O debate sobre o Antropoceno e a emergência climática nos currículos das IES - ANDES-SN

ERA	PERIOD	EPOCH	BEGAN (Years ago0
Cenozoic	Quaternary	ANTHROPOCENE	??
		Holocene	11,700
		Pleistocene	2.5 M
	Tertiary	Pliocene	5.3 M
		Miocene	23 M
		Oligocene	34 M
		Eocene	56 M
		Paleocene	65.5 M
Mesozoic	Cretaceous		146 M
	Jurassic		200 M
	Triassic		251 M
Paleozoic			542 M
Proterozoic			4.5 B

Luiz Marques luiz.marques4@gmail.com

UNICAMP

Sumário desta comunicação

I. Grande Aceleração, Antropoceno e a recusa do IUGS

II. A engrenagem do colapso socioambiental

1. Fracasso da UNFCCC, da CBD e da governança global (paz)
2. Aquecimento médio global de 2 ^{o}C antes de 2040
3. Trópicos inabitáveis até 2070

II - Propostas

Review

THE ANTHROPOCENE REVIEW

The trajectory of the Anthropocene: The Great Acceleration

The Anthropocene Review
2015, Vol. 2(1) 81–98

DOI: 10.1177/2053019614564785
anr.sagepub.com
SAGE

Will Steffen,[1,2] Wendy Broadgate,[3] Lisa Deutsch,[1] Owen Gaffney[3] and Cornelia Ludwig[1]

2015

"O termo "Grande Aceleração" busca capturar a natureza holística, pervasiva e interconectada das mudanças pós-1950, ocorrendo ao mesmo tempo nas esferas socioeconômica e biofísica do Sistema Terra, abrangendo muito mais que as mudanças climáticas"

"The term 'Great Acceleration' aims to capture the holistic, comprehensive and interlinked nature of the post-1950 changes simultaneously sweeping across the socio-economic and biophysical spheres of the Earth System, encompassing far more than climate change".

Singularidade histórica da "Grande Aceleração"

Global Change IGBP (International Geosphere – Biosphere Programme (1986 – 2015), organizado e coordenado por Bert Bolin:

http://www.igbp.net/globalchange/greatacceleration.4.1b8ae20512db692f2a680001630.html

"A segunda metade do século XX é única na história da existência humana. Muitas atividades humanas atingiram pontos de decolagem em algum momento no século e *aceleraram-se notavelmente ao se aproximarem de seu final*. Os últimos 60 anos viram sem dúvida a mais profunda transformação da relação do homem com o mundo natural na história da humanidade".

A Aceleração a partir de 1945:

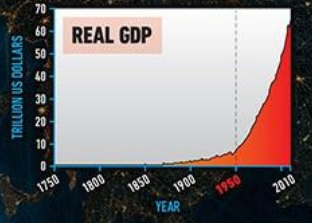
Richard Monastersky, “First atomic blast proposed as start of Anthropocene”. *Nature*, 16 de janeiro de 2015:

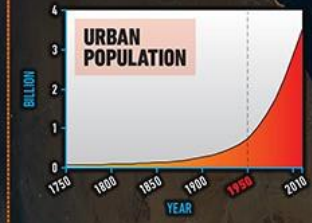
“Fertilizantes começaram a ser produzidos maciçamente, por exemplo, o que dobrou a quantidade de nitrogênio reativo no meio ambiente, e a quantidade de CO_2 na atmosfera começou a crescer. Novos plásticos disseminaram-se pelo globo e o crescimento do comércio mundial transportou de um continente a outro espécies invasivas animais e vegetais.

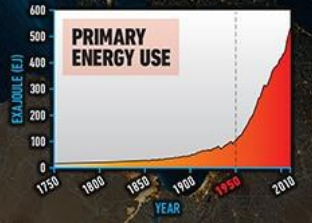
Além disso, as pessoas migraram crescentemente das áreas rurais para os centros urbanos, alimentando o crescimento das megacidades. Esse tempo foi chamado **A Grande Aceleração**”.

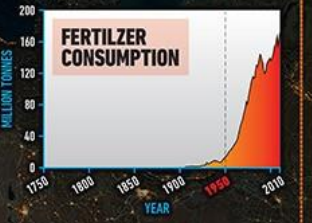
THE GREAT ACCELERATION

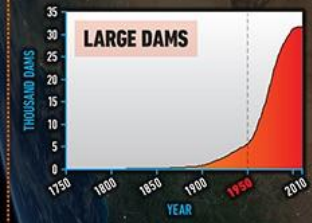
SOCIO-ECONOMIC TRENDS

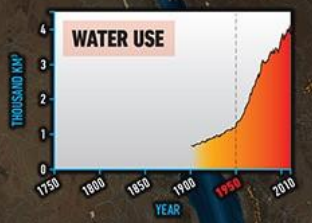




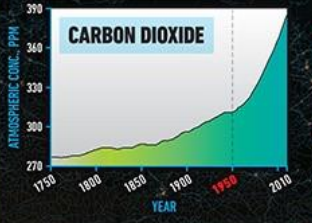


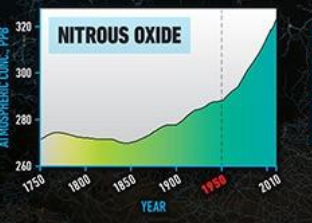


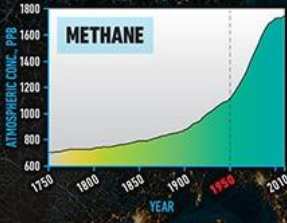


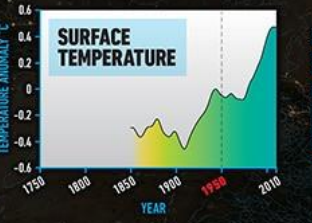


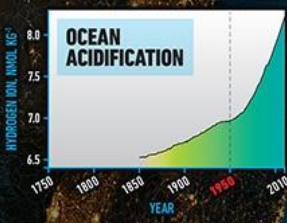
EARTH SYSTEM TRENDS

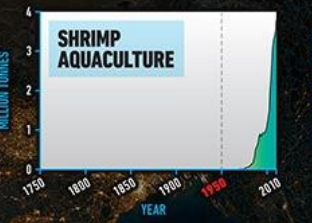


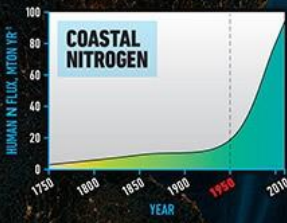


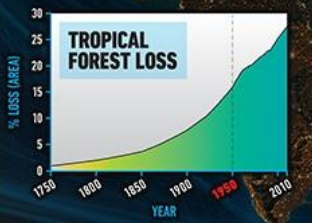


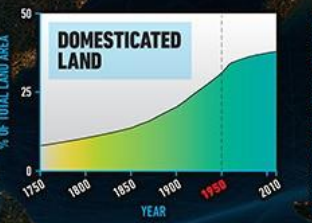


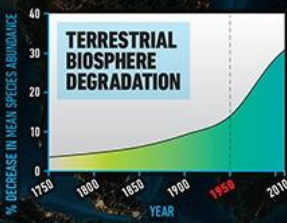










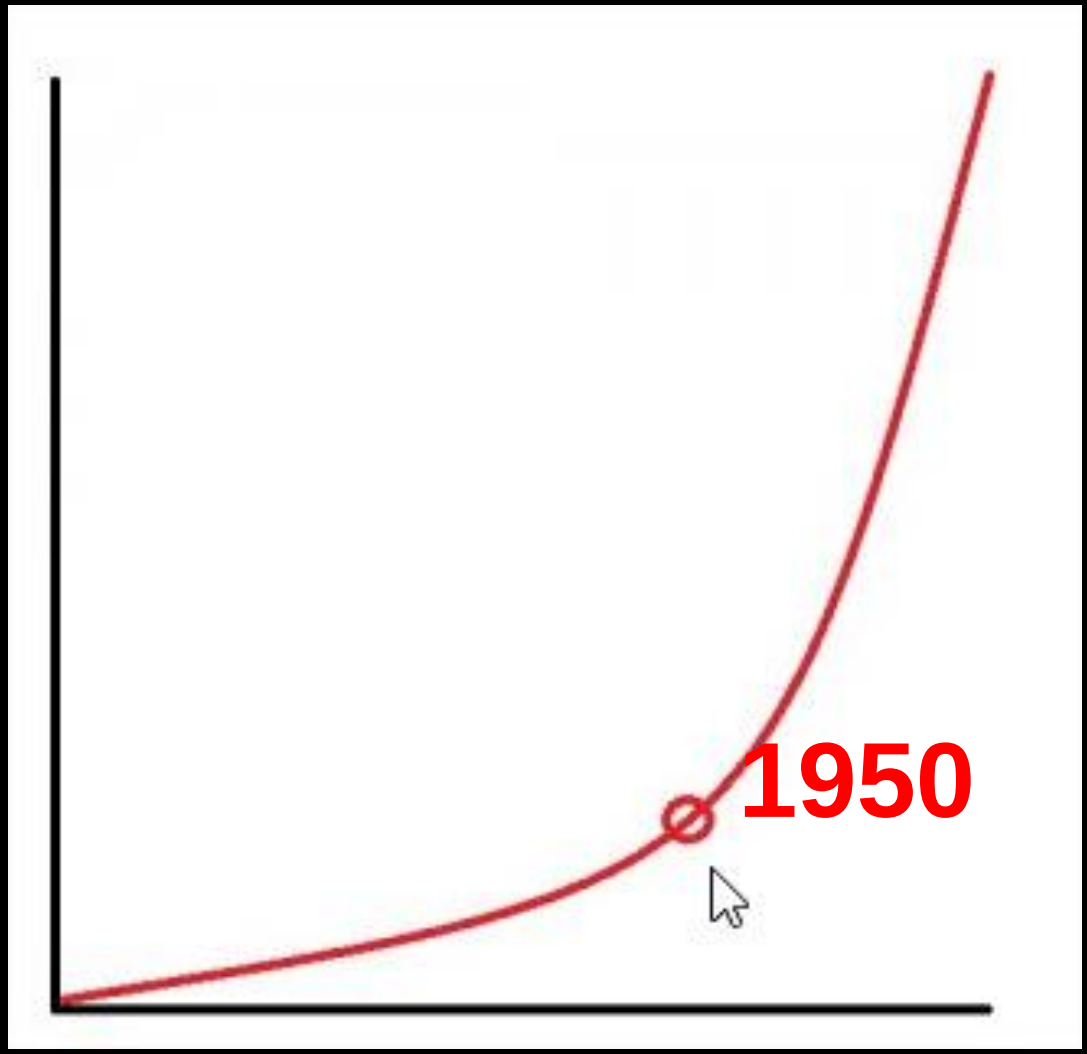


REFERENCE: Steffen, W., W. Broadgate, L. Deutsch, O. Gaffney and C. Ludwig (2015), The Trajectory of the Anthropocene: the Great Acceleration, Submitted to *The Anthropocene Review.*

MAP & DESIGN: Félix Pharand-Deschênes / Globaïa

Curvas ascendentes já eram detectáveis antes, mas em 1950 ocorre o “joelho da curva”

Desde ~1950, com a reorganização do sistema mundial pela *Pax americana* e pelo bloco socialista, todas as curvas indicadoras da interferência humana no Sistema Terra tornam-se muito mais íngremes.



Definição de Antropoceno

"O intervalo de tempo presente no qual muitas condições e processos geológicos significativos são profundamente alterados pelas atividades humanas.

