What we talk about when we talk about biodiversity

Simon Harold
Nature Ecology & Evolution
@NatureEcoEvo

SPRINGER NATURE

Outline

- Who I am
- Who I work for and what we do
- What is biodiversity and why does it matter?
- The current state of global biodiversity
- Threats to biodiversity
- What can be done to improve global biodiversity?

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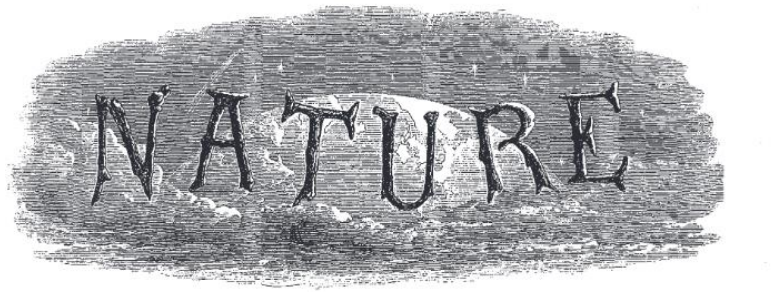

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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

THURSDAY, NOVEMBER 4, 1869

NATURE: APHORISMS BY GOETHE

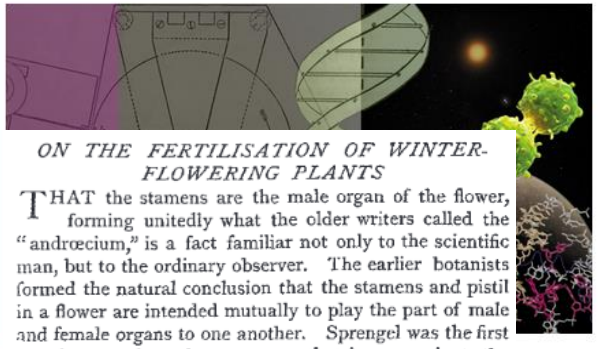
NATURE! We are surrounded and embraced by her: powerless to separate ourselves from her, and powerless to penetrate beyond her.

Without asking, or warning, she snatches us up into her circling dance, and whirls us on until we are tired, and drop from her arms.

all comprehending idea, which no searching can find out.

Mankind dwell in her and she in them. With all men she plays a game for love, and rejoices the more they win. With many, her moves are so hidden, that the game is over before they know it.

That which is most unnatural is still Nature; the stupidest philistinism has a touch of her genius. Whoso cannot see her everywhere, sees her no-



ON THE FERTILISATION OF WINTER-FLOWERING PLANTS

THAT the stamens are the male organ of the flower, forming unitedly what the older writers called the "androecium," is a fact familiar not only to the scientific man, but to the ordinary observer. The earlier botanists formed the natural conclusion that the stamens and pistil in a flower are intended mutually to play the part of male and female organs to one another. Sprengel was the first to point out, about the year 1790, that in many plants the arrangement of the organs is such, that this mutual interchange of offices in the same flower is impossible; and more re

England by inse by the s

The Fertilisation of Winter-flowering Plants

WILL you permit me to add a few words to Mr. Bennett's letter, published at p. 58 of your last number? I did not cover up the *Lamium* with a bell-glass, but with what is called by ladies, "net." During the last twenty years I have followed this plan, and have fertilised thousands of flowers thus covered up, but have never perceived that their fertility was in the least injured. I make this statement in case anyone should be induced to use a bell-glass, which I believe to be injurious from the moisture of the contained air. Nevertheless, I have occasionally placed flowers, which grew high up, within small wide-mouthed bottles, and have obtained good seed from them. With respect to the *Vinca*, I suppose that Mr. Bennett intended to express that pollen had actually fallen, without the aid of insects, on the stigmatic surface, and had emitted tubes. As far as the mere opening of the anthers in the bud is concerned, I feel convinced from repeated observations that this is a most fallacious indication of self-fertilisation. As Mr. Bennett asks about the fertilisation of Grasses, I may add that Signor Delpino, of Florence, will soon publish some novel and very curious observations on this subject, of which he has given me an account in a letter, and which I am glad to say are far from being opposed to the very general law that distinct individual plants must be

CHARLES DARWIN

Down, Beckenham, Kent, Nov. 13

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nature ecology & evolution

ARTICLES

https://doi.org/10.1038/s41559-021-01528-7

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Areas of global importance for conserving terrestrial biodiversity, carbon and water

Martin Jung[1], Andy Arnell[2], Xavier de Lamo[3], Shaenandhoa García-Rangel[2], Matthew Lewis[1,4], Jennifer Mark[2], Cory Merow[5], Lera Miles[2], Ian Ondo[6], Samuel Pironon[6], Corinna Ravilious[2], Malin Rivers[7], Dmitry Schepaschenko[1,8], Oliver Tallowin[2], Arnout van Soesbergen[2], Rafaël Govaerts[6], Bradley L. Boyle[9], Brian J. Enquist[9], Xiao Feng[10], Rachael Gallagher[11], Brian Maitner[9], Shai Meiri[12], Mark Mulligan[13], Gali Ofer[12], Uri Roll[14], Jeffrey O. Hanson[15], Walter Jetz[16,17], Moreno Di Marco[18], Jennifer McGowan[19], D. Scott Rinnan[16,17], Jeffrey D. Sachs[20], Myroslava Lesiv[1], Vanessa M. Adams[21], Samuel C. Andrew[22], Joseph R. Burger[23], Lee Hannah[24], Pablo A. Marquet[25,26,27,28,29], James K. McCarthy[30], Naia Morueta-Holme[31], Erica A. Newman[9], Daniel S. Park[32], Patrick R. Roehrdanz[24], Jens-Christian Svenning[33,34], Cyrille Violle[35], Jan J. Wieringa[36], Graham Wynne[37], Steffen Fritz[1], Bernardo B. N. Strassburg[38,39,40,41], Michael Obersteiner[1,42], Valerie Kapos[2], Neil Burgess[2], Guido Schmidt-Traub[43] and Piero Visconti[1]

To meet the ambitious objectives of biodiversity and climate conventions, the international community requires clarity on how these objectives can be operationalized spatially and how multiple targets can be pursued concurrently. To support goal setting and the implementation of international strategies and action plans, spatial guidance is needed to identify which land areas have the potential to generate the greatest synergies between conserving biodiversity and nature's contributions to people. Here we present results from a joint optimization that minimizes the number of threatened species, maximizes carbon retention and water quality regulation, and ranks terrestrial conservation priorities globally. We found that selecting the top-ranked 30% and 50% of terrestrial land area would conserve respectively 60.7% and 85.3% of the estimated total carbon stock and 66% and 89.8% of all clean water, in addition to meeting conservation targets for 57.9% and 79% of all species considered. Our data and prioritization further suggest that adequately conserving all species considered (vertebrates and plants) would require giving conservation attention to ~70% of the terrestrial land surface. If priority was given to biodiversity only, managing 30% of optimally located land area for conservation may be sufficient to meet conservation targets for 81.3% of the terrestrial plant and vertebrate species considered. Our results provide a global assessment of where land could be optimally managed for conservation. We discuss how such a spatial prioritization framework can support the implementation of the biodiversity and climate conventions.

Biodiversity and nature's contributions to people (NCP) are in peril, requiring increasing conservation efforts to avert further decline[1,2]. Existing global biodiversity conservation targets were not met by 2020 (ref. [3]), and the world is falling short of mobilizing the full climate mitigation potential of nature-based solutions, which could provide around a third of the mitigation target specified under the Paris Agreement[4]. A new Global Biodiversity Framework is scheduled to be adopted in 2022 by the Convention on Biological Diversity (CBD) in Kunming, China[5], and there are growing calls to integrate nature-based solutions into climate mitigation strategies[6].

Targets for site-based conservation actions (hereafter 'area-based conservation targets') are given particular emphasis in the draft Global Biodiversity Framework[5]. Target 3 calls for the protection and conservation of at least "30 percent globally of land areas [...], especially areas of particular importance for biodiversity and its contribution to people, are conserved". This target somewhat integrates calls made by conservation advocates to conserve 30% of land and the oceans[7] with proposals that emphasize targeting conservation outcomes rather than conservation area. This is to ensure that, by 2030, areas of global conservation importance for biodiversity are maintained or restored[8].

The Sustainable Development Goals and decisions under the United Nations Framework Convention on Climate Change and CBD emphasize that habitat conservation and restoration should contribute simultaneously to biodiversity conservation and climate change mitigation[9]. In particular, the draft Target 8 of the Global Biodiversity Framework post-2020 calls for "contribute to [climate change] mitigation and adaptation through ecosystem-based approaches [...] and avoid all negative impacts on biodiversity." Recent global-scale spatial analyses of conservation priorities for biodiversity and carbon have overlaid areas of value for both features, effectively treating the two goals as being pursued separately (for example, see refs. [10,11]). However, multicriteria spatial optimization

A full list of affiliations appears at the end of the paper.

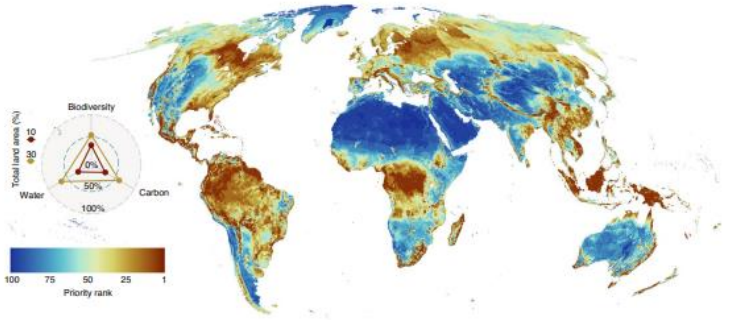


Fig. 1 | Global areas of conservation importance for terrestrial biodiversity, carbon and water. All features were jointly optimized with equal weighting given to each feature (the central point in the series of segments in Fig. 2) and ranked by the most (1–10) to least (90–100) valuable areas to conserve globally. The triangle plot shows the extent to which protecting the top-ranked 10% and 30% of global land areas (the dark brown and yellow areas on the map) contributes to minimize the number of threatened species, storing carbon and ensuring clean water. The percentages in the triangle plot refer to the proportion of all species targets reached (Fig. 3) or the average shortfall of carbon and water. The map is at 10 km resolution in a Mollweide projection. A map highlighting the uncertainty in priority ranks is shown in Extended Data Fig. 1.

managed for conservation. The range of carbon conserved is 15% to 25% when conserving 10% of land and 47.1% to 61.4% when conserving 30%. The range of clean water conserved is 16% to 21.5% when conserving 10% of land and 50% to 65.4% when conserving 30% (Fig. 2a). Our results suggest that there is ample scope for achieving co-benefits from conserving these three features, if explicit targets for each are considered, areas of conservation value for each feature are identified through multicriteria spatial optimization and the range of relative preference given to each feature is comprehensively explored.

The amount of land necessary to exclusively protect global biodiversity continues to be debated[10,11,12]. When splitting conservation targets across each biome, in the absence of any socio-economic constraints or costs and ignoring NCP such as water and carbon, bringing all vertebrate and plant species considered to a non-threatened conservation status would require at least ~70% of global land area to be managed for conservation (Fig. 3a). This is robust to the number of species included in the analyses, provided that they are a representative subset (Methods).

Optimally placing areas managed for conservation on 30% of the world's land area is already sufficient to conserve 81.3% of all species considered in this analysis (disregarding the additional contribution of existing protected areas and ignoring socio-economic constraints and costs and other NCP). Across the remaining species, the average target shortfall (Methods) was 4.4%. Currently protected areas are potentially sufficient to achieve conservation targets for 11.6% of the species analysed (Fig. 3b and Extended Data Fig. 6). However, multicriteria spatial planning aided with explicit targets and optimization algorithms could build on the highly inefficient set of existing protected areas to reach a global 30% coverage and achieve conservation targets for an additional 71.6% while leaving the average shortfall for the remaining species at 7.2% (Fig. 3b). There is thus an efficiency gap of ~10% between redesigning global conservation efforts and optimally building on existing efforts. While we do not recommend de-designations owing to other factors behind protected area establishment not considered in this analysis, the critical state of the world biodiversity suggests that ad hoc conservation efforts are no longer an option, and target-based conservation planning, using methods like ours, should be applied at all levels if we are to reverse global biodiversity trends.

When jointly optimizing for biodiversity, carbon and water (Fig. 3a), we found that selecting the top-ranked 30% and 50% of terrestrial land areas (which are popular proposals for area-based conservation targets[5]) would conserve 60.7% and 85.3% of the estimated total carbon stock and 66% and 89.8% of water quality regulation, in addition to achieving conservation targets for 57.9% and 79% of all species considered, with a remaining average shortfall of 14.1% and 6.9% (Fig. 3b).

