiversity loss, climate change, and unsustainable land use? When managed by using biodiversity-based techniques such as agroforestry, silvopasture, diversified farming, and ecosystem-based forest management, these socioeconomic systems can help maintain biodiversity and provide habitat connectivity, thereby complementing protected areas and providing greater resilience to climate change. Simultaneously, the use of these management techniques can improve yields and profitability more sustainably, enhancing livelihoods and food security. This approach to "working lands conservation" can create landscapes that work for nature and people. However, many socioeconomic challenges impede the uptake of biodiversity-based land management practices. Although improving voluntary incentives, market instruments, environmental regulations, and governance is essential to support working lands conservation, it is community action, social movements, and broad coalitions among citizens, businesses, nonprofits, and government agencies that have the power to transform how we manage land and protect the environment.

Kremen *et al.*, *Science* **362**, eaau6020 (2018) 19 October 2018

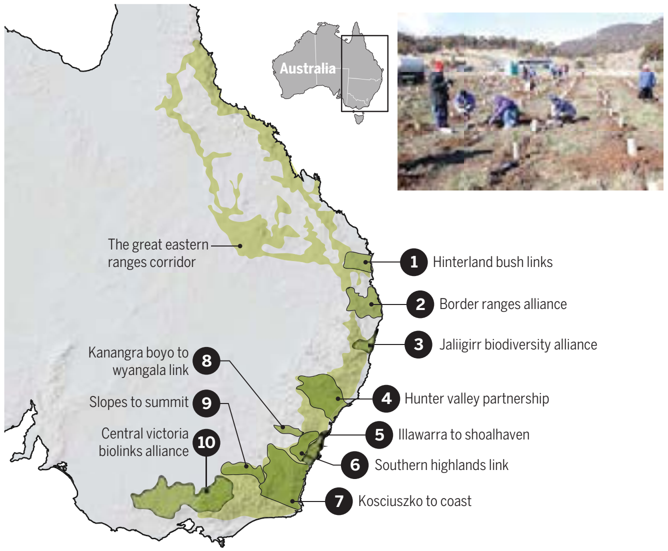


Fig. 4. The GER Corridor Initiative, Australia. The light green outline represents the plan to protect and restore more than 3,600 km^2 as a climate corridor. The numbered, dark green shapes denote regional alliances of conservation and natural resource management organizations, including Landcare communities (Box 2). In the photo, members of the Molonglo Catchment Group Landcare community conduct restoration.

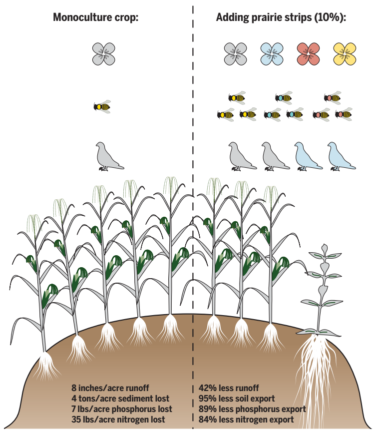
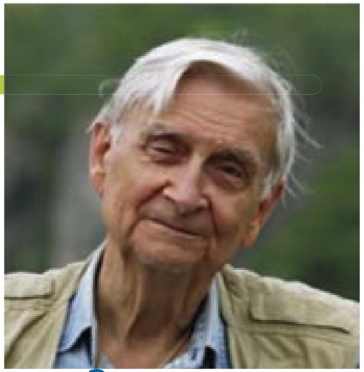


Fig. 5. Diversification practices can increase biodiversity. The integration of prairie strips into a corn-soy rotation exemplifies how diversification within working lands can substantially increase plant, pollinator, and bird species richness and abundance by two- to fourfold (as indicated by colors and numbers of icons, respectively) while minimizing externalities and enhancing other ecosystem services, such as pollination for the soy crop (table S2) (86).

Vers une gestion du système terre pour limiter la perte de la biodiversité et des services ?



Comment gérer durablement le système terre ?

- Deux sous-questions :
  - **Quelle est la dynamique de l'occupation de la planète par l'Homme ?**

    Les données satellitaires permettent d'analyser les changements d'utilisation des terres sur l'ensemble de la planète. Elles montrent que le système terrestre est aujourd'hui dominé par l'Homme qui agit directement sur les paysages sur de larges surfaces sur tous les continents. **77% des terres, hors l'Antarctique, et 87 % des océans** ont été modifiés par l'Homme.