Estes abrangem: erosão, transportes de sedimentos associados a uma variedade de processos antropogênicos, colonização, agricultura, urbanização, aquecimento global, a composição química da atmosfera, oceanos e solos com perturbações antropogênicas significativas dos ciclos de elementos como o carbono, nitrogênio, fósforo, vários metais, acidificação oceânica, ampliação das 'zonas mortas', perturbações da biosfera terrestre e marítima, perda de habitat, predação, invasões de espécies e as mudanças químicas mencionadas acima".

Cf. Grupo de trabalho sobre Antropoceno da Subcomissão sobre a Estratigrafia do Quaternário <http://quaternary.stratigraphy.org/workinggroups/anthropocene/>.

No Holoceno, e mais ainda em épocas geológicas anteriores, os principais fatores das mudanças no Sistema Terra eram não-antrópicos. Por exemplo:

- Variações nos ciclos solares
- Movimentos das placas tectônicas e vulcanismo
- Impactos de meteoros
- Mudanças na geometria da órbita e no eixo da rotação da Terra
- Composição química da atmosfera
- Degelo
- Ventos, marés, intemperismo, extinções de espécies, alterações na biodiversidade

Essas mudanças ocorriam em escalas de tempo mensuráveis em milhares ou em milhões de anos.

concepts

Geology of mankind

Paul J. Crutzen

For the past three centuries, the effects of humans on the global environment have escalated. Because of these anthropogenic emissions of carbon dioxide, global climate may depart significantly from natural behaviour for many millennia to come. It seems appropriate to assign the term 'Anthropocene' to the present, in many ways human-dominated, geological epoch, supplementing the Holocene — the warm period of the past 10–12 millennia. The Anthropocene could be said to have started in the latter part of the eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane. This date also happens to coincide with James Watt's design of the steam engine in 1784.

Mankind's growing influence on the environment was recognized as long ago as 1873, when the Italian geologist Antonio Stoppani spoke about a "new telluric force which in power and universality may be compared to the greater forces of earth," referring to the "anthropozoic era". And in 1926, V. I. Vernadsky acknowledged the increasing impact of mankind: "The direction in which the processes of evolution must proceed, namely towards increasing consciousness and thought, and forms having greater and greater influence on their surroundings." Teilhard de Chardin and Vernadsky used the term 'noösphere' — the 'world of thought' — to mark the growing role of human brain-power in shaping its own future and environment.

The rapid expansion of mankind in numbers and per capita exploitation of Earth's resources has continued apace. During the past three centuries, the human population has increased tenfold to more than 6 billion and is expected to reach 10 billion in this century. The methane-producing cattle population has risen to 1.4 billion. About 30–50% of the planet's land surface is exploited by humans. Tropical rainforests disappear at a fast pace, releasing carbon dioxide and strongly increasing species extinction. Dam building and river diversion have become commonplace. More than half of all accessible fresh water is used by mankind. Fisheries remove more than 25% of the primary production in upwelling ocean regions and 35% in the temperate continental shelf. Energy use has grown 16-fold during the twentieth century, causing 160 million tonnes of atmospheric sulphur dioxide emissions per year, more than twice the sum of its natural emissions. More nitrogen fertilizer is applied in agriculture than is fixed naturally in all terrestrial ecosystems; nitric oxide production by the burning of fossil fuel and biomass also overrides natural emissions. Fossil-fuel burning and agriculture have caused substantial increases in the concentrations of 'greenhouse' gases — carbon dioxide by 30% and methane by more than 100% — reaching their highest levels over the past 400 millennia, with more to follow.

So far, these effects have largely been caused by only 25% of the world population. The consequences are, among others, acid precipitation, photochemical 'smog' and climate warming. Hence, according to the latest estimates by the Intergovernmental Panel on Climate Change (IPCC), the Earth will warm by 1.4–5.8 °C during this century.

Many toxic substances are released into the environment, even some that are not toxic at all but nevertheless have severely damaging effects, for example the chlorofluorocarbons that caused the Antarctic 'ozone hole' (and which are now regulated). Things could have become much worse: the ozone-destroying properties of the halogens have been studied since the mid-1970s. If it had turned out that chlorine behaved chemically like bromine, the ozone hole would by then have been a global, year-round phenomenon, not just an event of the Antarctic spring. More by luck than by wisdom, this catastrophic situation did not develop.

Unless there is a global catastrophe — a meteorite impact, a world war or a pandemic — mankind will remain a major environmental force for many millennia. A daunting task lies ahead for scientists and engineers to guide society towards environmentally sustainable management during the era of the Anthropocene. This will require appropriate human behaviour at all scales, and may well involve internationally accepted, large-scale geo-engineering projects, for instance to 'optimize' climate. At this stage, however, we are still largely treading on *terra incognita*.

The Anthropocene

The Anthropocene could be said to have started in the late eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane.

Paul J. Crutzen is at the Max Planck Institute for Chemistry, PO Box 3060, D-55020 Mainz, Germany, and the Scripps Institution of Oceanography, University of California, San Diego, 9500 Gilman Drive, La Jolla, California 92093-0452, USA.

FURTHER READING

Marsh, G. P. *Man and Nature* (1864). Reprinted as *The Earth as Modified by Human Action* (Belknap Press, Cambridge, Massachusetts, 1965).

Crutzen, P. J. & Stoermer, E. F. *IGBP Newsletter* 41, (Royal Swedish Academy of Sciences, Stockholm, 2000).

Clark, W. C. & Munn, R. E. (eds) *Sustainable Development of the Biosphere* Ch. 1 (Cambridge Univ. Press, Cambridge, 1986).

Vernadski, V. I. *The Biosphere* (translated and annotated version from the original of 1926) (Springer, New York, 1998).

Turner, B. L. et al. *The Earth as Transformed by Human Action* (Cambridge Univ. Press, Cambridge, 1990).

McNeill, J. R. *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (W. W. Norton, New York, 2000).

Houghton, J. T. et al. (eds) *Climate Change 2001: The Scientific Basis* (Cambridge Univ. Press, Cambridge, 2001).

Berger, A. & Loutre, M.-F. *C. R. Acad. Sci. Paris* 333 (IIa), 1–16 (1996).

Schellnhuber, H. J. *Nature* 402, C19–C23 (1999).

A crescente influência da humanidade no meio ambiente foi reconhecida já em 1873, quando o geólogo italiano Antonio Stoppani falou sobre uma "nova força telúrica que em poder e universalidade pode ser comparada às forças maiores da terra", referindo-se à "era antropozóica".

Paul Crutzen (2002), "Geology of mankind". *Nature*, 415, 6867, p.23

concepts

Geology of mankind

Paul J. Crutzen

For the past three centuries, the effects of humans on the global environment have escalated. Because of these anthropogenic emissions of carbon dioxide, global climate may depart significantly from natural behaviour for many millennia to come. It seems appropriate to assign the term 'Anthropocene' to the present, in many ways human-dominated, geological epoch, supplementing the Holocene — the warm period of the past 10–12 millennia. The Anthropocene could be said to have started in the latter part of the eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane. This date also happens to coincide with James Watt's design of the steam engine in 1784.

Mankind's growing influence on the environment was recognized as long ago as 1873, when the Italian geologist Antonio Stoppani spoke about a "new telluric force which in power and universality may be compared to the greater forces of earth,"

The Anthropocene

The Anthropocene could be said to have started in the late eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane.

referring to the "anthropozoic era". And in 1926, V. I. Vernadsky acknowledged the increasing impact of mankind: "The direction in which the processes of evolution must proceed, namely towards increasing consciousness and thought, and forms having greater and greater influence on their surroundings." Teilhard de Chardin and Vernadsky used the term 'noösphere' — the 'world of thought' — to mark the growing role of human brain-power in shaping its own future and environment.

The rapid expansion of mankind in numbers and per capita exploitation of Earth's resources has continued apace. During the past three centuries, the human population has increased tenfold to more than 6 billion and is expected to reach 10 billion in this century. The methane-producing cattle population has risen to 1.4 billion. About 30–50% of the planet's land surface is exploited by humans. Tropical rainforests disappear at a fast pace, releasing carbon dioxide and strongly increasing species extinction. Dam building and river diversion have become commonplace. More than half of all accessible fresh water is used by mankind. Fisheries remove more than 25% of the primary production in upwelling ocean regions and 35% in the temperate continental shelf. Energy use has grown 16-fold during the twentieth century, causing 160 million tonnes of atmospheric sulphur dioxide emissions per year, more than twice the sum of its natural emissions. More nitrogen fertilizer is applied in agriculture than is fixed naturally in all terrestrial ecosystems; nitric oxide production by the burning of fossil fuel and biomass also overrides natural emissions. Fossil-fuel burning and agriculture have caused substantial increases in the concentrations of 'greenhouse' gases — carbon dioxide by 30% and methane by more than 100% — reaching their highest levels over the past 400 millennia, with more to follow.

So far, these effects have largely been caused by only 25% of the world population. The consequences are, among others, acid precipitation, photochemical 'smog' and climate warming. Hence, according to the latest estimates by the Intergovernmental Panel on Climate Change (IPCC), the Earth will warm by 1.4–5.8 °C during this century.

Many toxic substances are released into the environment, even some that are not toxic at all but nevertheless have severely damaging effects, for example the chlorofluorocarbons that caused the Antarctic 'ozone hole' (and which are now regulated). Things could have become much worse: the ozone-destroying properties of the halogens have been studied since the mid-1970s. If it had turned out that chlorine behaved chemically like bromine, the ozone hole would by then have been a global, year-round phenomenon, not just an event of the Antarctic spring. More by luck than by wisdom, this catastrophic situation did not develop.

Unless there is a global catastrophe — a meteorite impact, a world war or a pandemic — mankind will remain a major environmental force for many millennia. A daunting task lies ahead for scientists and engineers to guide society towards environmentally sustainable management during the era of the Anthropocene. This will require appropriate human behaviour at all scales, and may well involve internationally accepted, large-scale geo-engineering projects, for instance to 'optimize' climate. At this stage, however, we are still largely treading on terra incognita. ■

Paul J. Crutzen is at the Max Planck Institute for Chemistry, PO Box 3060, D-55020 Mainz, Germany, and the Scripps Institution of Oceanography, University of California, San Diego, 9500 Gilman Drive, La Jolla, California 92093-7452, USA.

FURTHER READING

Marsh, G. P. *Man and Nature* (1864). (Reprinted as *The Earth as Modified by Human Action* Belknap Press, Cambridge Massachusetts, 1965).

Crutzen, P. J. & Stoermer, E. F. *IGBP Newsletter* 41, 12 (Royal Swedish Academy of Sciences, Stockholm, 2000).

Clark, W. C. & Munn, R. E. (eds) *Sustainable Development of the Biosphere* 29–31 (Cambridge Univ. Press, Cambridge, 1986).

Vernadski, V. I. *The Biosphere* (translated and annotated version from the original of 1926) (Springer, New York, 1998).

Turner, B. L. *et al. The Earth as Transformed by Human Action* (Cambridge Univ. Press, Cambridge, 1990).

Mckibben, J. R. *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (W. W. Norton, New York, 2000).

Houghton, J. T. *et al.* (eds) *Climate Change 2001: The Scientific Basis* (Cambridge Univ. Press, Cambridge, 2001).

Berger, A. & Loutre, M.-F. *C. R. Acad. Sci. Paris* 323 (IIa) 1–16 (1996).

Schellnhuber, H. J. *Nature* 402, C19–C23 (1999).