When optimizing conservation efforts for biodiversity only, we found that the groups that benefited the most (that is, had the most rapid target accumulation curves) were amphibian and plant species (Fig. 3c,d) and threatened species (Fig. 3e,f). For plant species, this is consistent with previous work on the spatial aggregation of centres of plant diversity and endemicity[13]. Threatened species tend to have smaller range sizes and smaller absolute area targets than other groups and are inherently prioritized with budgets ≤30% of land area.

When assigning global-level rather than biome-level targets for each species, we found that current protected areas conserve 16.2% of all species. However, an optimally placed 30% of land area achieved a similar level of biodiversity performance to the biome-level analysis: conserving 76.6% of all species with an average target shortfall across the remainder of species of 5.3% (Extended Data Fig. 5). The differences in accumulation curves among taxonomic groups were generally larger if species ranges were not split by biome, especially so for threatened species, indicating that fragmented parts of their range probably occur across multiple biomes (Extended Data Fig. 5).

Our analysis included a representative subset of plant range data totalling ~41% of described vascular plant species[13] (Fig. 4). Incorporating data on plants resulted in spatial shifts in areas of importance for conservation compared with analyses where plants

Biodiversity is declining globally

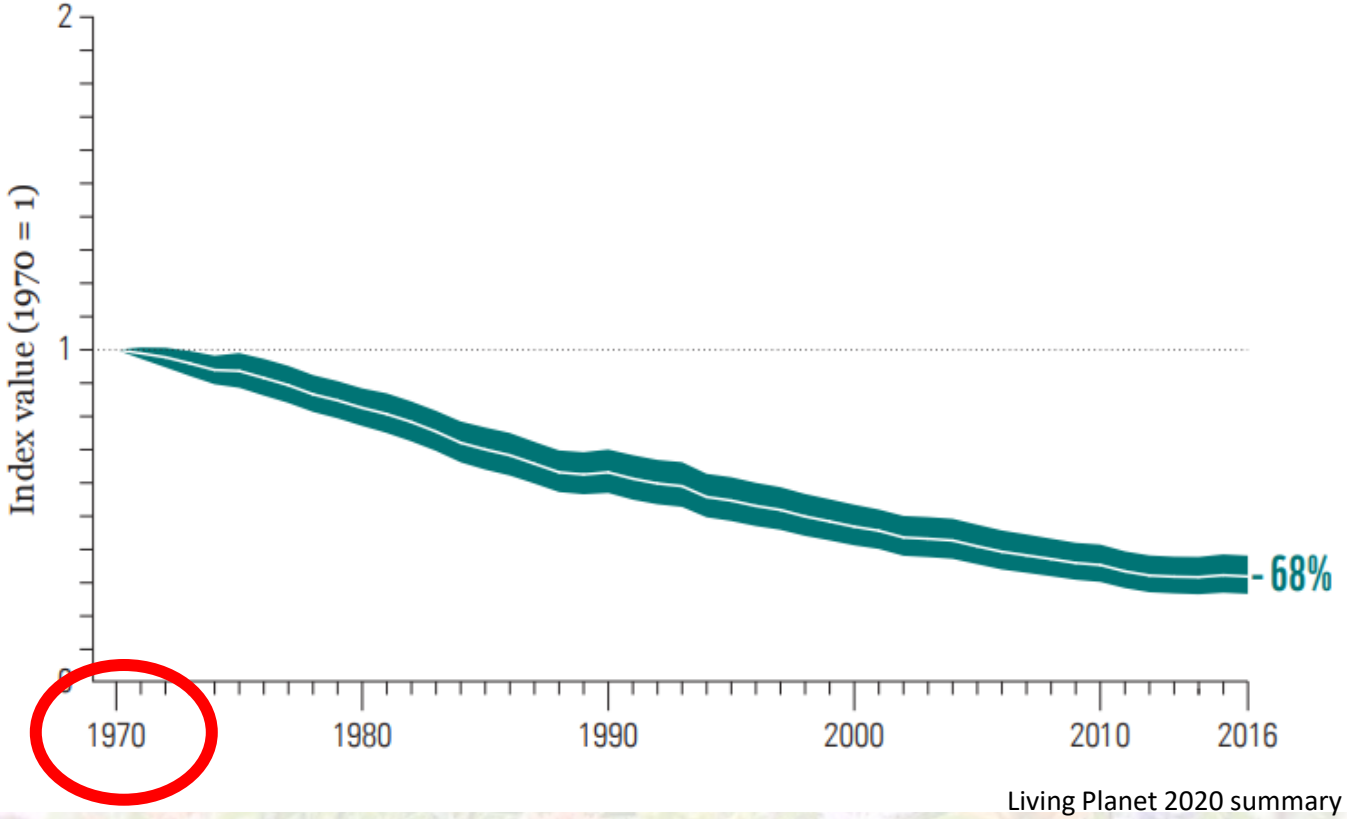


Figure 1: The global Living Planet Index: 1970 to 2016
Average abundance of 20,811 populations representing 4,392 species monitored across the globe declined by 68%. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (range: -73% to -62%). Sourced from WWF/ZSL (2020)[1].

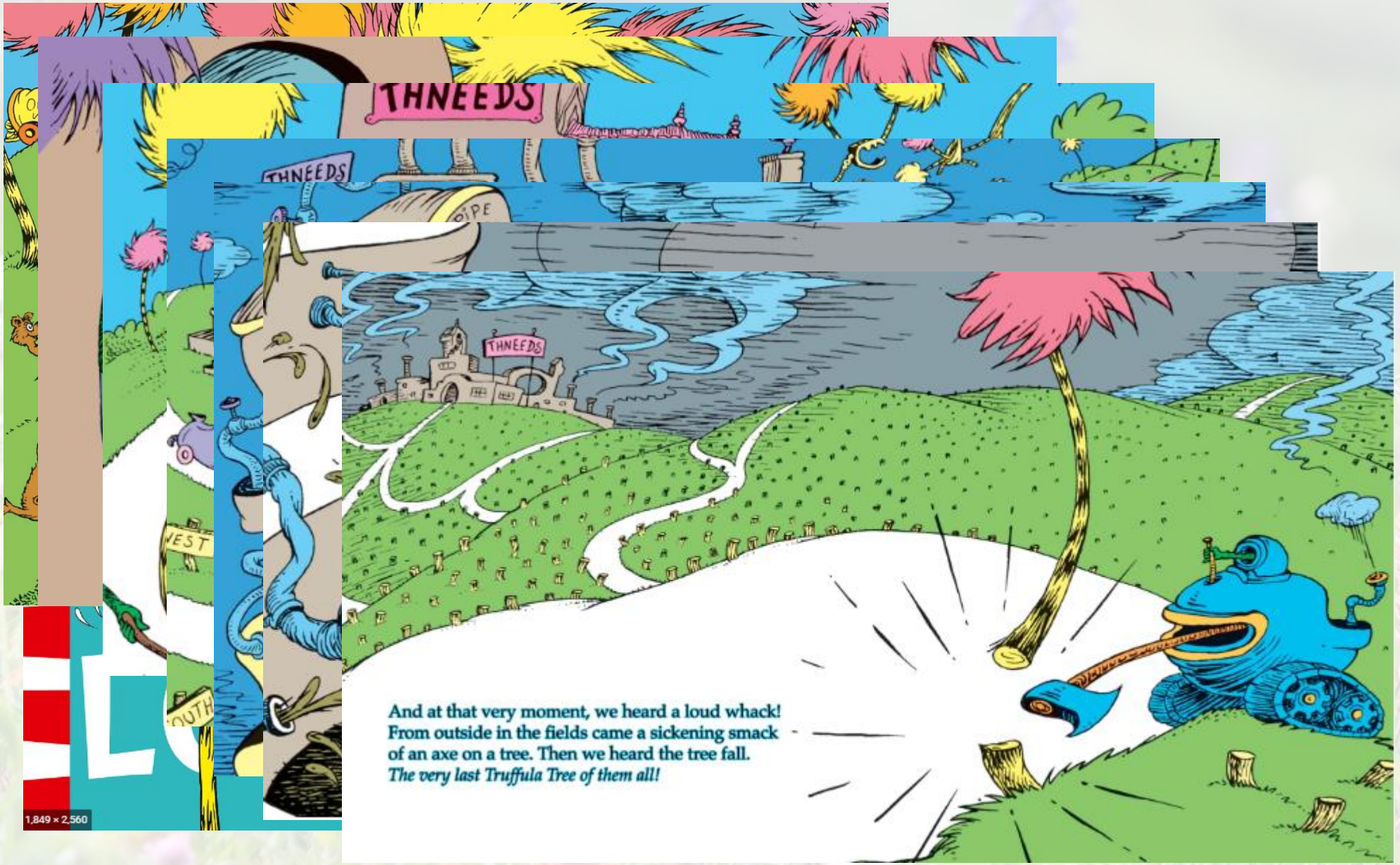
Key

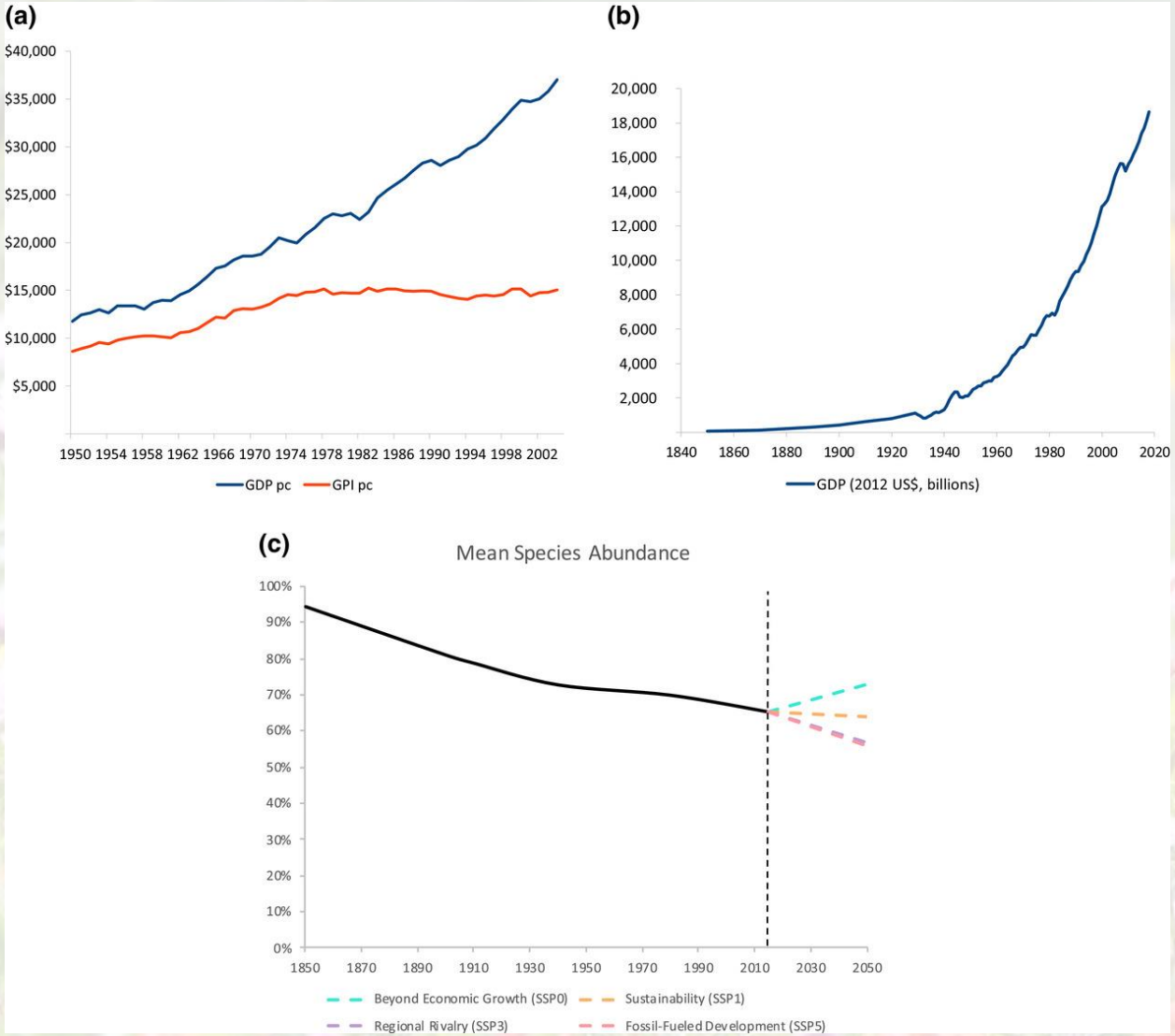
Global Living Planet Index

Confidence limits

Living Planet 2020 summary report https://https://livingplanet.panda.org/en-us/

- **Vertebrate time series**
- **Terrestrial, Freshwater, Marine**
- **Compiled from journals, databases and government reports**
- **Measures whether a population is declining and by how much**
- **A 'stock market' index for species**


THNEEDS
THNEEDS
THNEEDS
And at that very moment, we heard a loud whack!
From outside in the fields came a sickening smack
of an axe on a tree. Then we heard the tree fall.
The very last Truffula Tree of them all!
1,849 × 2,560