  - **Quelle surface de la planète faut-il protéger pour préserver la biodiversité ?**

    E. O. Wilson, dans son projet *Half Earth*, dit qu'il faut protéger 50 % de la planète ; un objectif qui ne semble pas irréaliste si on se tourne vers les aires où l'impact de l'Homme est le plus faible, mais qui abritent en fait une faible biodiversité.

    Baillie et Zhang (*Science*, 2018) rappellent que le **11ème objectif d'Aichi** prévoit que **17%** des terres et des eaux continentales doivent être protégées d'ici 2020, ainsi que **10%** des aires marines et côtières, des chiffres qu'ils voudraient voir portés à **30%** d'ici 2030 avant d'atteindre les fameux **50%** avancés par Wilson.

Vers une gestion du système terre pour limiter la perte de la biodiversité et des services ?

Protect the last of the wild

Global conservation policy must stop the disappearance of Earthís few intact ecosystems, warn **James E. M. Watson, James R. Allan** and colleagues.

1 NOVEMBER 2018 | VOL 563 | NATURE | 27

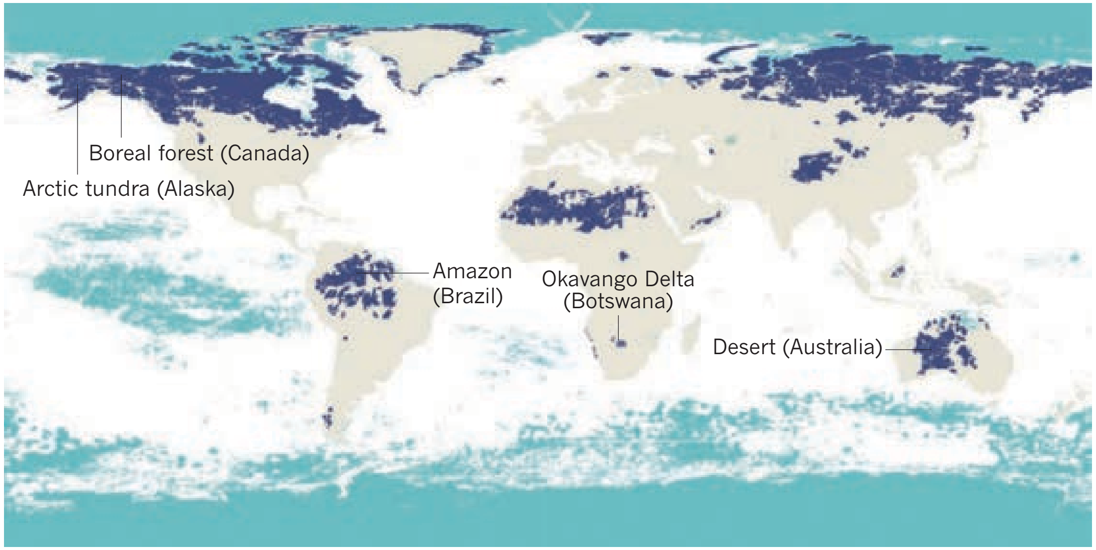
WHAT'S LEFT?

Earth's remaining wilderness areas are becoming increasingly important buffers against changing conditions in the Anthropocene. Yet they aren't an explicit target in international policy frameworks.

THE HUMAN FOOTPRINT

77% of land (excluding Antarctica) and 87% of the ocean has been modified by the direct effects of human activities.

REMAINING WILDERNESS: ■ Terrestrial ■ Marine



WILD EARTH

Mapping methods

To map Earth's remaining terrestrial wilderness, we used the best available data on eight indicators of human pressures at a resolution of 1 square kilometre. These were: built environments, crop lands, pasture lands, population density, night-time lights, railways, major roadways and navigable waterways[3,4]. (Data were collected in 2009.) For our map of intact ocean ecosystems, we used 2013 data on fishing, industrial shipping and fertilizer run-off, among 16 other indicators[2].

We identified wilderness land or ocean areas as those that were free of human pressures, with a contiguous area of more than 10,000 km^2 on land.