About 30–50% of the planet's land surface is exploited by humans. Tropical rainforests disappear at a fast pace, releasing carbon dioxide and strongly increasing species extinction. Dam building and river diversion have become commonplace. More than half of all accessible fresh water is used by mankind. Fisheries remove more than 25%

"Cerca de 30% - 50% da superfície do planeta é explorada pelos humanos. As florestas tropicais desaparecem rapidamente, liberando CO_2 e aumentando fortemente as extinções de espécies. A construção de represas e o desvio de rios tornaram-se comuns. Mais da metade da água doce acessível é usada pela humanidade...

NEWS | 06 March 2024 | Correction 06 March 2024

Geologists reject the Anthropocene as Earth's new epoch — after 15 years of debate

But some are now challenging the vote, saying there were 'procedural irregularities'.

By Alexandra Witze

NEWS | 20 March 2024

It's final: the Anthropocene is not an epoch, despite protest over vote

Governing body upholds earlier decision by geoscientists amid drama.

By Alexandra Witze

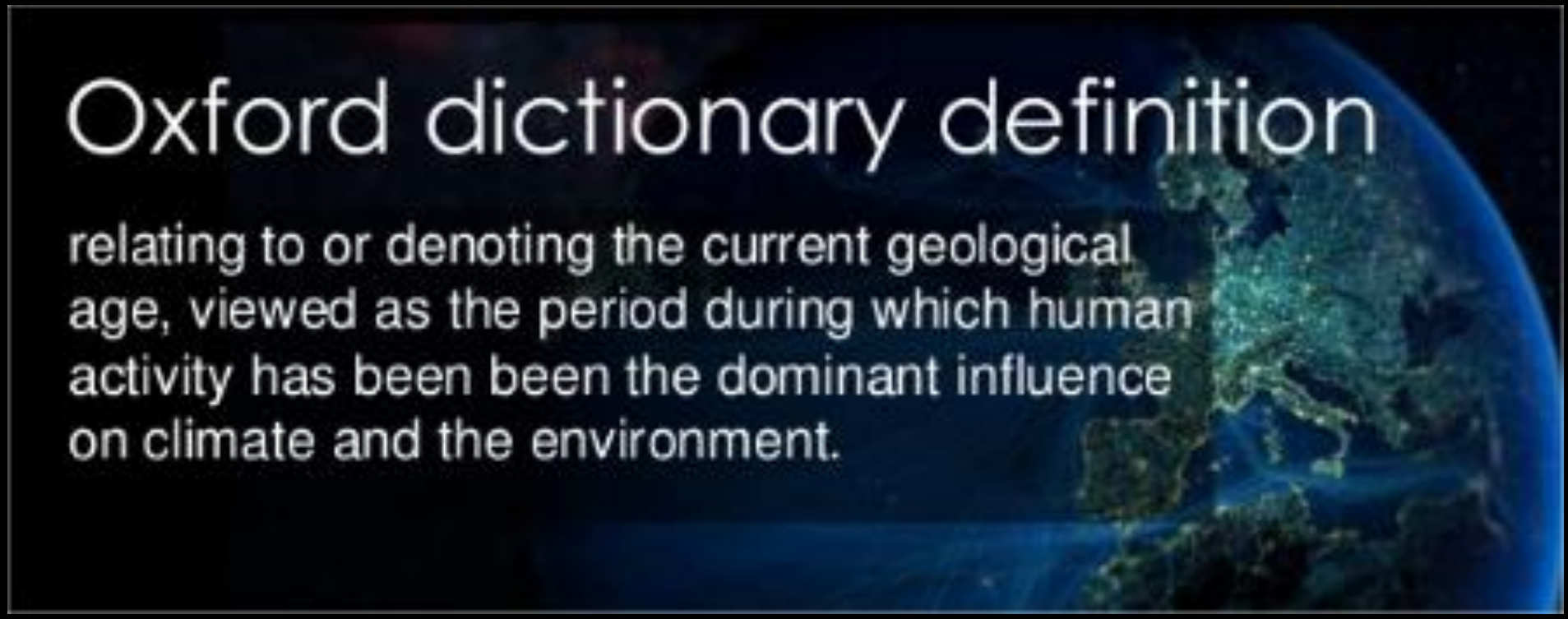
É tarde demais para a IUGS decidir sozinha.
O conceito de Antropoceno não está mais confinado nos limites estreitos da nomenclatura técnica.

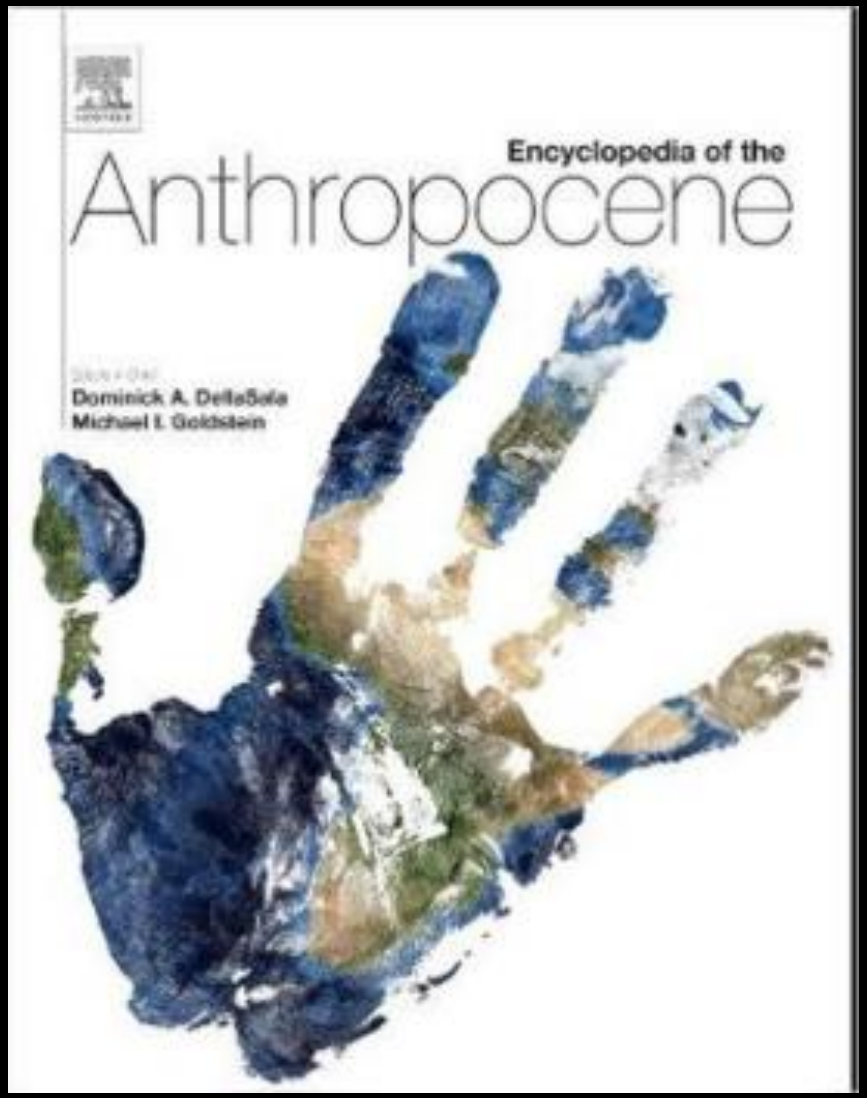
Como afirma Paul Crutzen:

It's a pity we're still officially living in an age called the Holocene. The Anthropocene - human dominance of biological, chemical and geological processes on Earth - is already an undeniable reality.

— Paul J. Crutzen —

O conceito caiu na circulação sanguínea da cultura contemporânea:




Encyclopedia of the
Anthropocene
Dominick A. DellaSala
Michael I. Goldstein

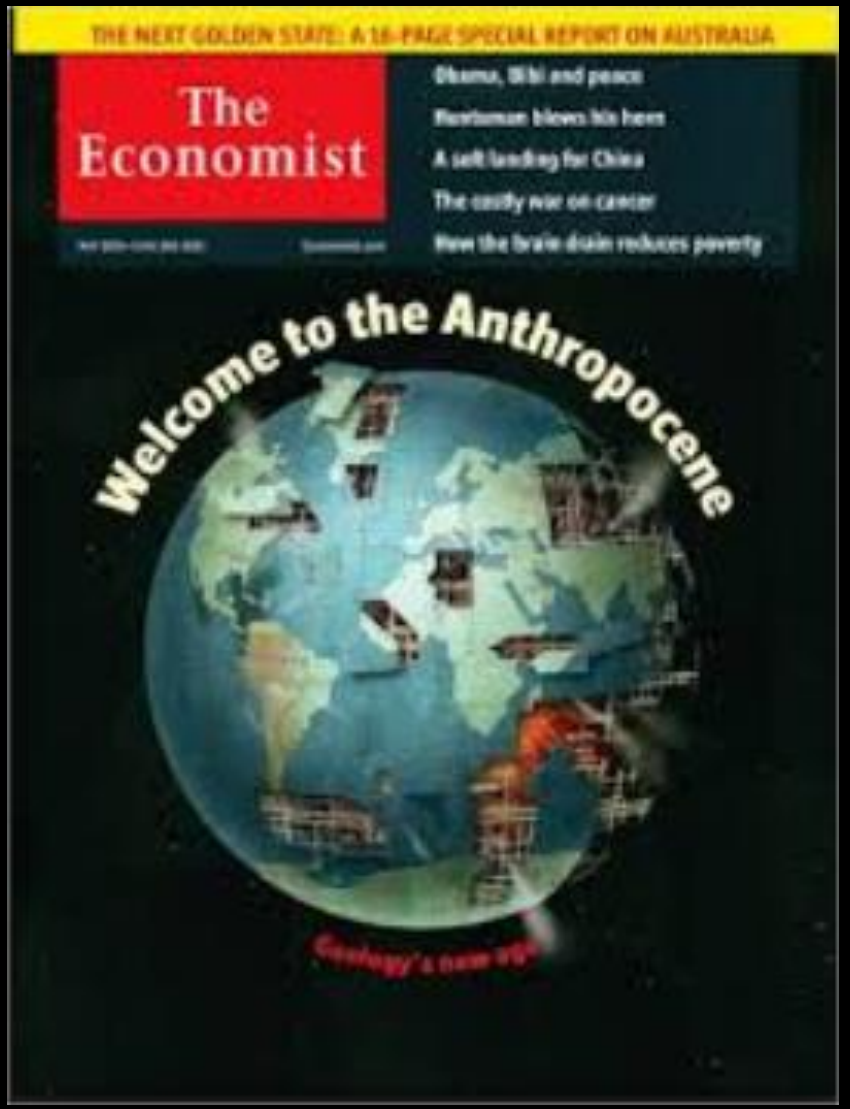

THE NEXT GOLDEN STATE: A 16-PAGE SPECIAL REPORT ON AUSTRALIA
The Economist
Obama, Bibi and peace
Rerisman blows his horn
A soft landing for China
The costly war on cancer
How the brain drain reduces poverty
Welcome to the Anthropocene