Biodiversity policy beyond economic growth
https://conbio.onlinelibrary.wiley.com/doi/10.1111/conl.12713

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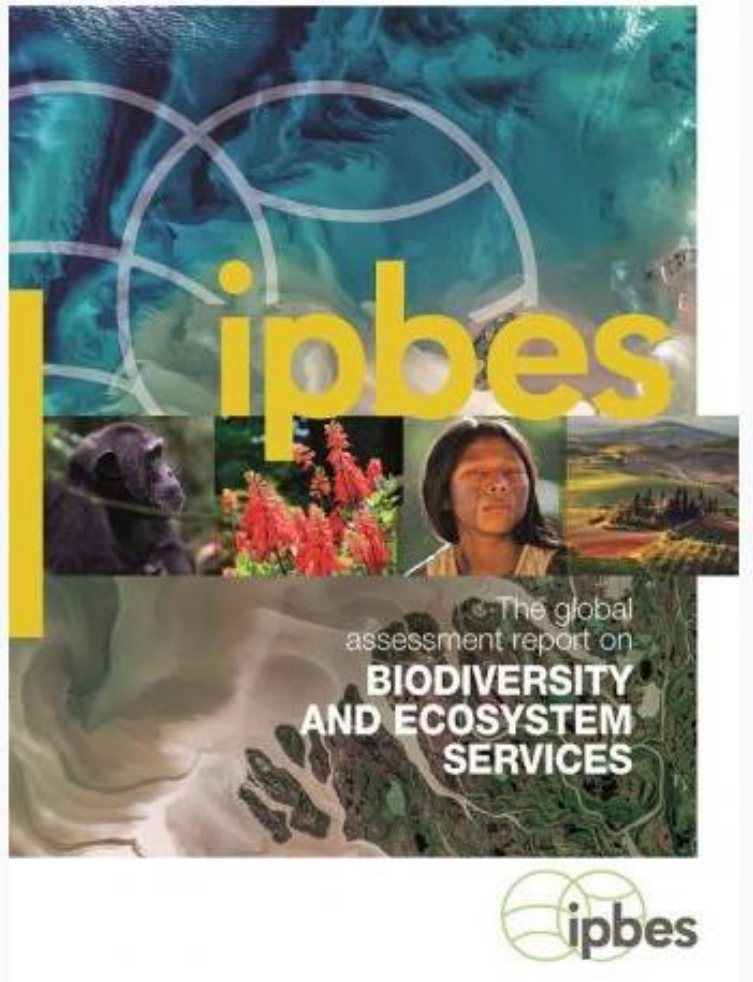
What we talk about when we talk about biodiversity – Science ↔ Policy



- IPCC for biodiversity
- 150 experts and >300 other contributing authors
- >15,000 scientific publications
- Approved, by more than 130 Governments

- 1 million species threatened with extinction
- 680 vertebrate species extinct since 16th century
- Native species abundance fallen by 20% since 1900
- Threatened: 40% of amphibians, 33% coral, 33% marine mammals

What we talk about when we talk about biodiversity – **What's in a name?**

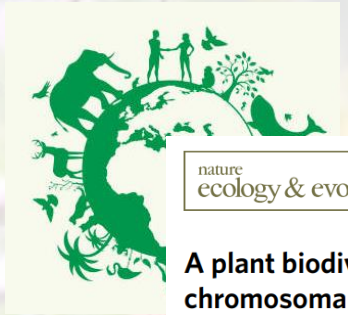
Names

Genes

Functions

Evolution

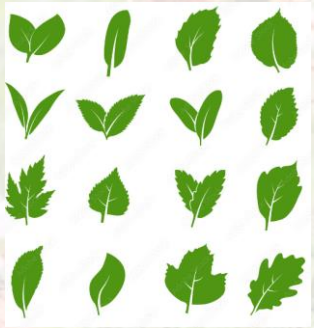
Science

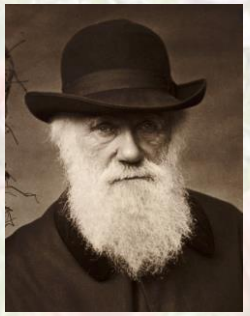


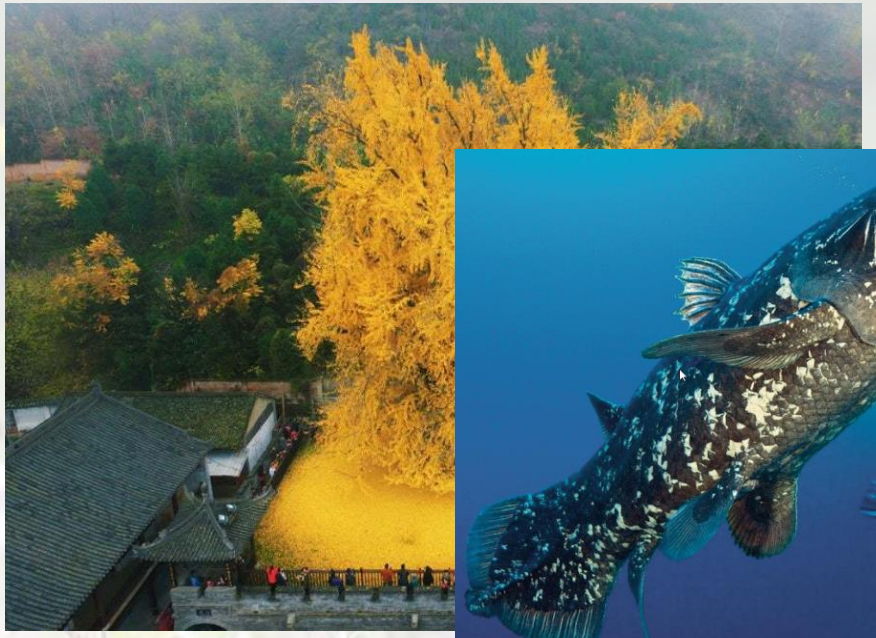
nature ecology & evolution ARTICLES https://doi.org/10.1038/s41559-018-0708-y

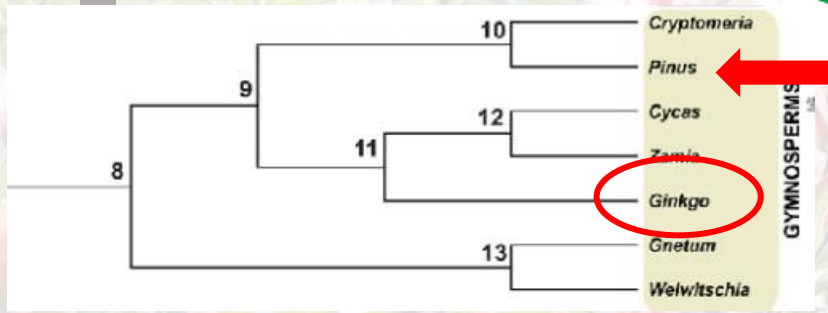
A plant biodiversity effect resolved to a single chromosomal region

Samuel E. Wuest[1,3*] and Pascal A. Niklaus[2]









Convention on Biological Diversity

80 species

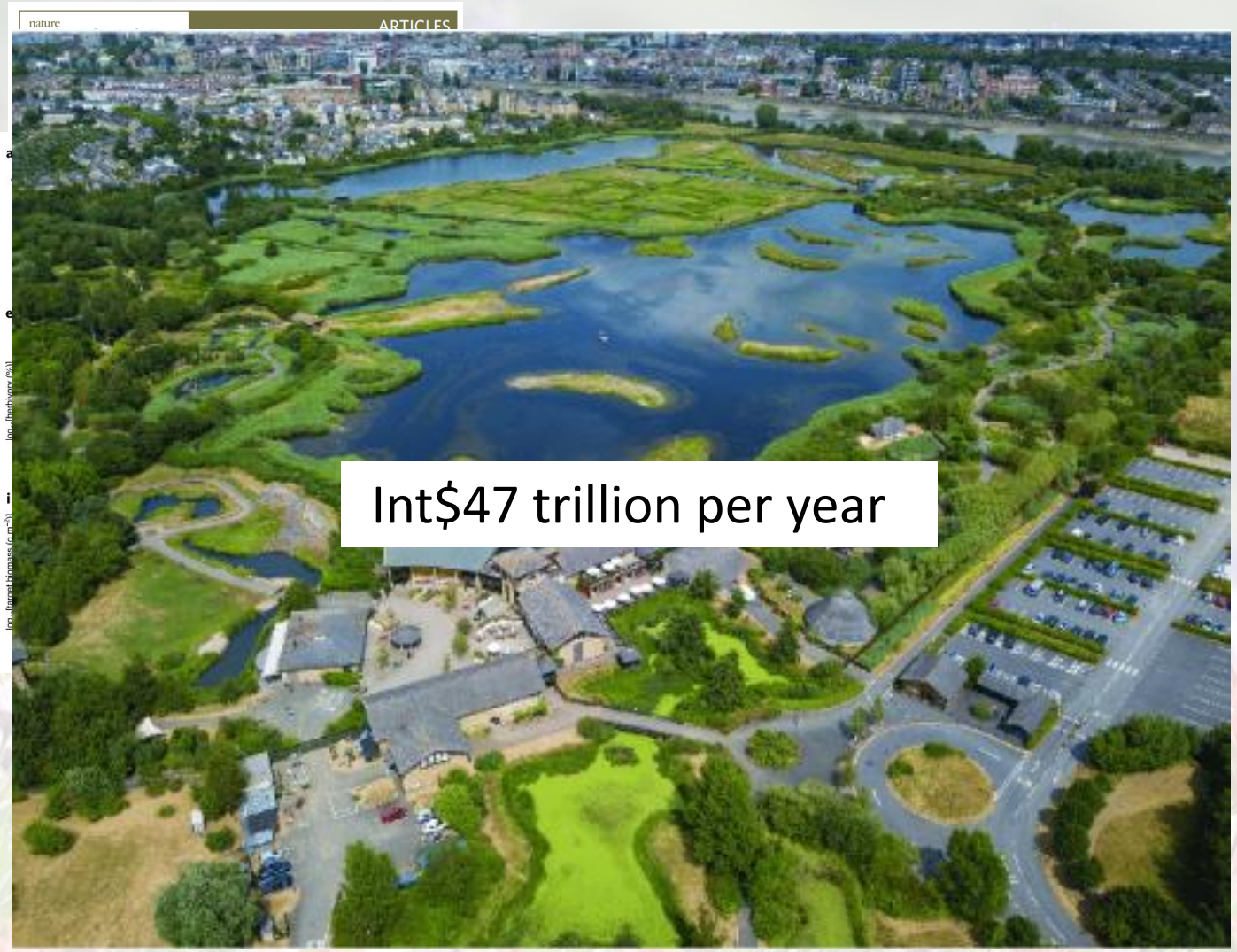
What we talk about when we talk about biodiversity – **Why does it matter?**

Functions
- Productivity
- Carbon storage
- Nutrient retention
- Decomposition
- Stability
- Resilience

Independent of human well-being

Services
- Food
- Timber
- Textiles
- Pollination
- Water purification
- Flood control
- Climate regulation
- Air pollution control
- Recreation

Impact human well-being



What we talk about when we talk about biodiversity – **Why does it matter?**

nature sustainability

REVIEW ARTICLE

https://doi.org/10.1038/s41893-019-0417-9

Biodiversity's contributions to sustainable development

Malgorzata Blicharska[1,2]*, Richard J. Smithers[2,3], Grzegorz Mikusiński[3], Patrik Rönnbäck[1], Paula A. Harrison[4], Måns Nilsson[5] and William J. Sutherland[6]

International concern to develop sustainably challenges us to act upon the inherent links between our economy, society and environment, and is leading to increasing acknowledgement of biodiversity's importance. This Review discusses the breadth of ways in which biodiversity can support sustainable development. It uses the Sustainable Development Goals (SDGs) as a basis for exploring scientific evidence of the benefits delivered by biodiversity. It focuses on papers that provide examples of how biodiversity components (that is, ecosystems, species and genes) directly deliver benefits that may contribute to the achievement of individual SDGs. It also considers how biodiversity's direct contributions to fulfilling some SDGs may indirectly support the achievement of other SDGs to which biodiversity does not contribute directly. How the attributes (for example, diversity, abundance or composition) of biodiversity components influence the benefits delivered is also presented, where described by the papers reviewed. While acknowledging potential negative impacts and trade-offs between different benefits, the study concludes that biodiversity may contribute to fulfilment of all SDGs.