J.E.M.W. *et al.*

ECOLOGY

How to protect half of Earth to ensure it protects sufficient biodiversity

S uart L. Pimm[1]*, Clinton N. Jenkins[2], Binbin V. Li[3]

It is theoretically possible to protect large fractions of species in relatively small regions. For plants, 85% of species occur entirely within just over a third of the Earth's land surface, carefully optimized to maximize the species captured. Well-known vertebrate taxa show similar patterns. Protecting half of Earth might not be necessary, but would it be sufficient given the current trends of protection? The predilection of national governments is to protect areas that are "wild," that is, typically remote, cold, or arid. Unfortunately, those areas often hold relatively few species. Wild places likely afford the easier opportunities for the future expansion of protected areas, with the expansion into human-dominated landscapes the greater challenge. We identify regions that are not currently protected, but that are wild, and consider which of them hold substantial numbers of especially small-ranged vertebrate species. We assess how successful the strategy of protecting the wilder half of Earth might be in conserving biodiversity. It is far from sufficient. (Protecting large wild places for reasons other than biodiversity protection, such as carbon sequestration and other ecosystem services, might still have importance.) Unexpectedly, we also show that, despite the bias in establishing large protected areas in wild places to date, numerous small protected areas are in biodiverse places. They at least partially protect significant fractions of especially small-ranged species. So, while a preoccupation with protecting large areas for the sake of getting half of Earth might achieve little for biodiversity, there is more progress in protecting high-biodiversity areas than currently appreciated. Continuing to prioritize the right parts of Earth, not just the total area protected, is what matters for biodiversity.

Pimm *et al.*, *Sci. Adv.* 2018; **4** : eaat2616 29 August 2018

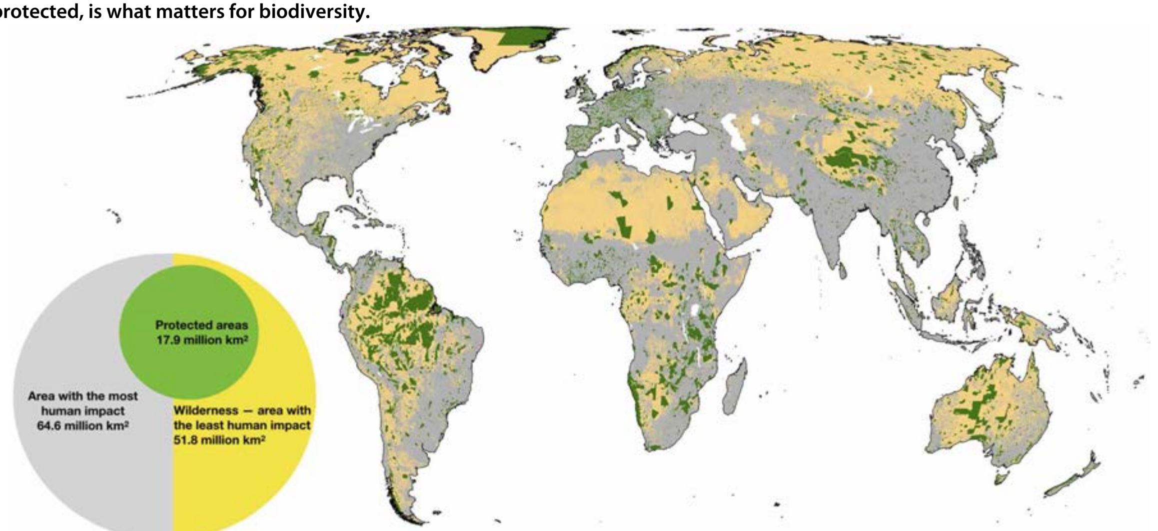


Fig. 1. Protected areas (green) plus the areas having the lowest human footprint index (≤3.3), which we call wilderness (buff), up to a combined extent that is as close to half of the Earthís land surface as we could make it (51.9%) given the discrete nature of the index. In the Venn diagram, protected areas are composed mostly of wilderness (65%) but also include some more heavily affected areas (35%).

LES SOLUTIONS : VERS UNE GESTION DU SYSTEME TERRE ?

- L'apport de la modélisation :
  - La solution pour un futur souhaitable est de **préserver simultanément les services écosystémiques d'approvisionnement et de régulation** en définissant un compromis équilibré entre la conservation de la nature et la conversion des terres pour l'agriculture. Augmenter le taux de terres naturelles de **0,3 à 0,4** aura un effet positif sur la quantité de nourriture par personne, en empêchant la surexploitation des terres et la décroissance de la production alimentaire

    (Cazalis, Loreau et Henderson, 2018).