Image: Jason de Caires Taylor

Culture and the Anthropocene

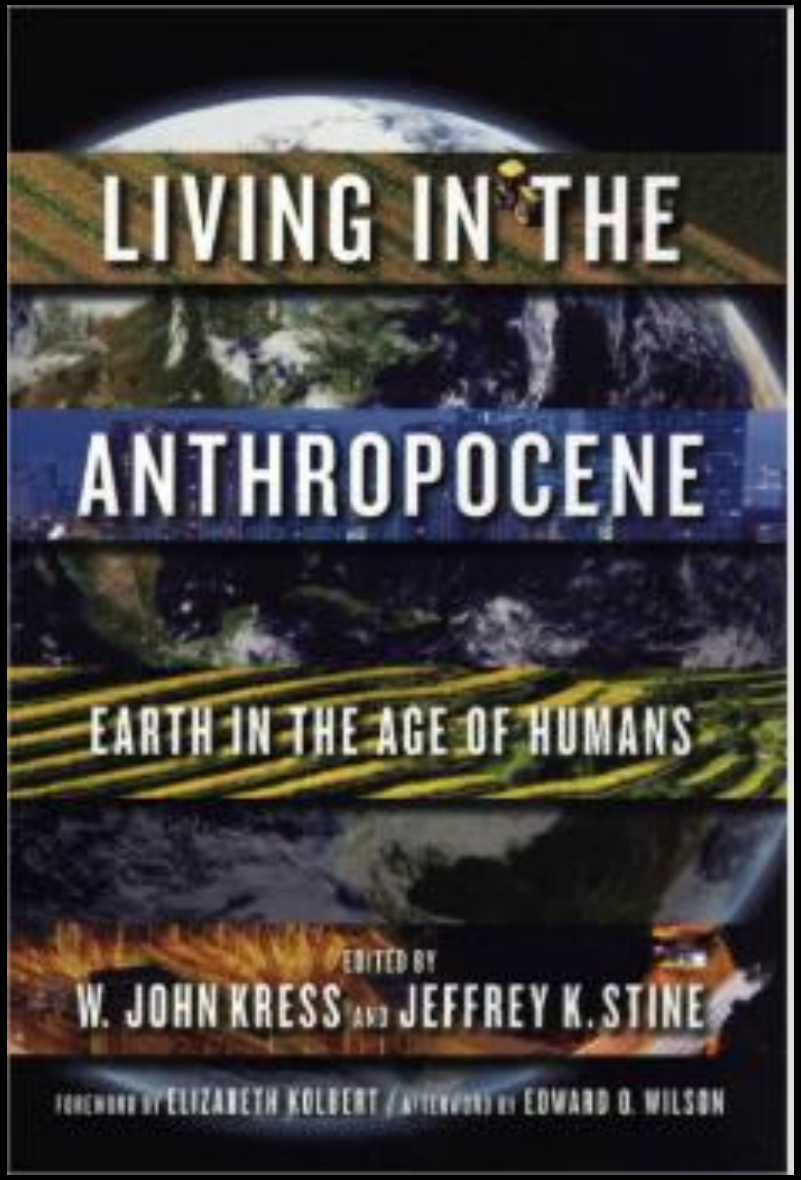
OWEN GAFFNEY

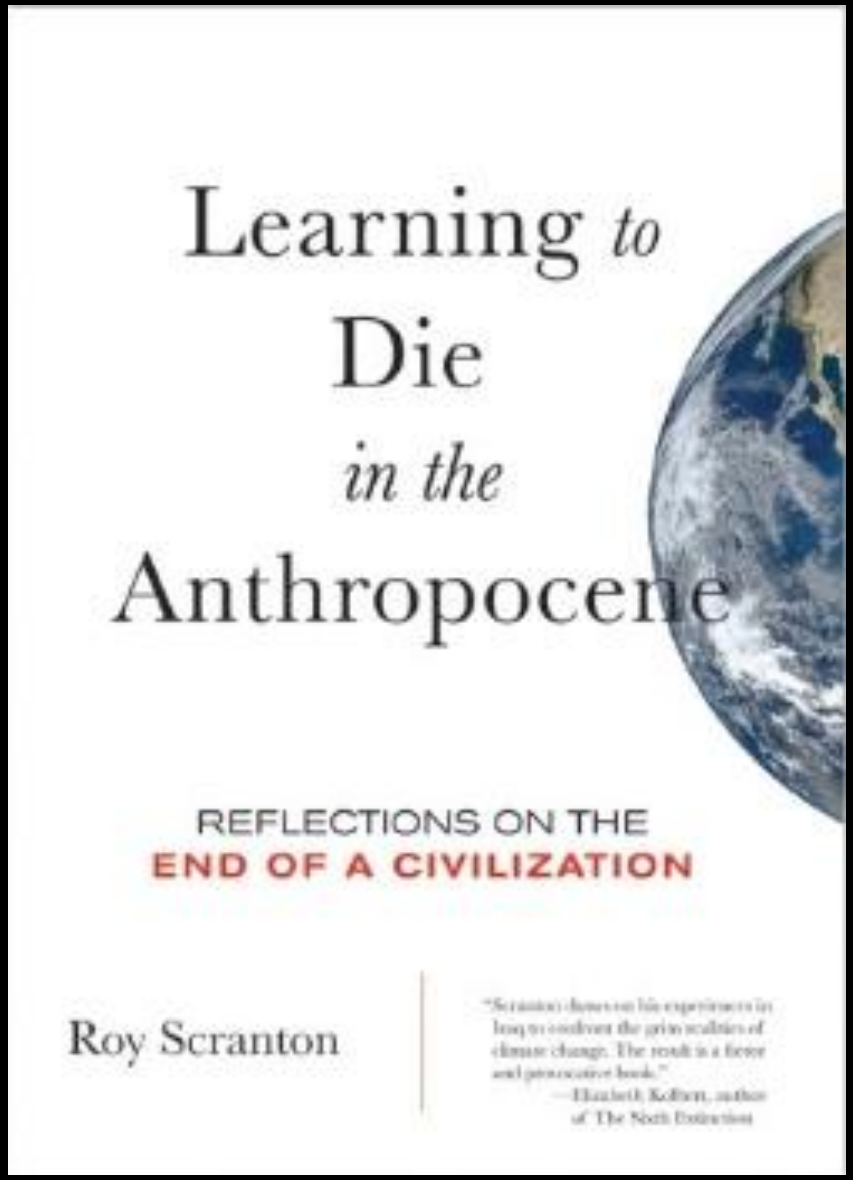
Director of communications, International Geosphere-Biosphere Programme

Botswana, November 2013


ARCADE
35 YEARS
ISSUE 35.1
GENERATION ANTHROPOCENE
CLIMATE CHANGE AND LIFE AFTER THE END OF A WORLD


Arquitectura Viva
189.11/2016
Anthropocene
Luis Fernández-Galiano


LIVING IN THE
ANTHROPOCENE
EARTH IN THE AGE OF HUMANS
EDITED BY
W. JOHN KRESS AND JEFFREY K. STINE
FOREWORD BY ELIZABETH KOLBERT / AFTERWORD BY EDWARD O. WILSON


Learning to
Die
in the
Anthropocene
REFLECTIONS ON THE
END OF A CIVILIZATION
Roy Scranton
"Scranton draws on his experiences to
help us confront the grim realities of
climate change. The result is a fierce
and provocative book."
—Elizabeth Kolbert, author
of The Sixth Extinction

Liz-Rejane Issberner & Philippe Lena (eds.), *Brazil in the Anthropocene. Conflicts between predatory development and environmental policies.* London, Routledge, 2016

“Brazil's role within the global ecological crisis”

Capitaloceno: um debate equivocado nas ciências humanas:

Há complementaridade entre os conceitos de Antropoceno e de Capitaloceno.

Antropoceno é um conceito *descritivo* e *geológico* (estratigráfico): entre as variáveis que moldam o comportamento do sistema Terra, a variável antrópica tornou-se agora a mais importante.

Capitaloceno é um conceito *judicativo* (crítico) e *sociológico:* a causa do advento do Antropoceno é um sistema socioeconômico no qual a razão de ser da atividade econômica é a reprodução ampliada do capital. Um tal sistema é incompatível com os recursos limitados e com os equilíbrios planetários.

Sumário desta comunicação

I. Grande Aceleração, Antropoceno e a recusa do IUGS

II. A engrenagem do colapso socioambiental

1. **Fracasso da UNFCCC,** da CBD e da governança global (paz)
2. Aquecimento médio global de 2 ^{o}C antes de 2040
3. Trópicos inabitáveis até 2070

II - Propostas

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

UNITED NATIONS
1992

Article 2

OBJECTIVE

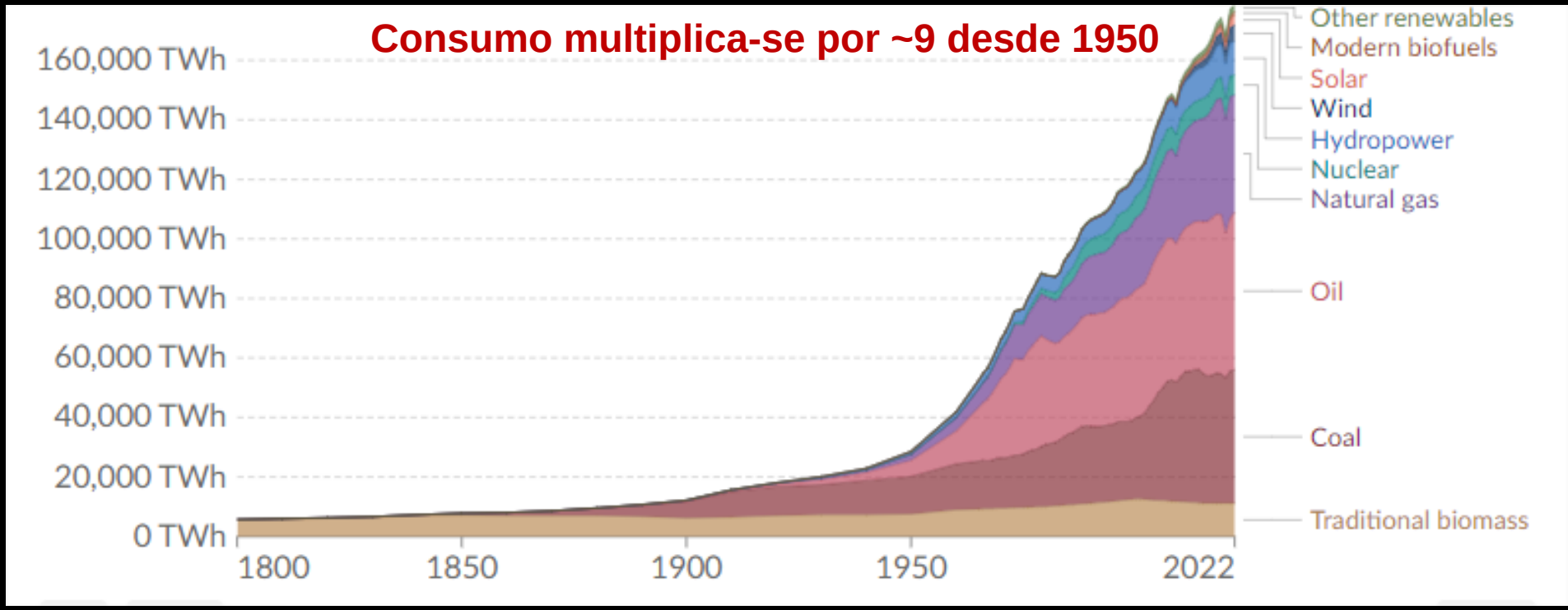
The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

"O objetivo último desta Convenção (...) é alcançar (...) a estabilização das concentrações de gases de efeito estufa na atmosfera em um nível que **evite interferências antrópicas perigosas no sistema climático**.

Esse nível deve ser alcançado em um período de tempo suficiente para permitir que os ecossistemas se adaptem naturalmente às mudanças climáticas, para garantir que a produção de alimentos não seja ameaçada e para possibilitar ao desenvolvimento econômico prosseguir de maneira sustentável".