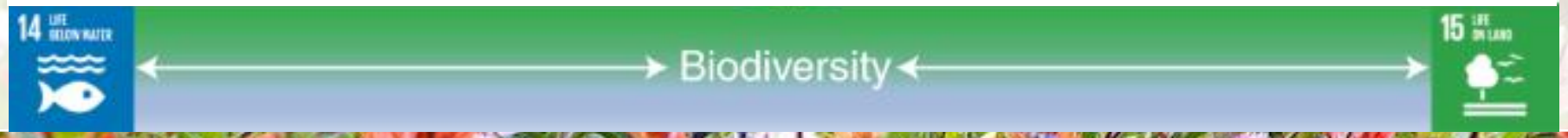
The concept of sustainable development (Box 1) is based on the notion of three pillars supporting sustainability: economy, society and environment[1]. However, there is growing evidence of their interrelations and recognition that the environment, particularly its biodiversity (Box 2), provides benefits that help to support our society and economy[2]. In 2008, the Millennium Development Goals incorporated the Convention on Biological Diversity (CBD) target "to achieve by 2010 a significant reduction of the current rate of biodiversity loss […] as a contribution to poverty alleviation and to the benefit of life on earth". The subsequent 2030 Agenda for Sustainable Development ('the 2030 Agenda') comprises the 17 Sustainable Development Goals (SDGs)[3], including SDG 14 (Life below water) and SDG 15 (Life on land). The SDGs are presented as an interconnected whole, however, by only explicitly considering biodiversity at the goal level in the wording of SDGs 14 and 15, the breadth of ways in which it can contribute to human well-being, the key rationale of the CBD Strategic Plan 2011–2020 (a worldwide framework for biodiversity conservation), may not be fully acknowledged. The academic and policy communities are striving to increase societal appreciation of the value of ecosystem services for human well-being[4]. However, they often focus on ecosystem services without identifying the biodiversity components (that is, ecosystems, species and genes) responsible for delivering benefits to people[5]. Thus, our study aims to review and exemplify the ways in which biodiversity can deliver benefits that support sustainable development.

The CBD Secretariat and others analysed how the CBD Strategic Plan's Aichi Targets are reflected in SDGs and associated targets[6]. They showed that the 2030 Agenda may help to address drivers of biodiversity loss and improve associated governance. They also highlighted that biodiversity may contribute to the achievement of a number of SDGs and to some of their targets. In December 2016, the thirteenth Conference of the Parties to the CBD called for integration of the 2030 Agenda strategies and plans with national biodiversity strategies and actions plans. This was motivated by increasing recognition that the 2030 Agenda provides a major opportunity to mainstream biodiversity considerations and enhance achievement of the Aichi Targets[7]. In pursuing our aim, we use the SDGs as a basis for exploring how biodiversity helps to support sustainable development. Although some studies have descriptively summarized how benefits delivered by biodiversity may contribute to the fulfilment of all SDGs[8,9], our study goes further in exploring the scientific evidence and providing specific examples in relation to each SDG.

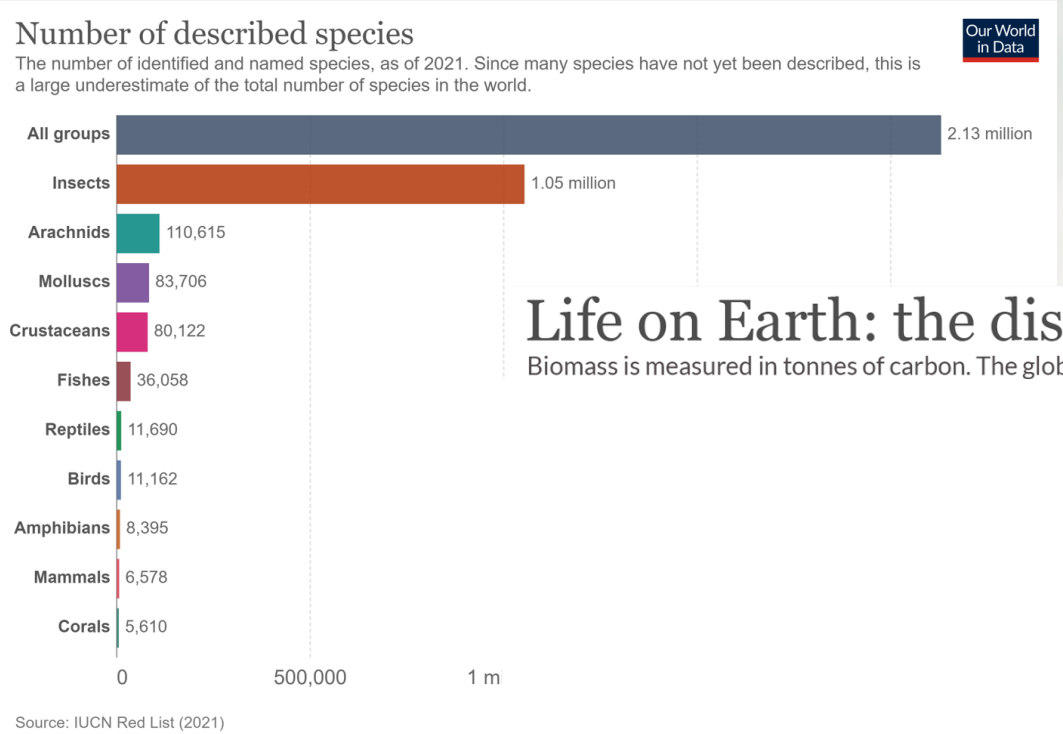
Our study is pertinent to assessments by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). IPBES was established in 2012 to strengthen the scientific evidence base for developing policy on biodiversity conservation and sustainable development. The four regional assessments published in 2018[10–13] reviewed past and current trends and synthesized projections of future trends in nature (including biodiversity), nature's contributions to people (including ecosystem services) and human well-being. Although the regional assessments highlight biodiversity's role in "maintaining and promoting multiple contributions of nature to people", they do not explain how biodiversity may contribute to each SDG. Instead, they broadly interpret what the trends in biodiversity, ecosystem services and human well-being may mean for achieving the Aichi Targets and SDGs. Building upon the regional assessments, in May 2019, IPBES published the Global Assessment[14], which will contribute to the fifth Global Biodiversity Outlook of the CBD that will report in 2020 on implementation of the CBD Strategic Plan. The Global Assessment specifically acknowledges how benefits delivered by biodiversity may contribute to fulfilment of SDGs 1 (poverty), 2 (hunger), 3 (health),

[1]Natural Resources and Sustainable Development, Department of Earth Sciences, Uppsala University, Uppsala, Sweden. [2]Ricardo Energy & Environment, Didcot, UK. [3]Grimsö Wildlife Research Station, Department of Ecology, Swedish University of Agricultural Sciences (SLU), Riddarhyttan, Sweden. [4]Centre for Ecology & Hydrology, Lancaster Environment Centre, Lancaster, UK. [5]Stockholm Environment Institute, Stockholm, Sweden. [6]Department of Zoology, University of Cambridge, Cambridge, UK. †These authors contributed equally: Malgorzata Blicharska, Richard J. Smithers. *e-mail: malgorzata.blicharska@geo.uu.se

"…the study concludes that biodiversity may contribute to fulfilment of all SDGs."

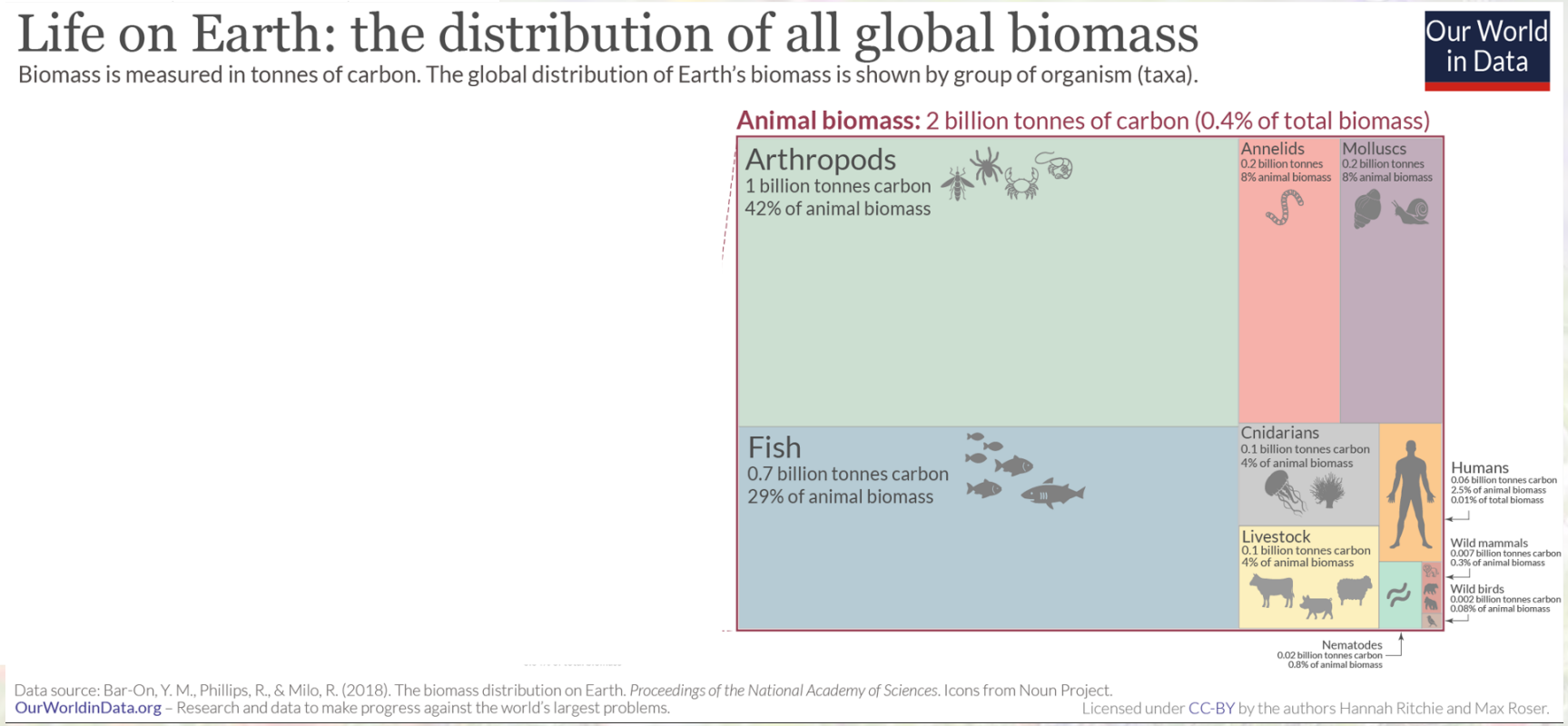


What we talk about when we talk about biodiversity – **How much?**



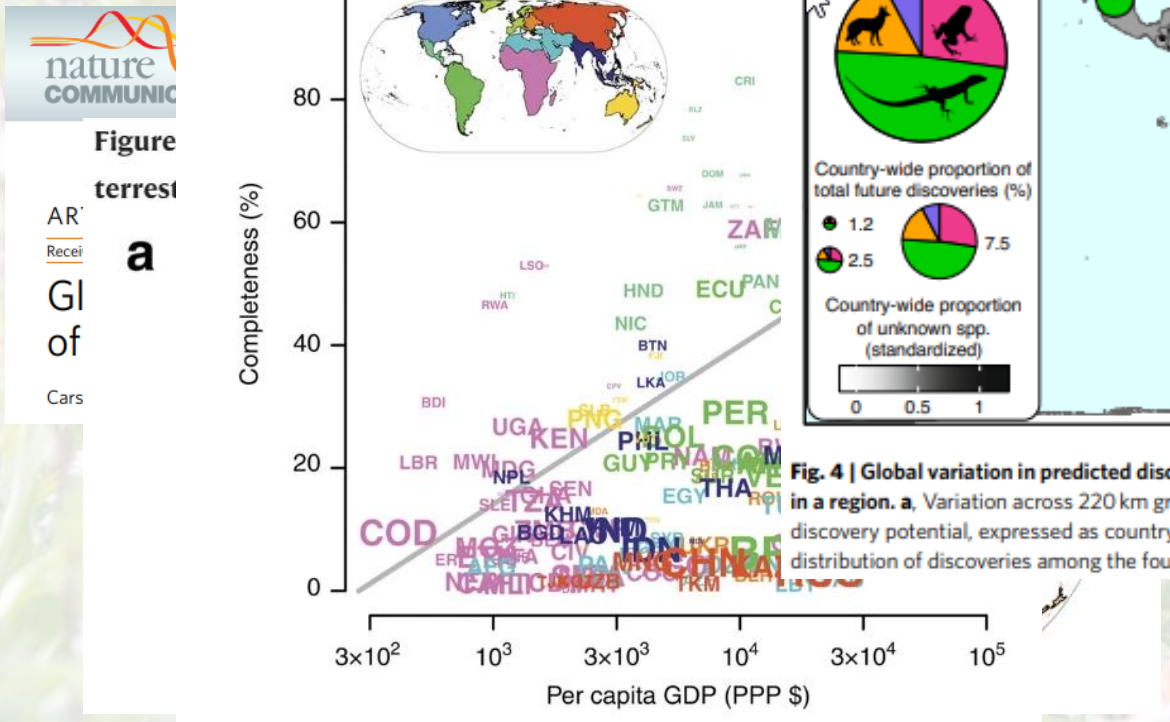
True value? ~9 million?