Do we have to choose between feeding the human population and conserving nature? Modelling the global dependence of people on ecosystem services

Victor Cazalis*, Michel Loreau, Kirsten Henderson

Centre for Biodiversity Theory and Modelling, Theoretical and Experimental Ecology Station - UMR 5321, CNRS and Paul Sabatier University, 2 route du CNRS, Moulis 09200, France

Science of the Total Environment 634 (2018) 1463 1474

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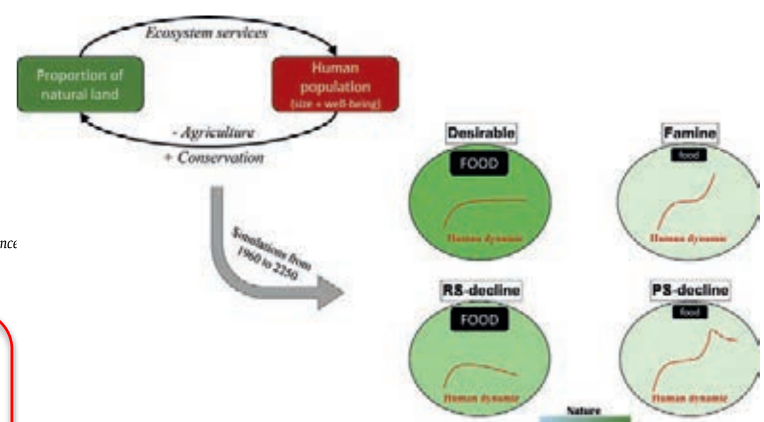


http://www.fondationbiodiversite.fr/images/documents/Syntheses/2018-11_Synthese_ModelesFuturs.pdf

Vers une gestion du système terre pour limiter la perte de la biodiversité et des services ?

- L'apport de la modélisation :

  – Henderson et Loreau (2018) : on ne pourra maintenir une population de 11 milliards d'habitants, comme attendue à la fin du siècle, qu'**en préservant des activités humaines intensives 5 milliards d'ha soit 38% des terres émergées de la planète**. De ces 5 milliards d'ha, les Humains retireront **des services d'approvisionnement et de régulation** indispensables.

RESEARCH ARTICLE

How ecological feedbacks between human population and land cover influence sustainability

Kirsten Henderson*, Michel Loreau

Centre for Biodiversity, Theory, and Modelling, Theoretical and Experimental Ecology Station, CNRS, Moulis, France

PLOS Computational Biology | https://doi.org/10.1371/journal.pcbi.1006389 August 17, 2018

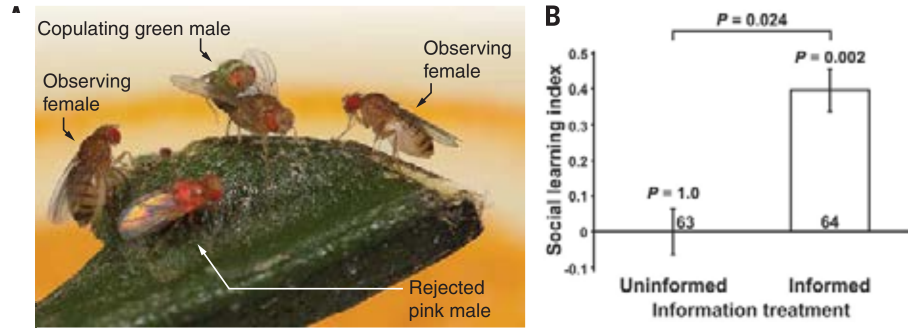
Et que reste-t-il au « propre de l'Homme » ?

ANIMAL CULTURE

Cultural flies: Conformist social learning in fruitflies predicts long-lasting mate-choice traditions

Et enne Danchin[1*]†, Sabine Nöbel[1,2*], Arnaud Pocheville[3*], Anne-Cecile Dagaeff[1], Léa Demay[1], Mathilde Alphand[1], Sarah Ranty-Roby[1], Lara van Renssen[1,4], Magdalena Monier[1], Eva Gazagne[5], Mélanie Allain[1,6], Guillaume Isabel[6]

Danchin *et al.*, *Science* **362**, 1025–1030 (2018)   30 November 2018



1. **Criterion 1 of social learning.** (**A**) A situation of mate-copying in which two females watch a copulating green male while a pink male is rejected. (**B**) Social learning index of informed versus uninformed observer females. Positive social learning indices reveal preference for the male color chosen during demonstrations, whereas zero reveals random choice. *P* values above bars, binomial tests of departure from random choice; error bars, SEM.

Culture used to be considered to be limited to humans. However, the range of species showing patterns of local variation in behavior akin to traditions now includes several mammals and birds (*1–4*). In this study, we found that fruitfly females express strong social learning (criterion 1) across age classes (criterion 2) that is memorized for sufficient time to be copied (criterion 3) and is trait-based (criterion 4) and conformist (criterion 5). With a model pa-

"Animal culture may be a much more widespread phenomenon than hitherto acknowledged"

Andrew Whiten, *Science*, 30 novembre 2018