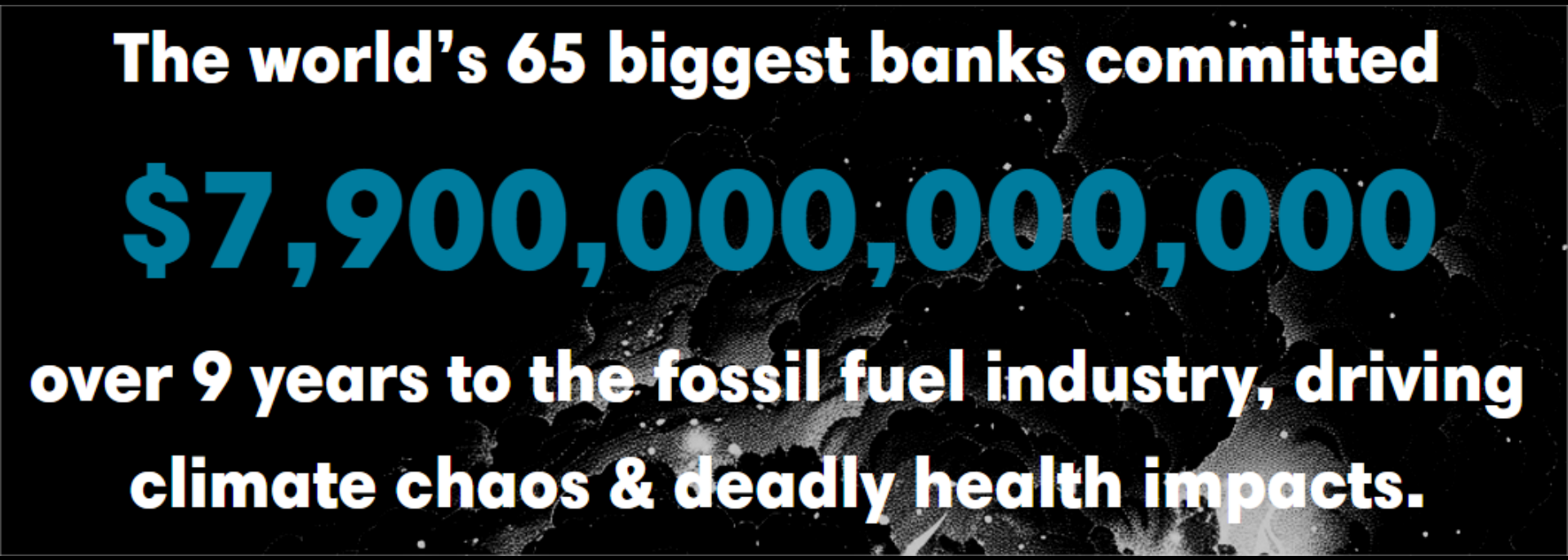
Historicamente, não há transição energética de uma matriz para outra:
o carvão não substitui a biomassa; o petróleo não substitui o carvão;
o gás não substitui o petróleo e as renováveis não substituem as fósseis.

Há adição (não substituição) das fontes de energia primária

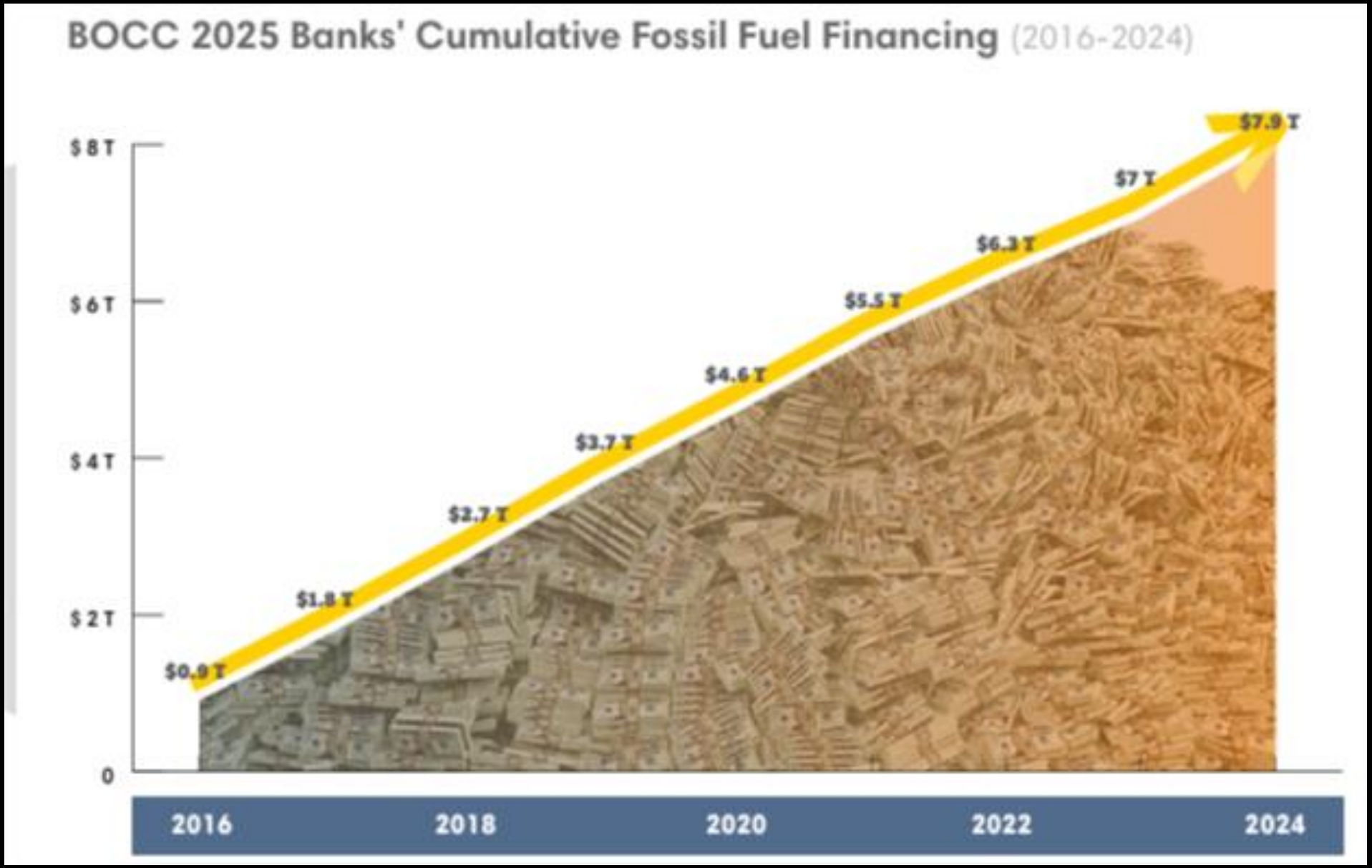


Consumo global de energia primária entre 1800 e 2022 em Terawatts/hora (TWh) por fontes de energia (*Our World in Data*, 2023)
https://ourworldindata.org/grapher/global-energy-substitution?time=earliest..2022

2016-2024: 65 bancos canalizaram US$ 7,9 trilhões para a indústria de combustíveis fósseis



Desde a entrada em vigor do Acordo de Paris:

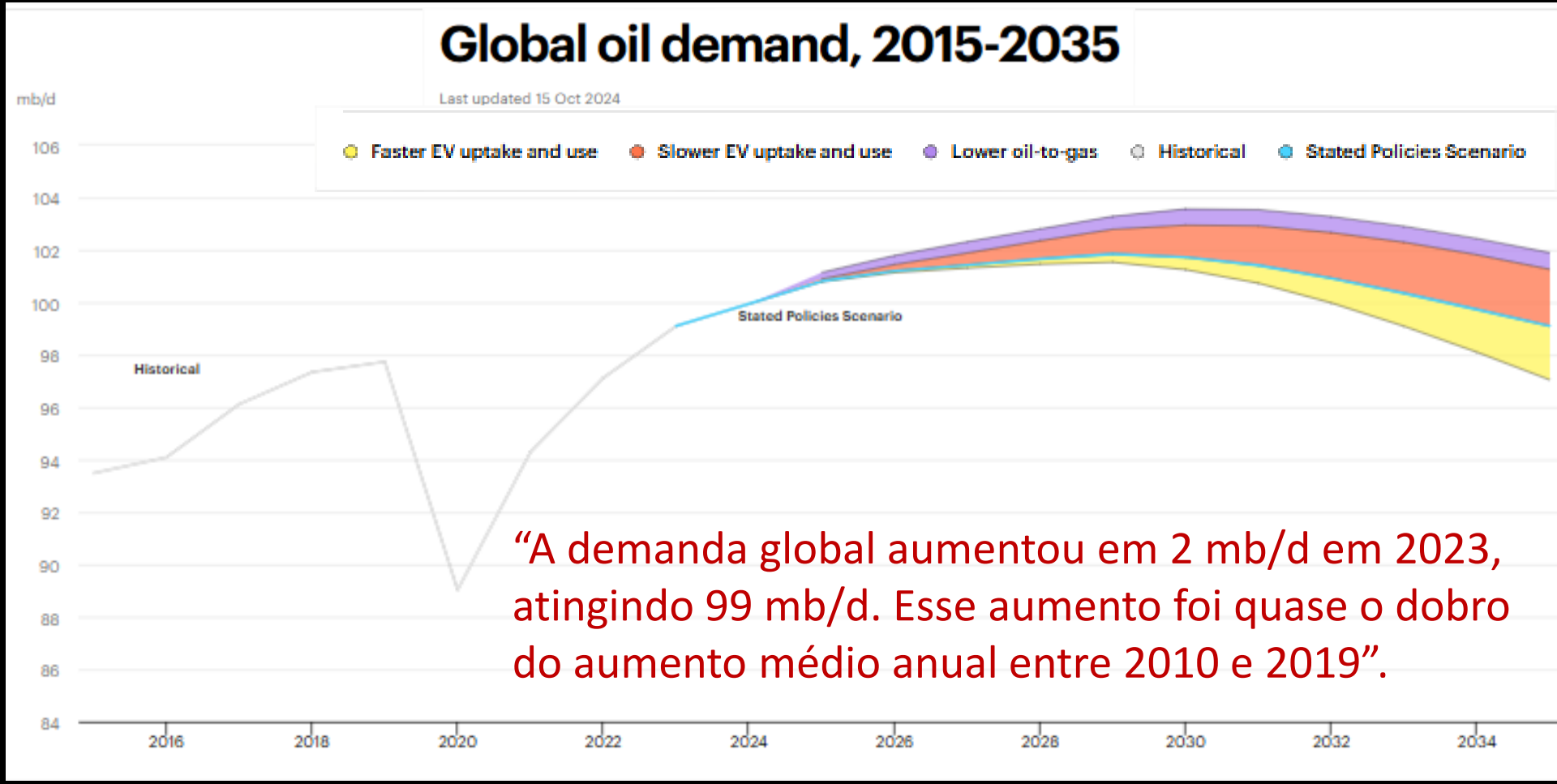


World Energy Outlook 2024

Milhões de barris por dia:

2022: 97 2023: 99 2024: 100

2030: 100 a 103 2035: 98 a 102



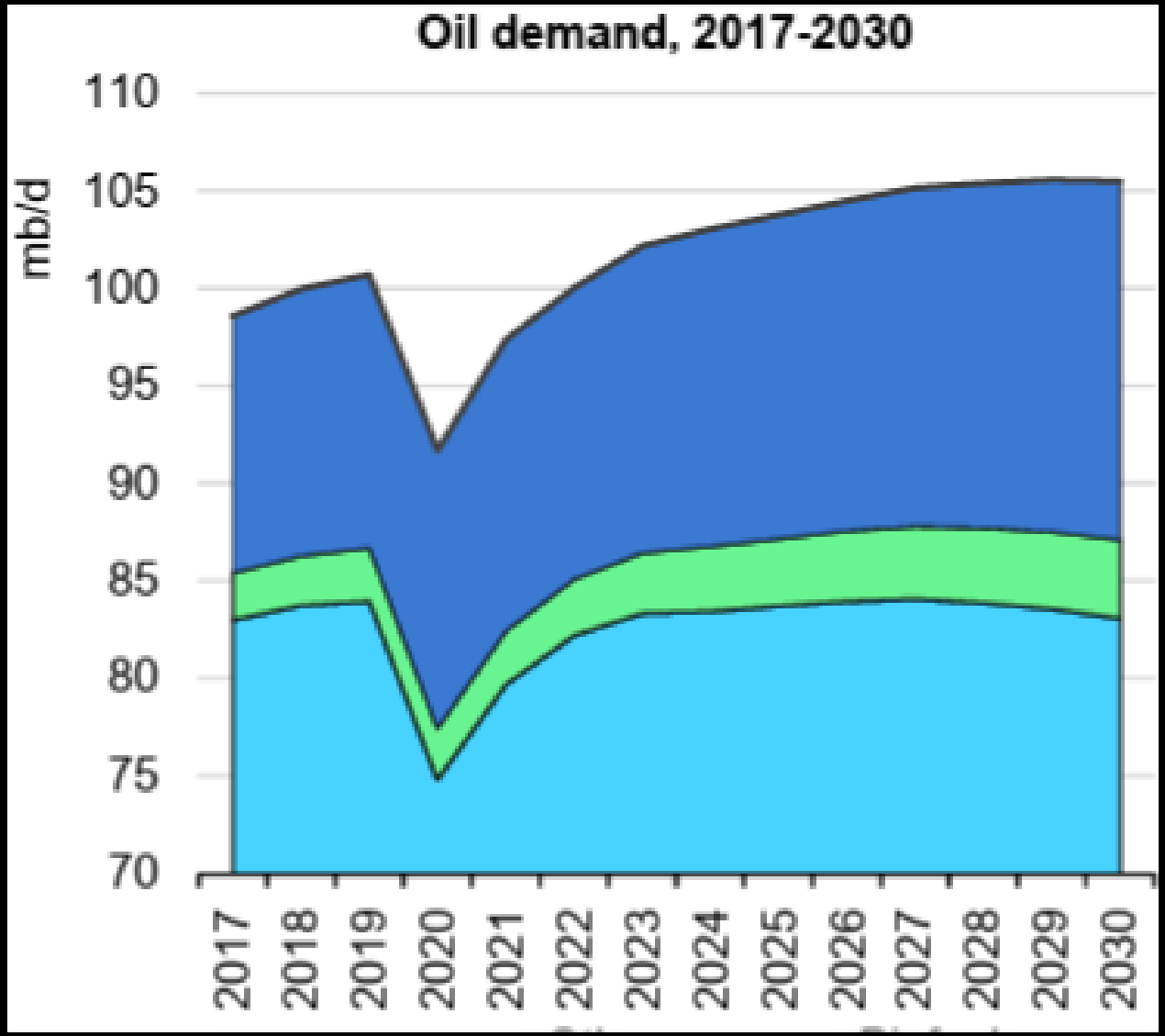
"A demanda global aumentou em 2 mb/d em 2023, atingindo 99 mb/d. Esse aumento foi quase o dobro do aumento médio anual entre 2010 e 2019".

Global oil demand increased by 2 million barrels per day (mb/d) in 2023 to 99 mb/d. This increase was nearly double the average annual increase between 2010 and 2019

Oil 2025

Analysis and forecast to 2030

"A demanda global deve aumentar em 2,5 mb/d de 2024 a 2030, atingindo um platô de cerca de 105,5 md/d até o fim da década"



"Global oil demand is forecast to rise by 2.5 mb/d from 2024 to 2030, reaching a plateau around 105.5 mb/d by the end of the decade".

https://iea.blob.core.windows.net/assets/c0087308-f434-4284-b5bb-bfaf745c81c3/Oil2025.pdf

gov.br

Órgãos do Governo

Ministério de Minas e Energia

Publicado em 24/03/2023

PETRÓLEO E GÁS NATURAL

MME desenvolve projeto para elevar investimentos e tornar o Brasil o quarto maior produtor de petróleo do mundo

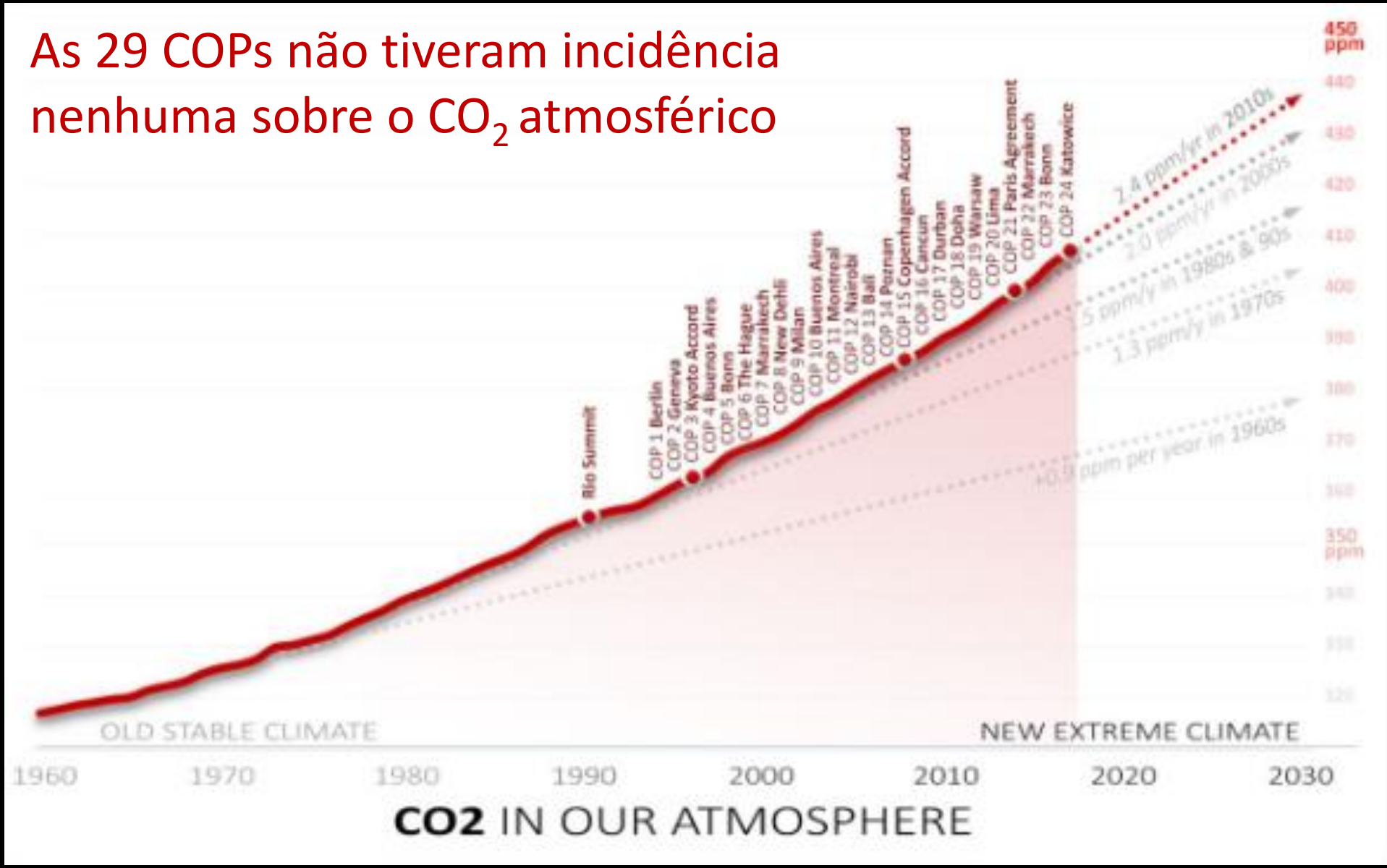
Ministro Alexandre Silveira irá apresentar o programa "Potencializa E&P" na próxima reunião do CNPE, que tem como objetivo promover o desenvolvimento regional e fomentar a produção nacional

"O Brasil produz, atualmente, três milhões de barris de petróleo por dia. A expectativa é de que este número chegue a 5,4 milhões até 2029, com expectativa de se tornar o 4º maior produtor de petróleo do mundo – com 80% destes recursos vindos do pré-sal".

Após as grandes descobertas do pré-sal ocorridas no governo do presidente Lula, foram atraídos grandes investimentos em exploração e produção de petróleo e gás natural, com destaque para atuação da Petrobras. O Brasil produz, atualmente, três milhões de barris de petróleo por dia. A expectativa é de que este número chegue a 5,4 milhões até 2029, com expectativa de se tornar o 4º maior produtor de petróleo do mundo – com 80% destes recursos vindos do pré-sal.

Conclusão

As 29 COPs não tiveram incidência nenhuma sobre o CO_2 atmosférico



Aceleração das concentrações atmosféricas de CO_2

Decade	Atmospheric CO_2 Growth Rate (ppm per year)
2011 - 2020	2.43
2001 - 2010	2.04
1991 - 2000	1.55
1981 - 1990	1.56
1971 - 1980	1.35
1961 - 1970	0.91

450 ppm em 2035

”If the pace of the last decade continues, carbon dioxide will reach 450 ppm as soon as 2035”.

SCRIPPS INSTITUTION OF OCEANOGRAPHY

2ª década = +2,43 ppm / ano

1ª década = +2,04 ppm / ano

Velocidade multiplica-se por 2,7 em 5 décadas

Mauna Loa Observatory (MLO)
https://www.co2.earth/co2-acceleration

Sumário desta comunicação

I. Grande Aceleração, Antropoceno e a recusa do IUGS

II. A engrenagem do colapso socioambiental

1. Fracasso da UNFCCC**, da CBD e da governança global (paz)**
2. Aquecimento médio global de 2 ^{o}C antes de 2040
3. Trópicos inabitáveis até 2070

II - Propostas

“Subestimando os desafios para evitar um futuro pavoroso”
Frontiers in Conservation Science, 13/I/2021

PERSPECTIVE ARTICLE

Front. Conserv. Sci., 13 January 2021 |
https://doi.org/10.3389/fcosc.2020.615419