- 86% of land species and 91% of marine species likely remain undiscovered.



What we talk about when we talk about biodiversity – **Where?**

- Biodiversity is concentrated in the tropics
- Tropics are data poor
- Highest potential for new species discoveries



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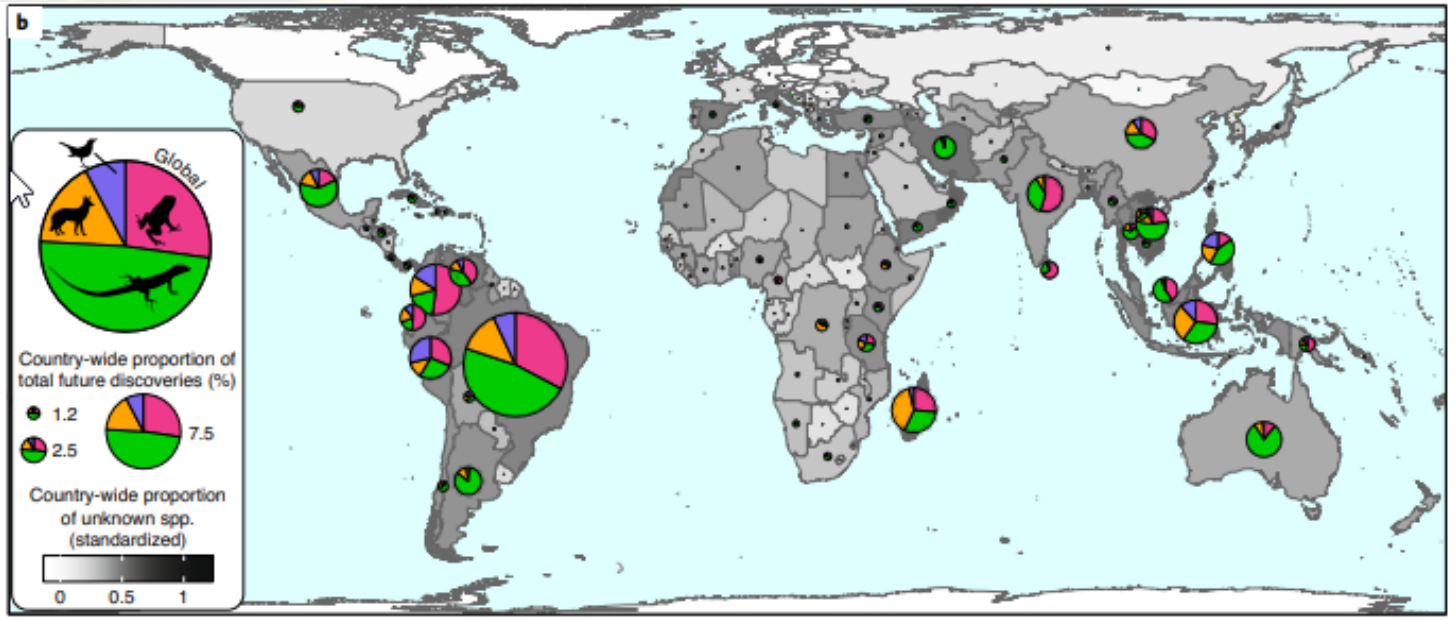
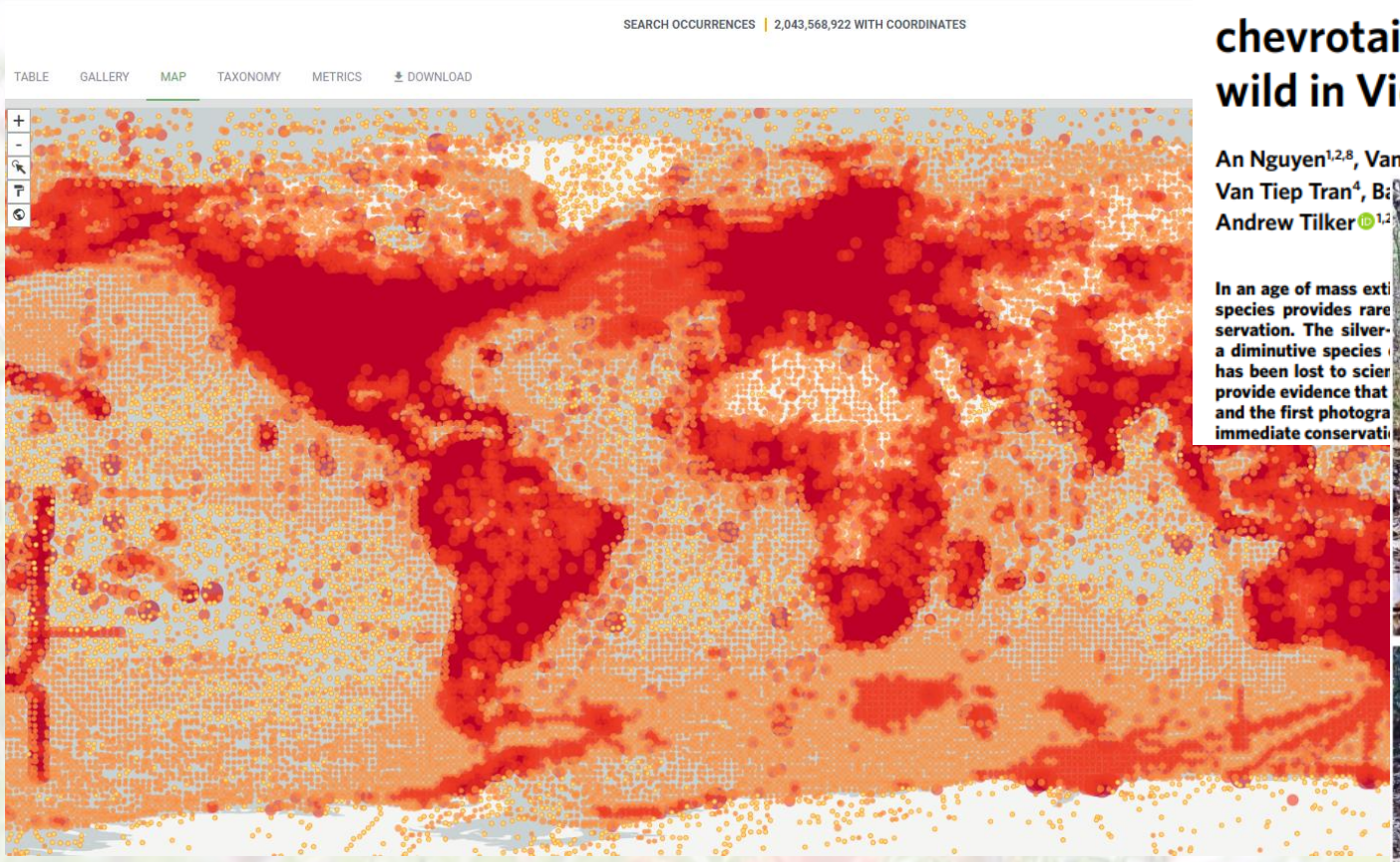


Fig. 4 | Global variation in predicted discovery potential, quantified as the percent of all global terrestrial vertebrate discoveries predicted to occur in a region. a, Variation across 220 km grid cells, standardized to percent of total discoveries. **b**, Variation among countries, with colours showing mean discovery potential, expressed as country-wide proportion of undiscovered species and standardized to vary from 0 to 1. Pie charts illustrate the predicted distribution of discoveries among the four vertebrate classes in each country ('global' in the legend shows the global pattern); pie chart size indicates

What we talk about when we talk about biodiversity – **Where?**

- Citizen science can help fill data gaps*
- Still only 6.4% of globe sampled
- Around 15,000 new species discoveries each year**



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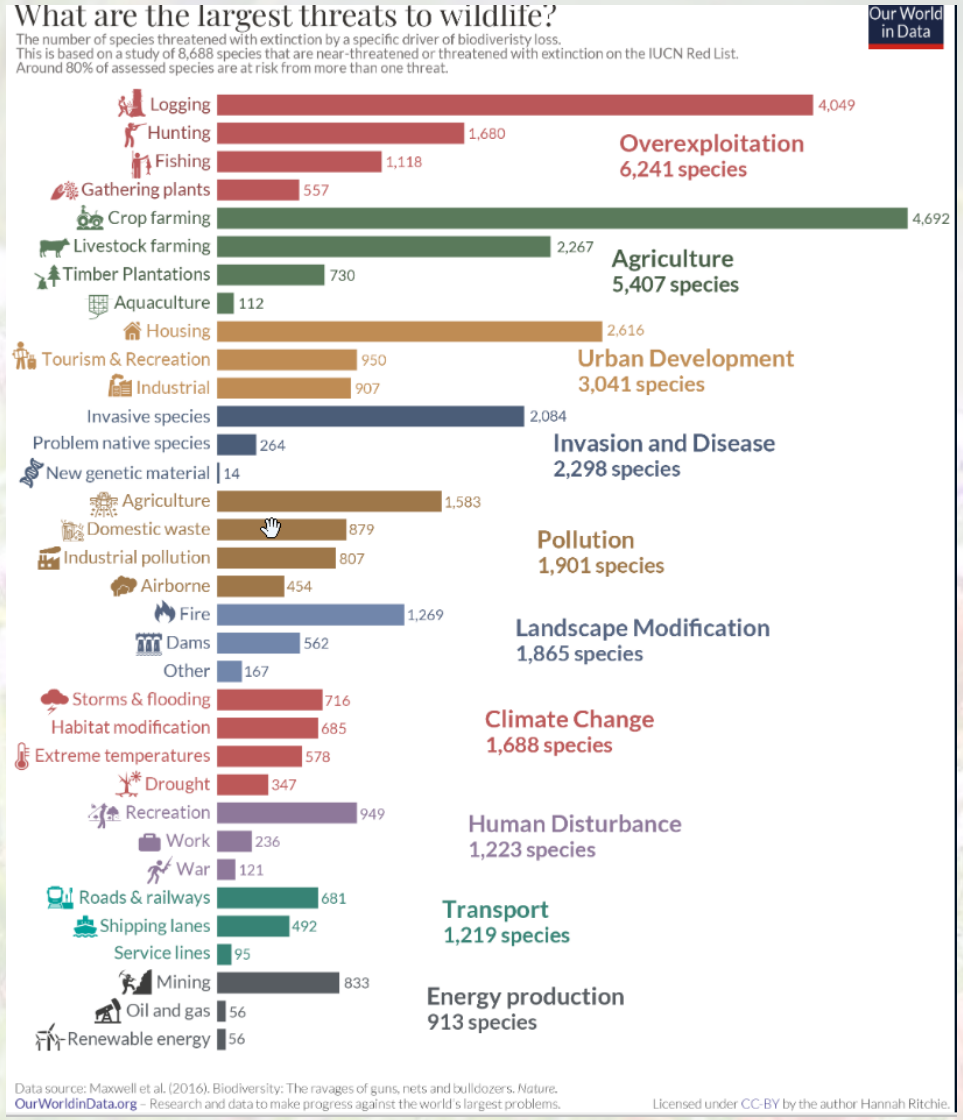
Camera-trap evidence that the silver-backed chevrotain *Tragulus versicolor* remains in the wild in Vietnam

An Nguyen[1,2,8], Van Bang Tran[3], Duc Minh Hoang[3], Thi Anh Minh Nguyen[3], Dinh Thang Nguyen[4], Van Tiep Tran[4], Ba
Andrew Tilker[1,2

In an age of mass exti
species provides rare
servation. The silver-
a diminutive species
has been lost to scier
provide evidence that
and the first photogra
immediate conservati

What we talk about when we talk about biodiversity – **Threats**



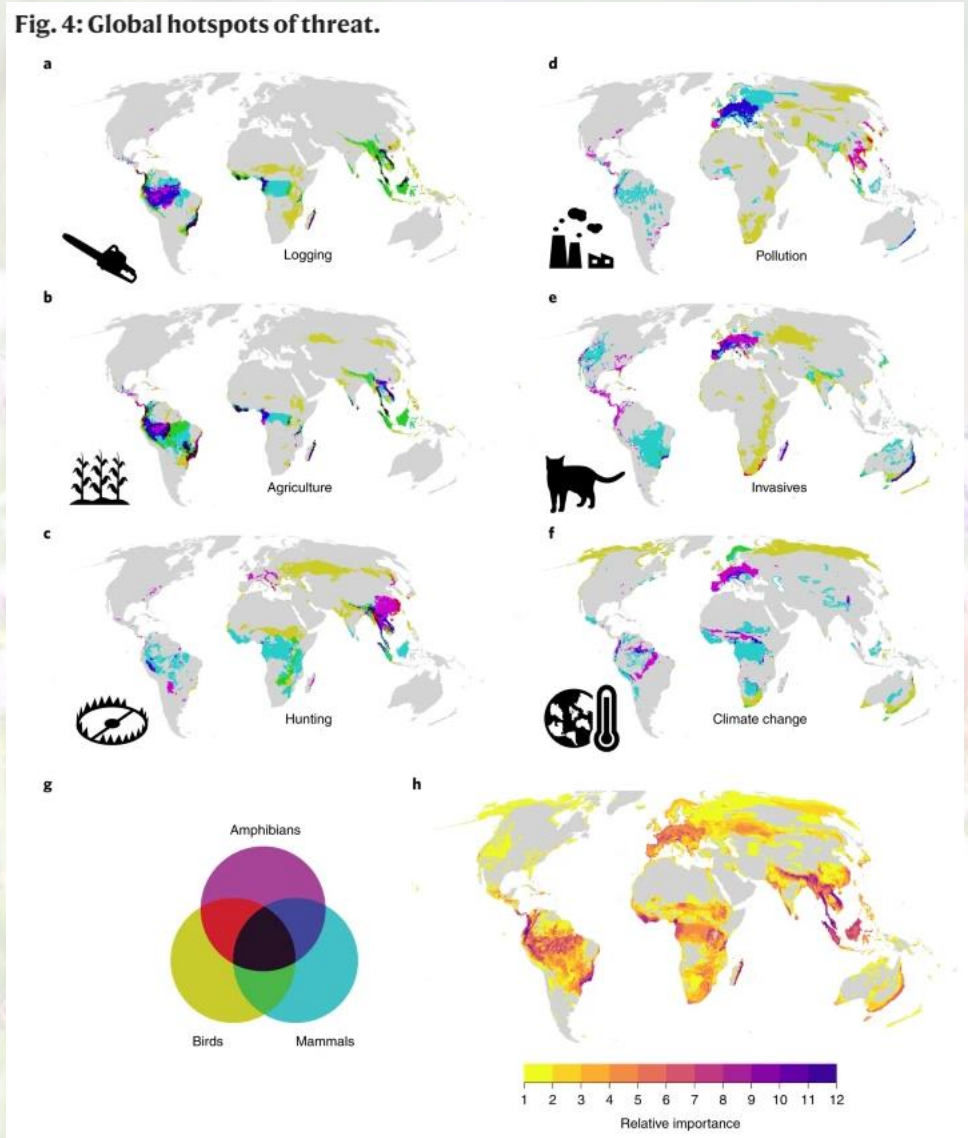
IPBES Global Assessment Top 5 threats

(1) changes in land and sea use;
(2) direct exploitation of organisms;
(3) climate change;
(4) pollution and
(5) invasive alien species.

>33%: world's land surface (and +/-75% of freshwater resources) devoted to crop or livestock production

"Current negative trends in biodiversity and ecosystems will undermine progress towards 80% (35 out of 44) of the assessed targets of the Sustainable Development Goals"

What we talk about when we talk about biodiversity – **Threats**



- Expert-derived information from the International Union for Conservation of Nature (IUCN) Red List on threats
- >23,000 species
- all terrestrial amphibians, birds and mammals

"agriculture and logging are pervasive in the tropics and that hunting and trapping is the most geographically widespread threat to mammals and birds…

…Alarmingly, this is particularly the case in **areas of the highest biodiversity importance.**"

ARTICLES
https://doi.org/10.1038/s41559-021-01542-9
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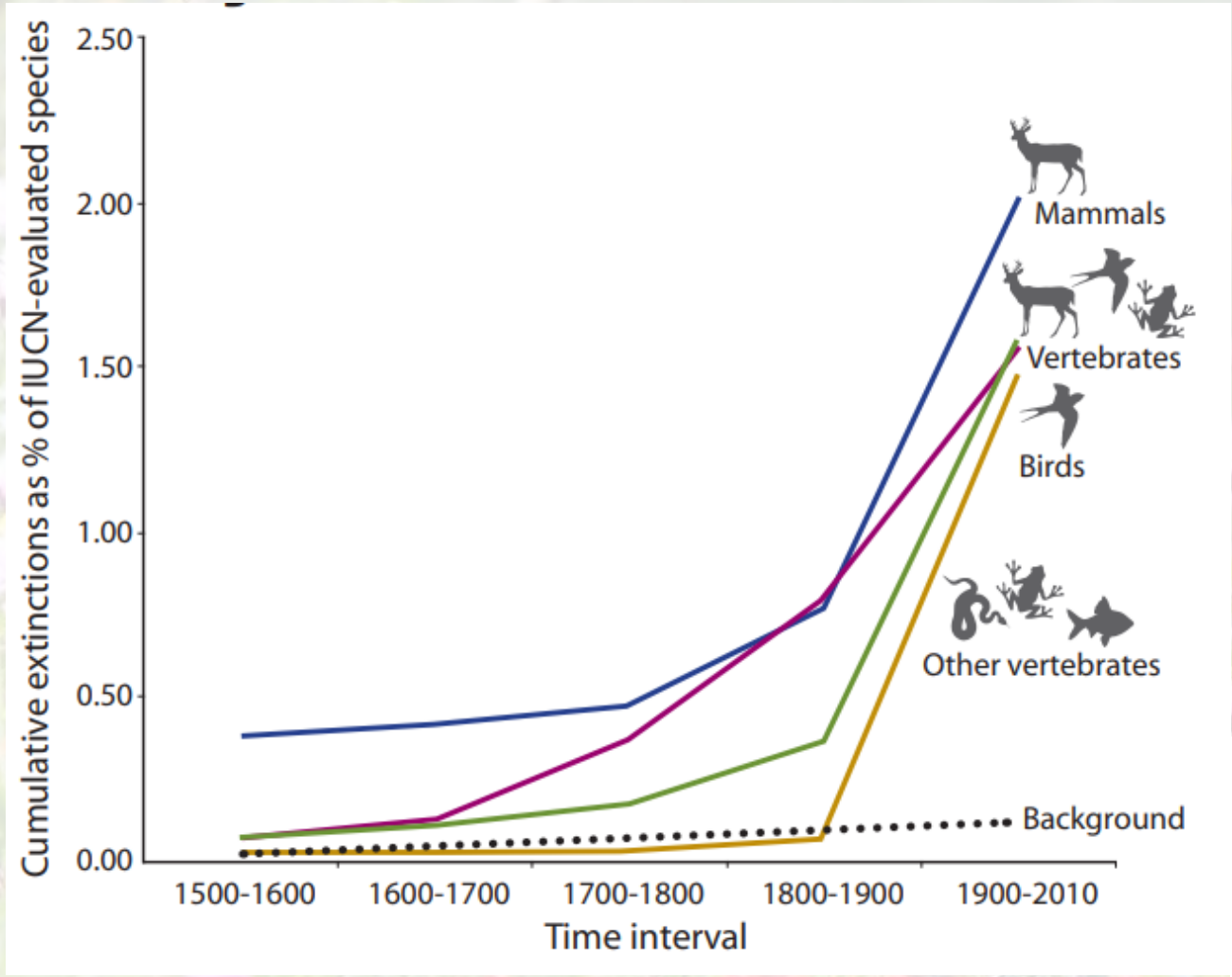
Using the IUCN Red List to map threats to terrestrial vertebrates at global scale

Michael B. J. Harfoot[1], Alison Johnston[2,3], Andrew Balmford[3], Neil D. Burgess[1,4,3], Stuart H. M. Butchart[5,3], Maria P. Dias[5,6], Carolina Hazin[5], Craig Hilton-Taylor[7], Michael Hoffmann[8], Nick J. B. Isaac[9], Lars L. Iversen[4,10], Charlotte L. Outhwaite[11], Piero Visconti[12] and Jonas Geldmann[3,4]

What we talk about when we talk about biodiversity – **Threats**



"Under the…background rate, the number of species that have gone extinct in the last century would have taken, depending on the vertebrate taxon, between 800 and 10,000 years to disappear"

RESEARCH ARTICLE

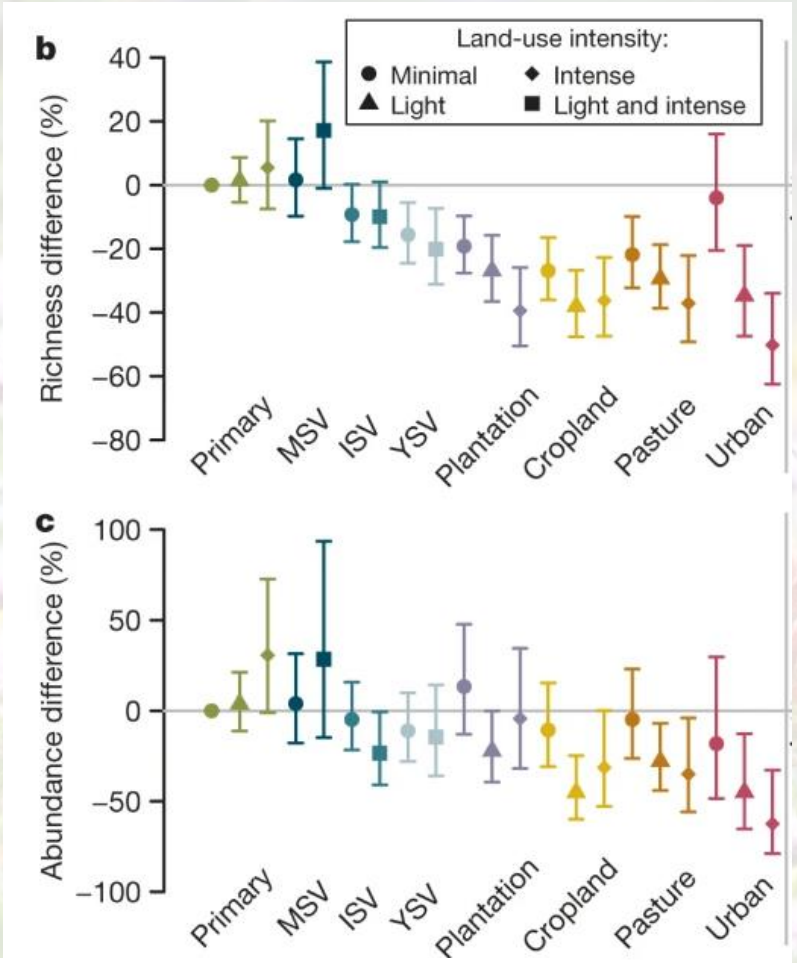
ENVIRONMENTAL SCIENCES

Accelerated modern human–induced species losses: Entering the sixth mass extinction

Gerardo Ceballos,[1]* Paul R. Ehrlich,[2] Anthony D. Barnosky,[3] Andrés García,[4] Robert M. Pringle,[5] Todd M. Palmer[6]

10.1126/sciadv.1400253

What we talk about when we talk about biodiversity – **Threats**



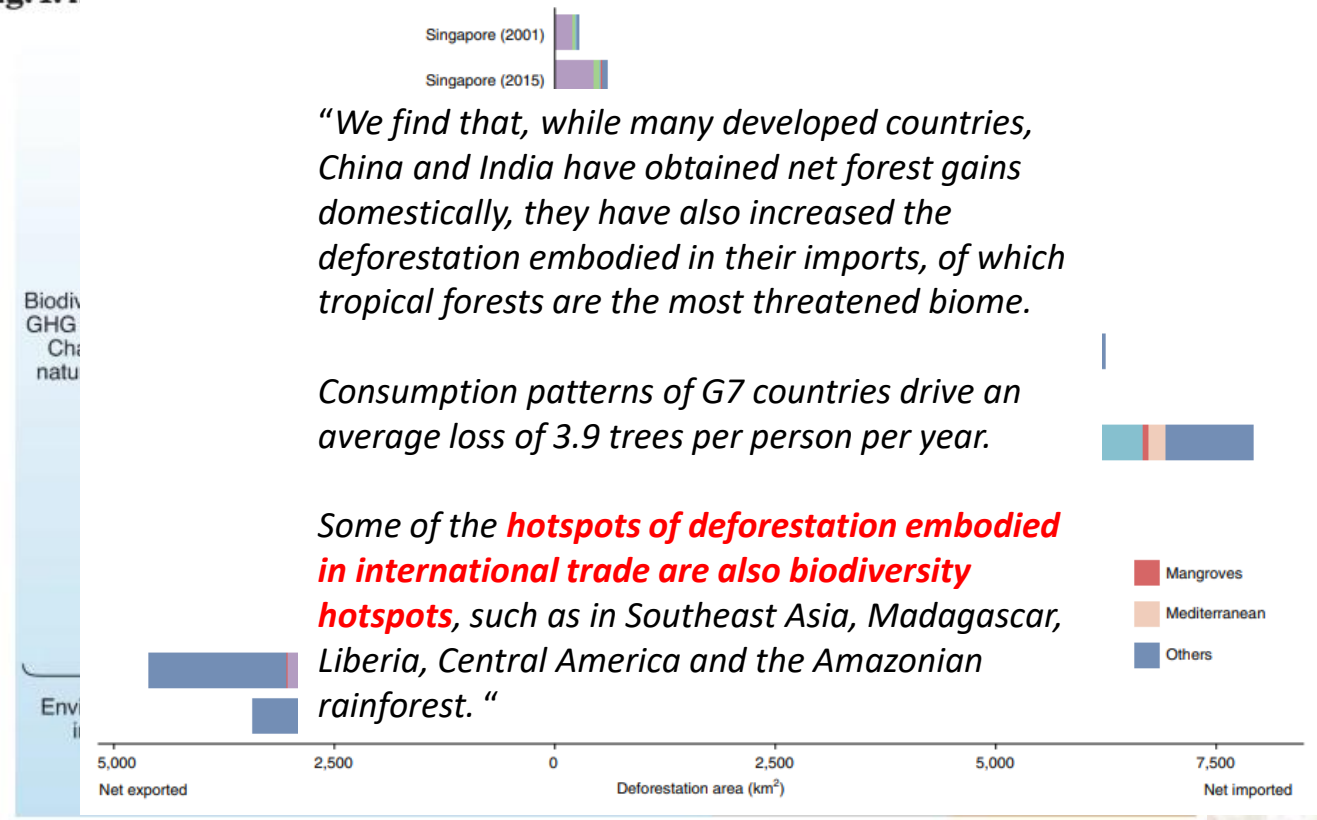
ARTICLE

doi:10.1038/nature14324

Global effects of land use on local terrestrial biodiversity

Tim Newbold[1,2]*, Lawrence N. Hudson[3]*, Samantha L. L. Hill[1,3], Sara Contu[3], Igor Lysenko[4], Rebecca A. Senior[3]†, Luca Börger[5],

Fig. 1: International trade links consumption patterns to deforestation



"We find that, while many developed countries, China and India have obtained net forest gains domestically, they have also increased the deforestation embodied in their imports, of which tropical forests are the most threatened biome.