Underestimating the Challenges of Avoiding a Ghastly Future

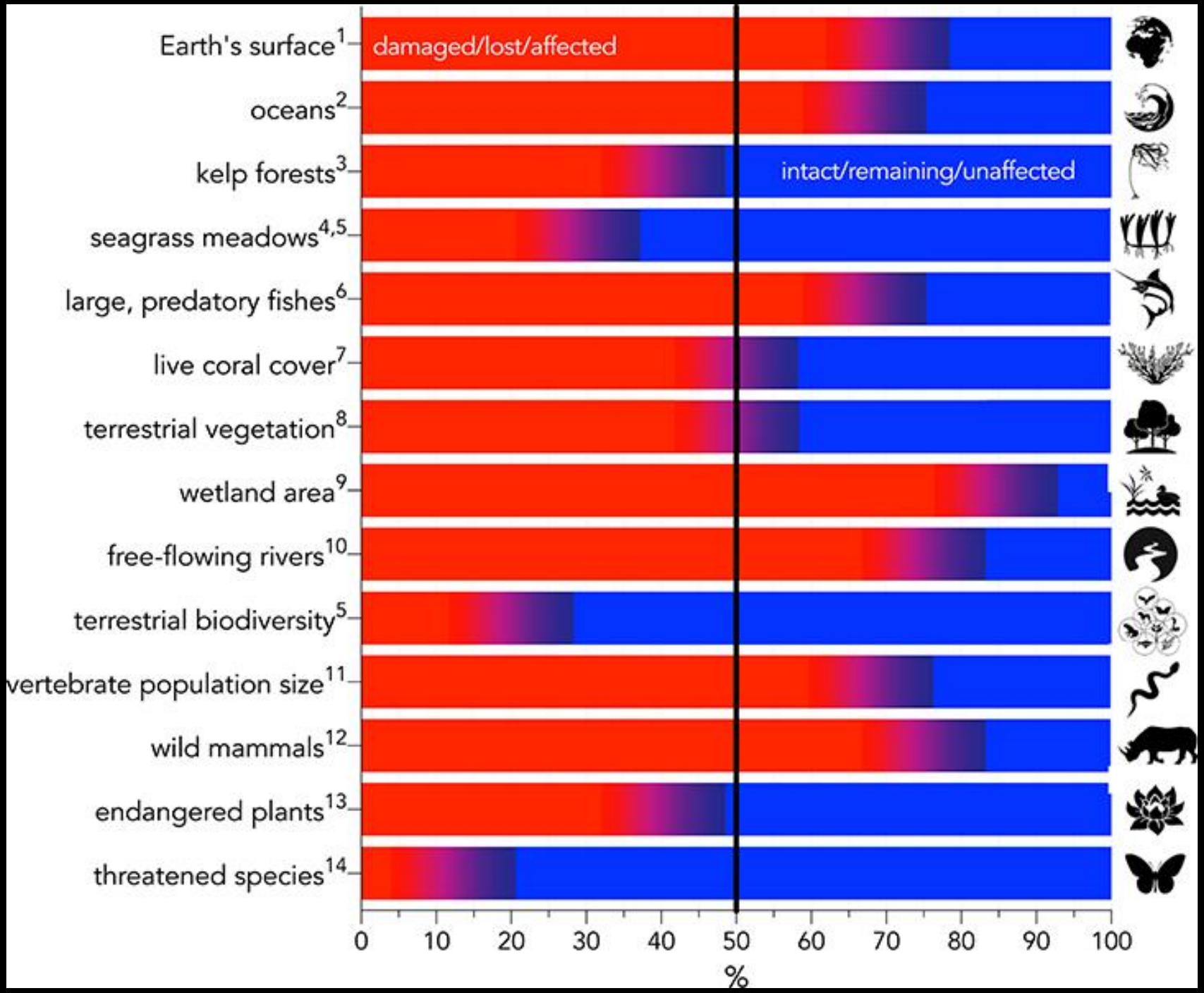
 Corey J. A. Bradshaw[1,2*], Paul R. Ehrlich[3*], Andrew Beattie[4], Gerardo Ceballos[5], Eileen Crist[6], Joan Diamond[7], Rodolfo Dirzo[3], Anne H. Ehrlich[3], John Harte[8,9], Mary Ellen Harte[9], Graham Pyke[4], Peter H. Raven[10], William J. Ripple[11],  Frédérik Saltré[1,2], Christine Turnbull[4],  Mathis Wackernagel[12] and  Daniel T. Blumstein[13,14*]

Três constatações:

1. *Homo sapiens* alterou >70% da superfície terrestre da Terra

2. Os insetos estão desaparecendo rapidamente em muitas regiões (**90% da vitamina C** de que precisamos provém de frutas, verduras, óleos e sementes polinizados por insetos)

3. ~40% das plantas são consideradas em perigo de extinção.


Earth's surface[1]
oceans[2]
kelp forests[3]
seagrass meadows[4,5]
large, predatory fishes[6]
live coral cover[7]
terrestrial vegetation[8]
wetland area[9]
free-flowing rivers[10]
terrestrial biodiversity[5]
vertebrate population size[11]
wild mammals[12]
endangered plants[13]
threatened species[14]
damaged/lost/affected
intact/remaining/unaffected
0
10
20
30
40
50
60
70
80
90
100
%

SCIENCE • ENVIRONMENT

2020 Marks the Point When Human-Made Materials Outweigh All the Living Things on Earth, a New Study Finds

2020 marca o momento em que o peso dos materiais fabricados pelo homem ultrapassou o peso de toda a biomassa viva da Terra

https://time.com/5919294/human-materials-biomass-2020/

Global human-made mass exceeds all living biomass

nature

https://doi.org/10.1038/s41586-020-3010-5

Received: 1 November 2019

Accepted: 9 October 2020

Published online: 9 December 2020

Check for updates

Emily Elhacham[1], Liad Ben-Uri[1], Jonathan Grozovski[1], Yinon M. Bar-On[1] & Ron Milo[1]✉

Humanity has become a dominant force in shaping the face of Earth[1–9]. An emerging question is how the overall material output of human activities compares to the overall natural biomass. Here we quantify the human-made mass, referred to as 'anthropogenic mass', and compare it to the overall living biomass on Earth, which currently equals approximately 1.1 teratonnes[10,11]. We find that Earth is exactly at the crossover point; in the year 2020 (± 6), the anthropogenic mass, which has recently doubled roughly every 20 years, will surpass all global living biomass. On average, for each person on the globe, anthropogenic mass equal to more than his or her bodyweight is produced every week. This quantification of the human enterprise gives a mass-based quantitative and symbolic characterization of the human-induced epoch of the Anthropocene.

Massa antropogênica *vs* biomassa total na Terra
(~1,1 trilhão de toneladas ou Teratonelada)

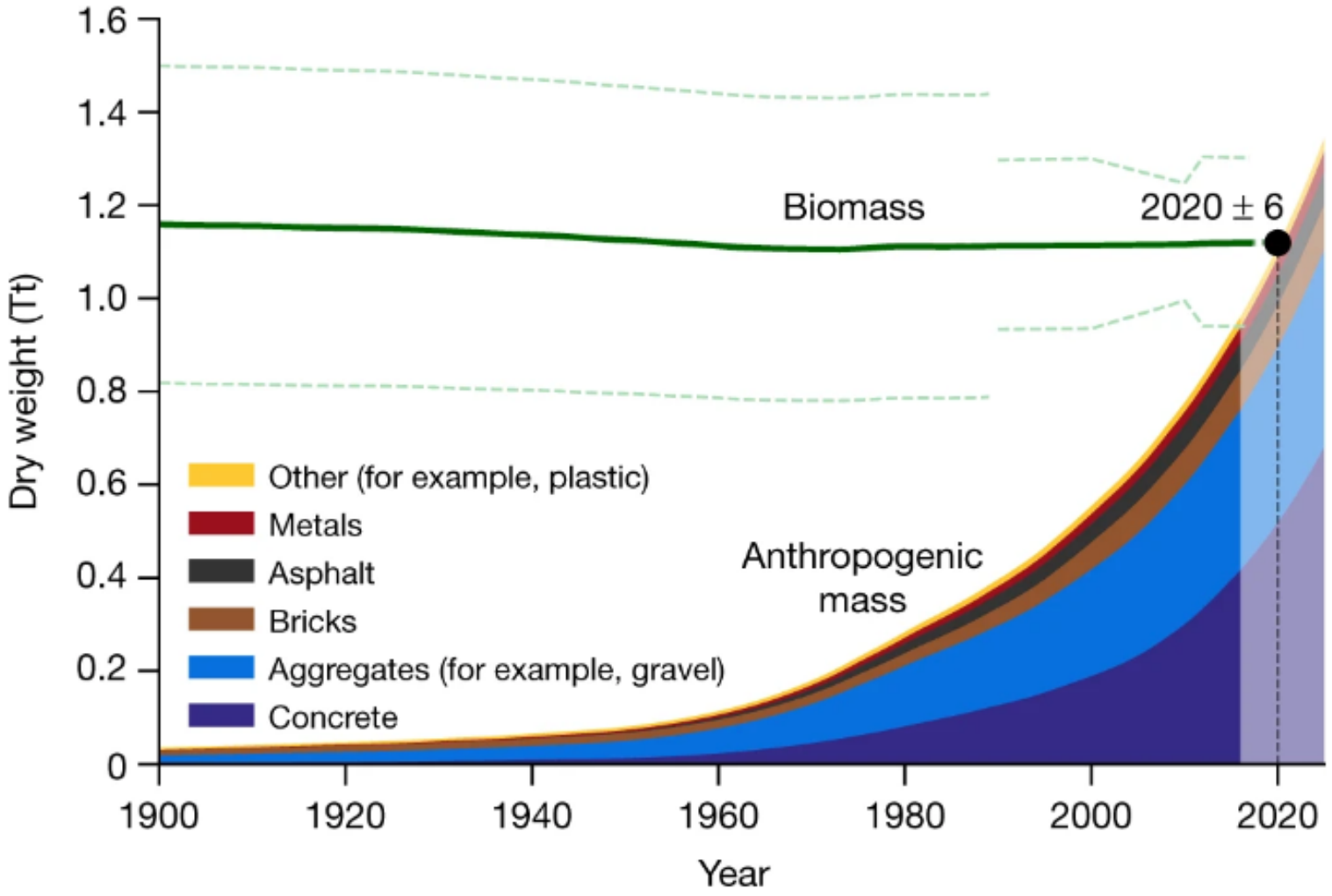
Em 2020 (±6), a massa antropogênica, que vem dobrando a cada 20 anos, ultrapassou toda a biomassa viva global

Em média, para cada pessoa no globo, uma massa antropogênica igual a mais do que seu peso corporal é produzida a cada semana.

2020 +/- 6 anos: cruzamento entre massa fabricada e biomassa

Fig. 1: Biomass and anthropogenic mass estimates since the beginning of the twentieth century on a dry-mass basis.

From: Global human-made mass exceeds all living biomass



A nova distribuição da biomassa (em carbono)