Consumption patterns of G7 countries drive an average loss of 3.9 trees per person per year.

Some of the ***hotspots of deforestation embodied in international trade are also biodiversity hotspots****, such as in Southeast Asia, Madagascar, Liberia, Central America and the Amazonian rainforest. "*

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ARTICLES

https://doi.org/10.1038/s41559-021-01417-z

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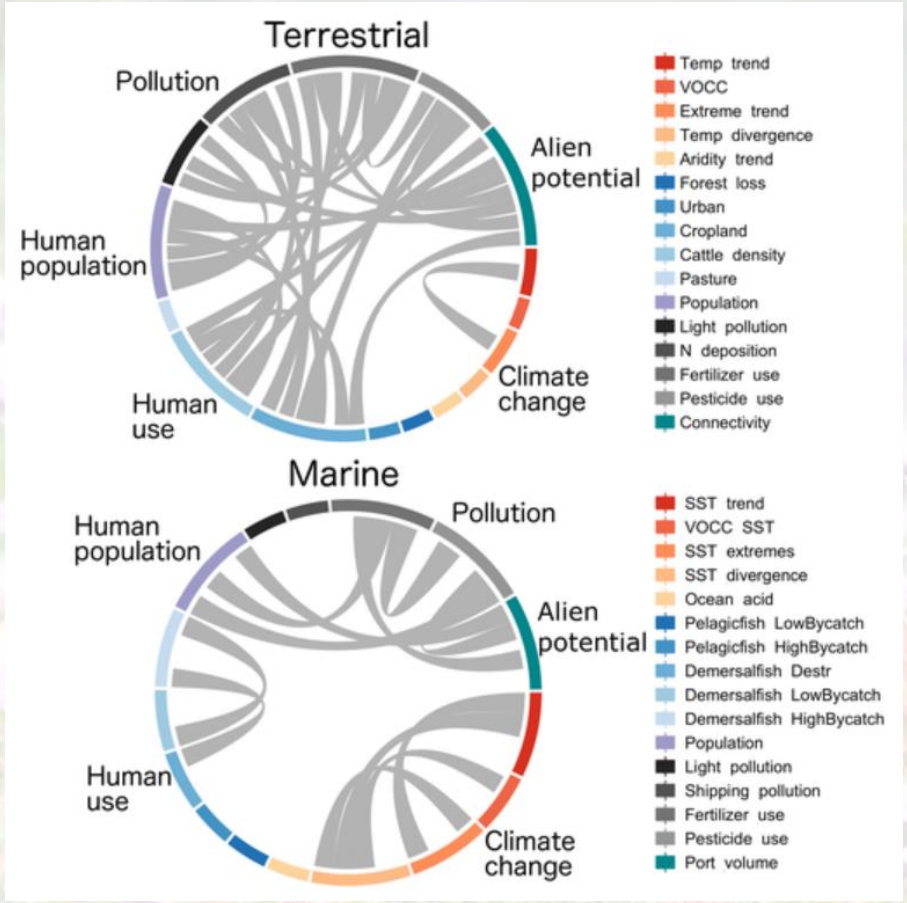
Mapping the deforestation footprint of nations reveals growing threat to tropical forests

Nguyen Tien Hoang and Keiichiro Kanemoto

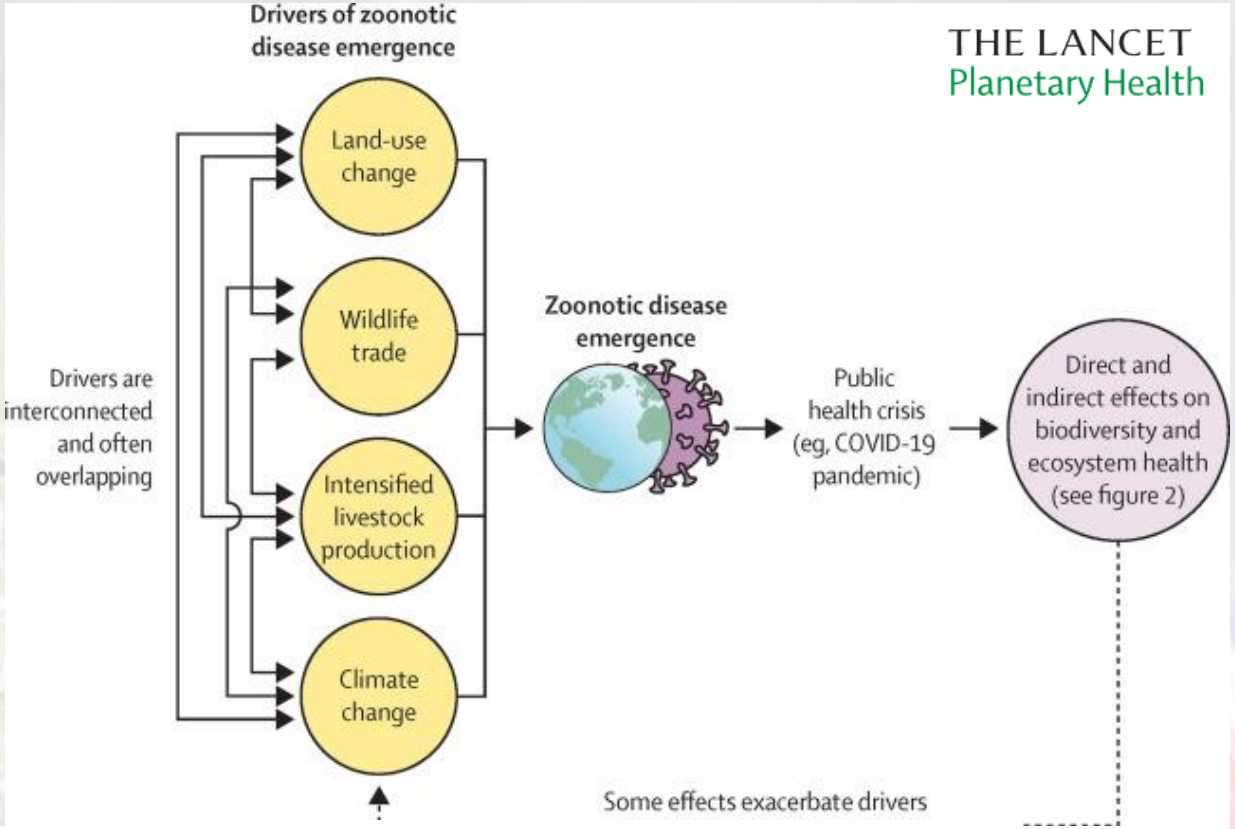
What we talk about when we talk about biodiversity – **Threats**



RESEARCH ARTICLE

PEOPLE NATURE | BRITISH ECOLOGICAL SOCIETY

Mapping human pressures on biodiversity across the planet uncovers anthropogenic threat complexes



"Effects of the COVID-19 pandemic on biodiversity and ecosystem health can exacerbate drivers of zoonotic and infectious disease emergence, increasing the risk for future zoonotic pathogen spillover events and possible public health crises; these cyclic relationships create ***a positive feedback loop****"*

What we talk about when we talk about biodiversity – **Bright spots**

UNITED NATIONS DECADE ON
ECOSYSTEM
RESTORATION
2021-2030

GREAT
GREEN
WALL

TRILLION
TREES

WCS

WWF

BirdLife
INTERNATIONAL

What we talk about when we talk about biodiversity – **Cautious optimism**

nature ecology & evolution

ARTICLES

https://doi.org/10.1038/s41559-019-1012-1

Deficits of biodiversity and productivity linger a century after agricultural abandonment

Forest Isbell[1*], David Tilman[1,2], Peter B. Reich[3,4] and Adam Thomas Clark[5,6]

"during the century following agricultural abandonment, local plant diversity recovers only incompletely and plant productivity does not significantly recover."

Fig. 2: Trends in biodiversity, productivity, species richness and species evenness.

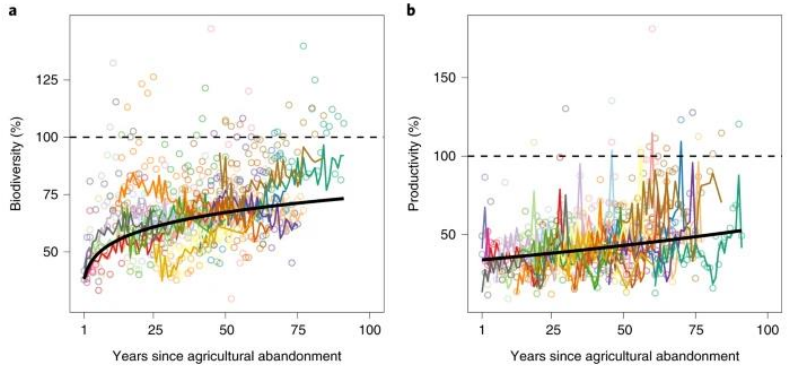


Fig. 1: Changing characteristics of the world's forests and biodiversity.

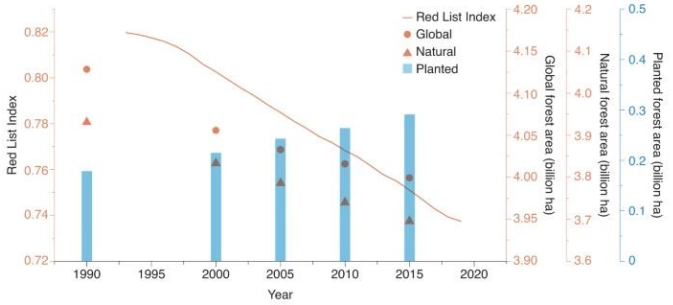


Fig. 2: Two contrasting perspectives of the same monoculture plantation of Masson pine (*Pinus massoniana*) in the red soil area of southern China.

comment

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Improve forest restoration initiatives to meet Sustainable Development Goal 15

Monoculture plantations have been promoted for the restoration of the world's forested area, but these have not contained or reversed the loss of biodiversity. More innovative incentive policies should be implemented to shift the planet's forest restoration policies from increasing the area of forests per se to improving their biodiversity.

Junze Zhang, Bojie Fu, Mark Stafford-Smith, Shuai Wang and Wenwu Zhao

What we talk about when we talk about biodiversity – **Cautious optimism**

nature ecology & evolution

ARTICLES

https://doi.org/10.1038/s41559-022-01737-8

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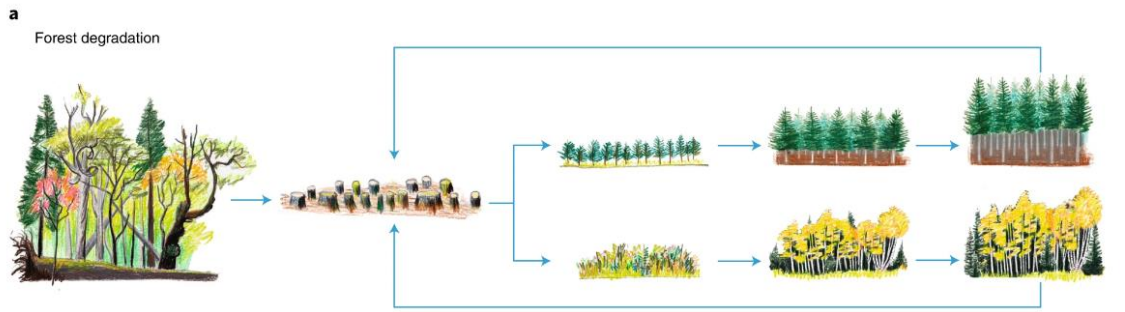
OPEN

Forest degradation drives widespread avian habitat and population declines

Matthew G. Betts[1✉], Zhiqiang Yang[2], Adam S. Hadley[3], Adam C. Smith[4], Josée S. Rousseau[5], Joseph M. Northrup[6], Joseph J. Nocera[7], Noel Gorelick[8] and Brian D. Gerber[9]



"Despite little change in overall forest cover, we found substantial reductions in old forest as a result of frequent clear-cutting and a broad-scale transformation to intensified forestry.

*Our results indicate that forest degradation has led to **habitat declines for the majority of forest bird species** with negative consequences for bird populations, **particularly species associated with older forest**"*

"We find that 294.5 million people live on tropical forest restoration opportunity land in the Global South, including 12% of the total population in low-income countries.

*Forest landscape restoration that **prioritizes local communities** by affording them rights to manage and restore forests provides a promising option to align global agendas for climate mitigation, conservation, environmental justice and sustainable development."*

BRIEF COMMUNICATION

https://doi.org/10.1038/s41559-020-01282-2

nature ecology & evolution

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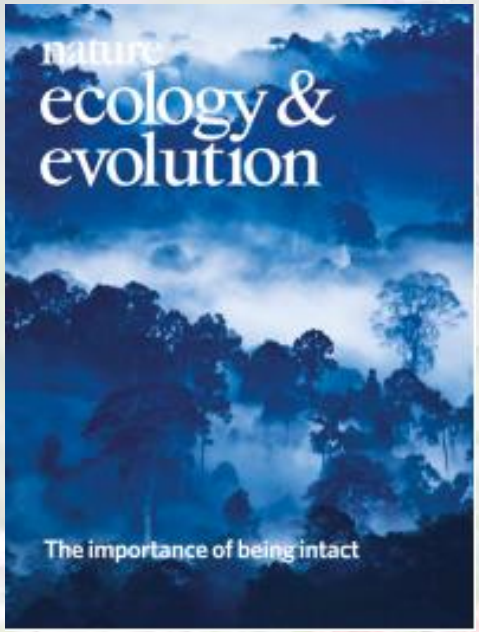
Global forest restoration and the importance of prioritizing local communities

J. T. Erbaugh[1✉], N. Pradhan[2], J. Adams[3], J. A. Oldekop[4], A. Agrawal[5], D. Brockington[6], R. Pritchard[4,6] and A. Chhatre[2]

What we talk about when we talk about biodiversity – **Apart from….**

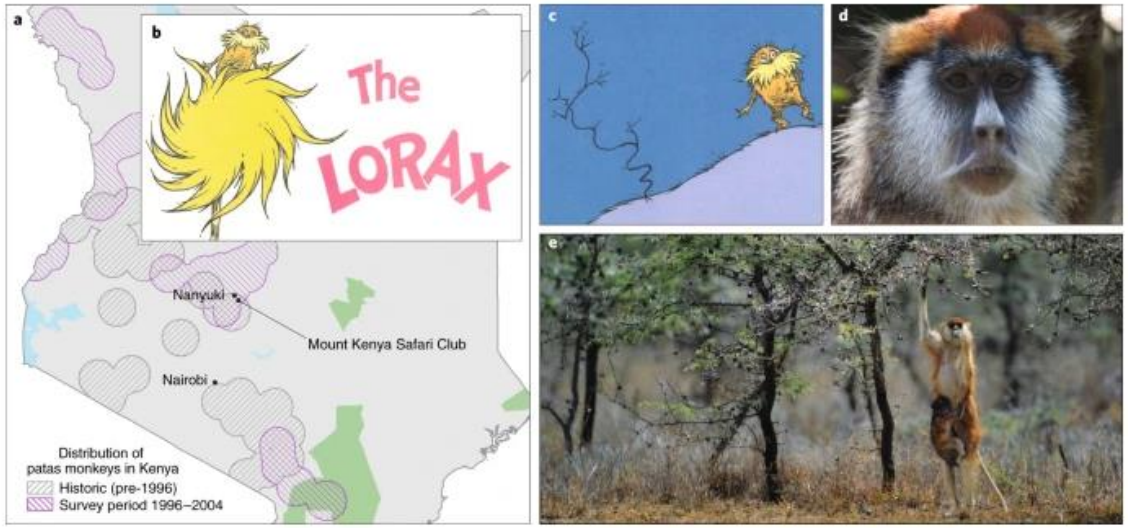
- Climate change mitigation
- More above- and belowground carbon stored.
- More faunal complexity, which helps carbon storage and sequestration.
- Major carbon sequestration.
- Regulating local and regional weather regimes
- Generation of rain and reduced risk of drought.
- Ensuring hydrological services are maintained
- Buffer human settlements against negative effects of extreme climatic events.
- Conserving biodiversity
- Consistently higher numbers of forest-dependent species.
- More effectively sustain important large-scale ecological processes.
- Intact forests have higher functional diversity.
- Higher intra-species genetic diversity.
- Higher ability for species to undertake dispersal or retreat to refugia.
- Refuge for forest species from increased fire frequencies in degraded landscapes under changing climates.
- Increased likelihood of providing key pollination and dispersal processes.
- Indigenous cultures
- Increased basis for the material and spiritual aspects of traditional indigenous cultures to function
- Human health benefits
- Reduced health impacts of wildfires.
- Reduced infectious disease risks.



…What have intact forests ever done for us?

books & arts

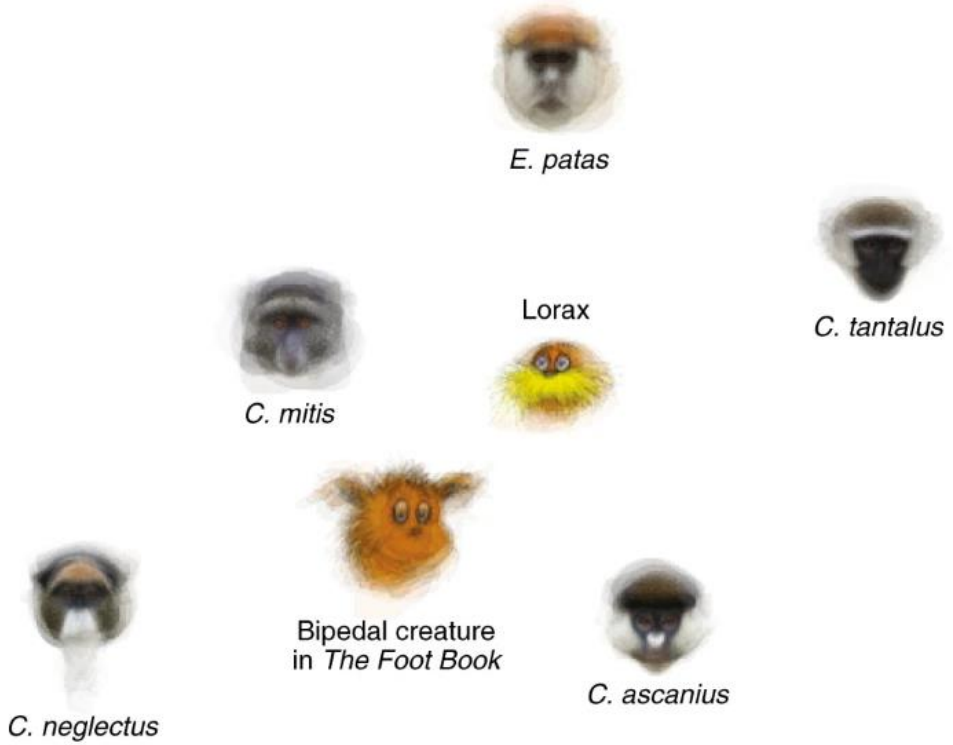
Dr Seuss and the real Lorax



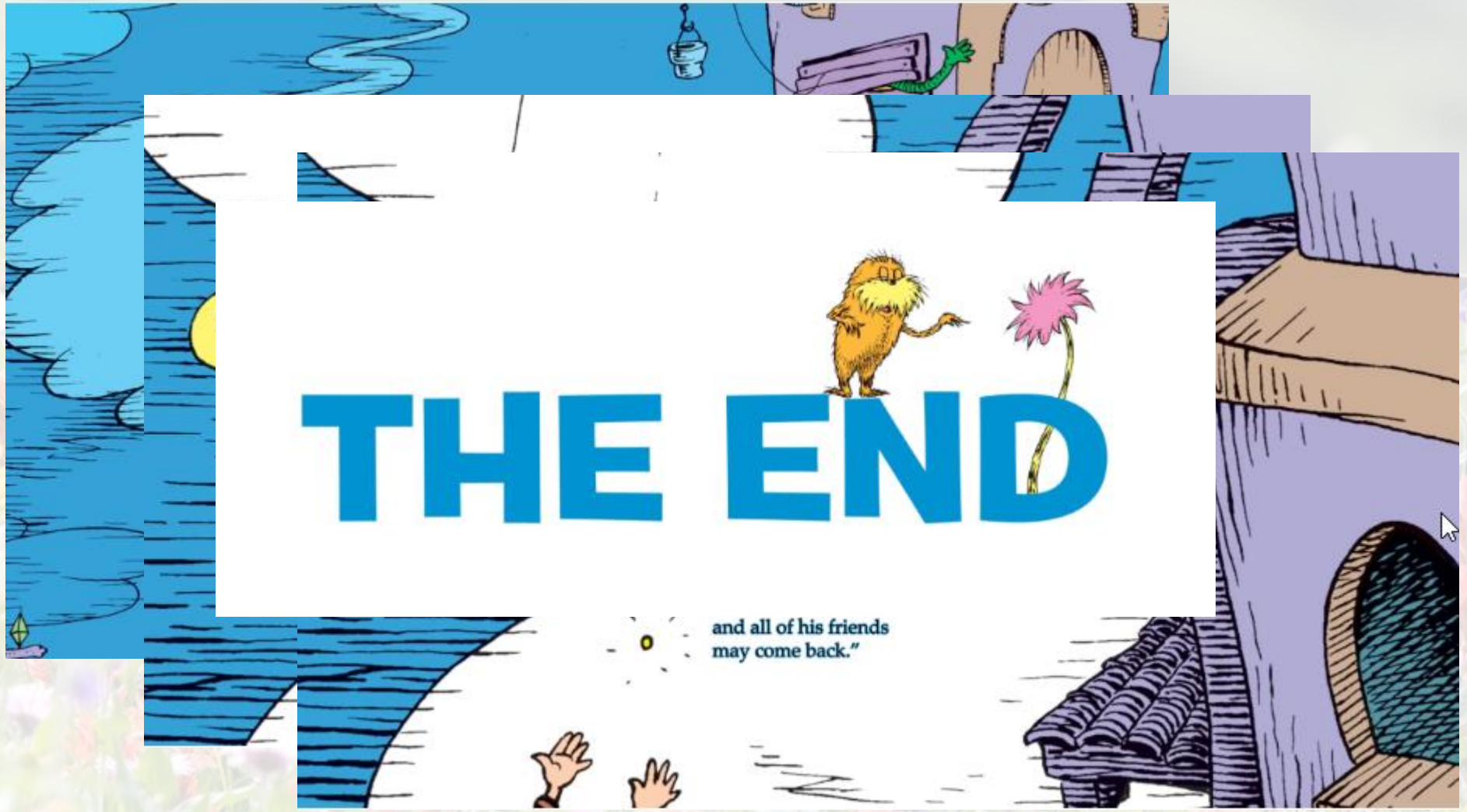
a,**d**, Yvonne A. de Jong and Thomas M. Butynski; **b**,**c**, Dr. Seuss Enterprises; **e**, Anup Shah, courtesy of Nature Picture Library

a, Location of the Mount Kenya Safari Club together with data on the patchy distribution of patas monkeys (*E. patas*) in Kenya. A comparison of historical records (pre-1996) and surveys between 1996 and 2004 indicates that the range of *E. patas* has declined by 46% in Kenya[24]. **b**, The Lorax in the crown of a silk-tufted Truffula tree. **c**, Spindly tree that resembles the whistling thorn acacia (*A. drepanolobium*). **d**, Male patas monkey; the subspecies in Kenya (*E. patas pyrrhonotus*) is distinguished by its black facial skin and white nose[25]. **e**, Female patas monkey feeding on *A. drepanolobium*.

Fig. 3: Perceptual face space.



"We found that the Lorax is better characterized by primate face space than even the most similar-looking Seussian character, and specifically that the face of the Lorax clusters closely with three species: the blue monkey (Cercopithecus mitis), the red-tailed monkey (C. ascanius) and the patas monkey (E. patas; Fig. 3)"


THE END
and all of his friends
may come back."