The biomass distribution on Earth

2018

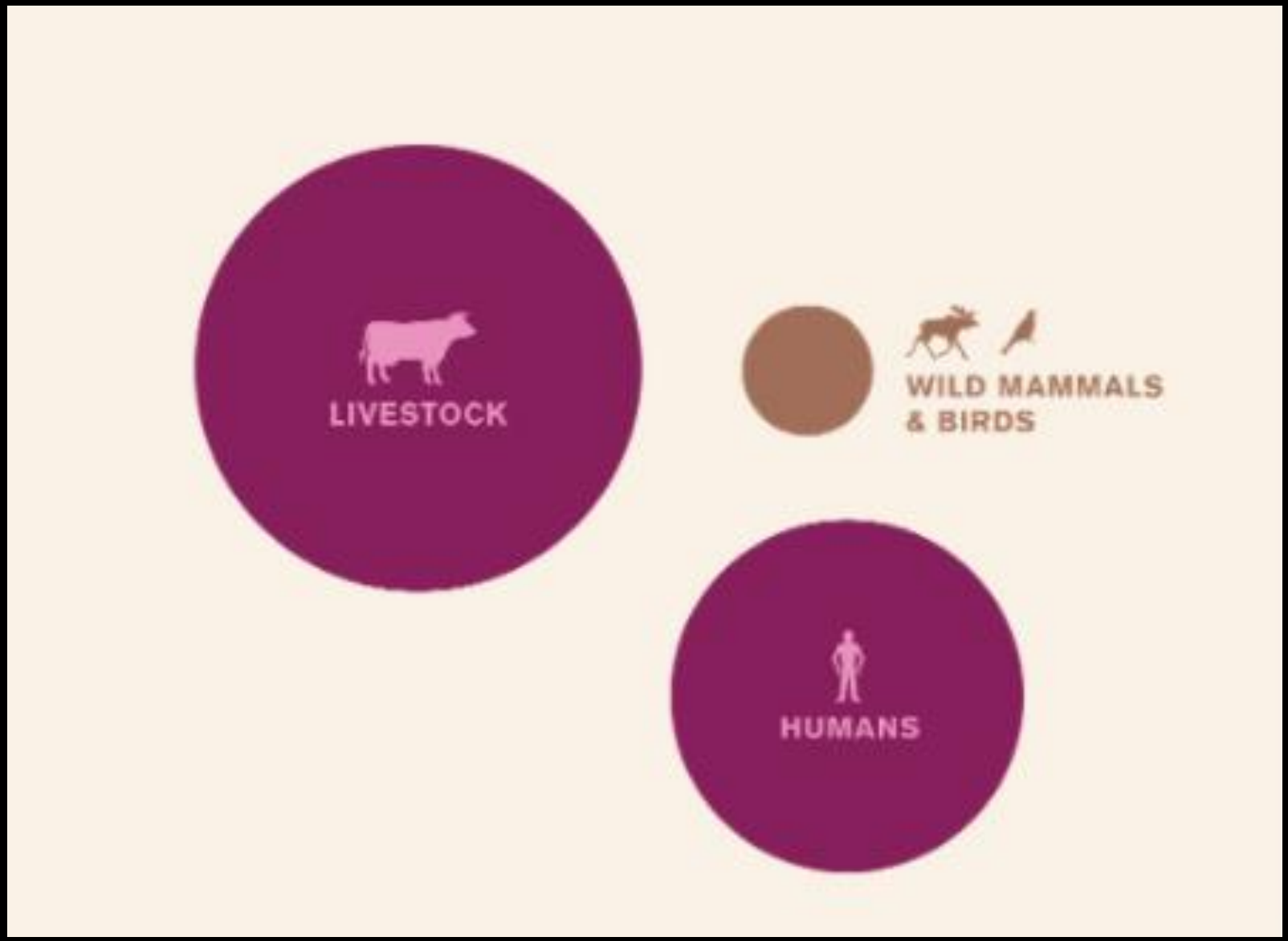
Yinon M. Bar-On, Rob Phillips, and Ron Milo

PNAS June 19, 2018 115 (25) 6506-6511; first published May 21, 2018; https://doi.org/10.1073/pnas.1711842115

Edited by Paul G. Falkowski, Rutgers, The State University of New Jersey, New Brunswick, NJ, and approved April 13, 2018 (received for review July 3, 2017)

"Humanos e gado superam todos os vertebrados combinados, com exceção dos peixes".

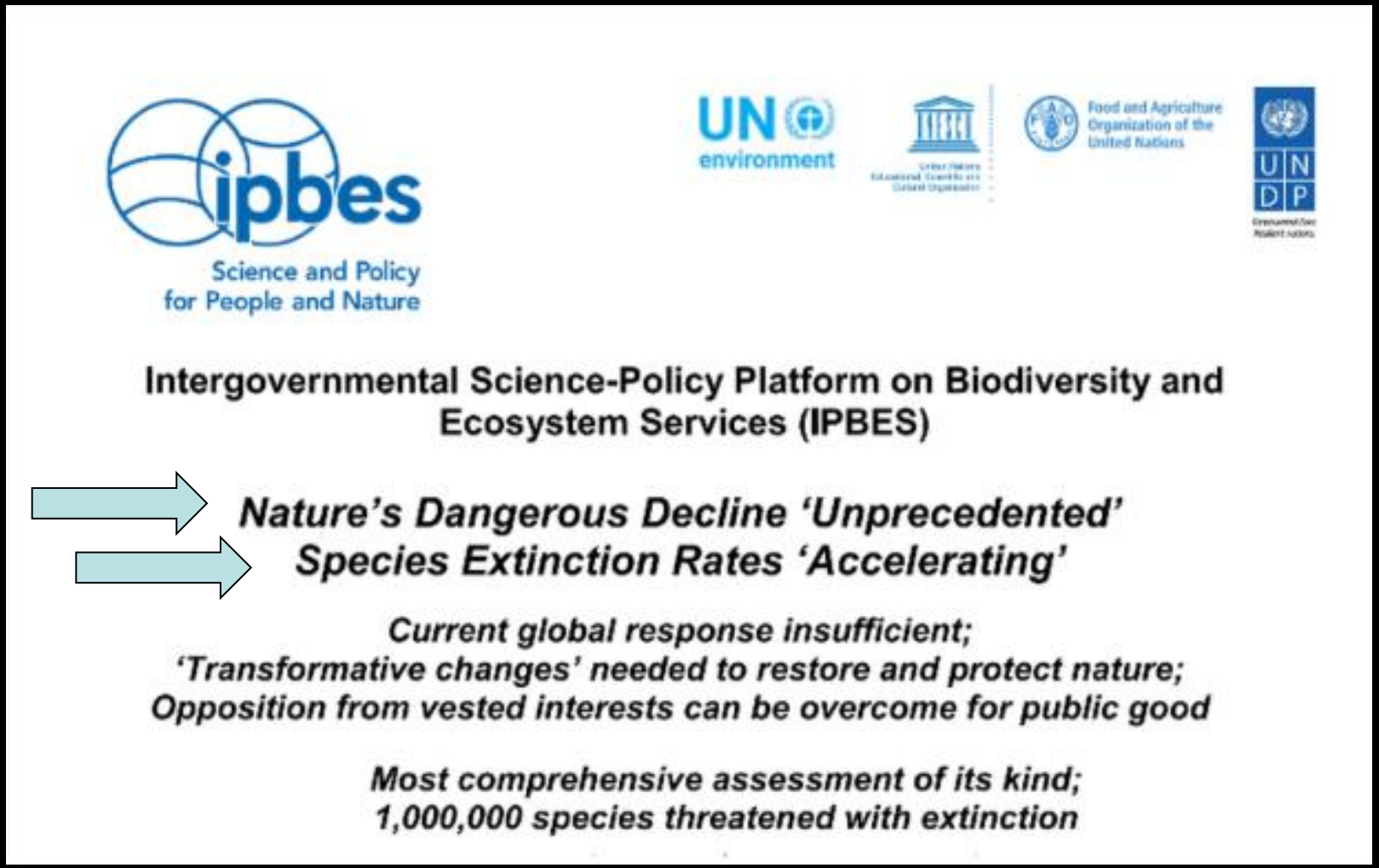
Tamanhos relativos da biomassa dos humanos (carbono), dos rebanhos e dos mamíferos e pássaros silvestres



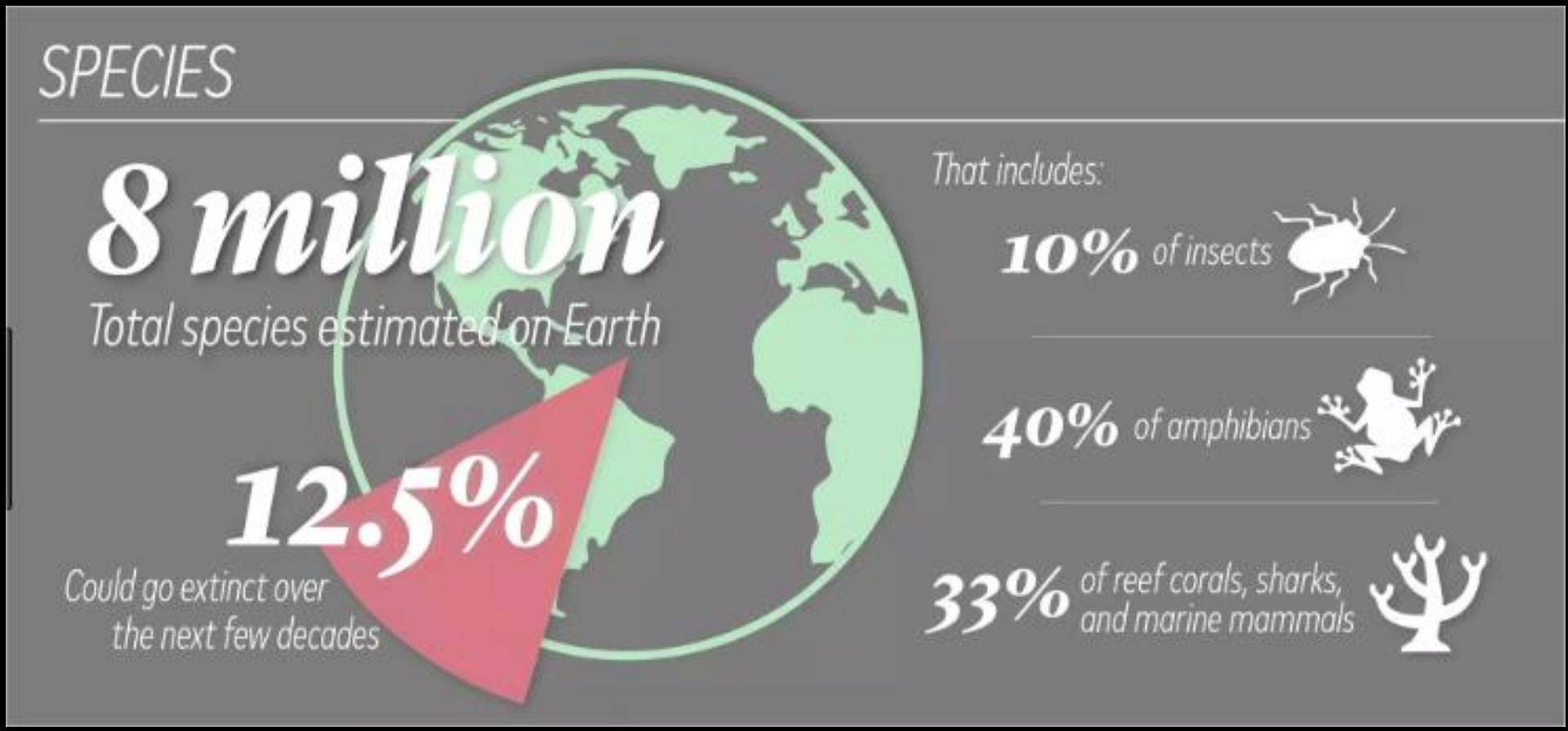
IPBES, publicado em maio de 2019:

"O declínio perigoso da natureza é ***sem precedentes***"

"A taxa de extinção de espécies ***está se acelerando***"



1 milhão ou 12,5% do total estimado de 8 milhões de espécies na Terra podem se extinguir nas próximas poucas décadas



36 SPECIES

DECLARED EXTINCT IN 2020

IUCN confirmed the extinction of 36 animal and plant species which have not been seen for decades

FISH

Barbodes amarus
Lake Lanao, Philippines — 1982**

Critala lopis
Java, Indonesia — 1852

Barbodes baculan	Lake Lanao, Philippines	1991
Barbodes clemensi	*	1975
Barbodes disa	*	1964
Barbodes flavifuscus	*	1964
Barbodes herrei	*	1974
Barbodes katolo	*	1977
Barbodes lanaoensis	*	1964
Barbodes manalak	*	1977
Barbodes pachychellus	*	1964
Barbodes palaemochagus	*	1975
Barbodes paludis	*	1964
Barbodes resimus	*	1964
Barbodes tras	*	1976
Barbodes truncatulus	*	1973
Schizothorax saltans	Kazakhstan	1953

PLANTS

Ochrosia
kilauaeensis
Hawaii — 1977

Leucadendron grandiflorum
South Africa — 1806

Persoonia laxa	Australia	1908
Persoonia prostrata	Australia	1901
Leucadendron spirale	South Africa	1933

MAMMALS

Pipistrellus sturdeei
Japan — 1899

Nyctophilus howensis
Australia — 1972

INSECTS

Ameles fasciipennis
Italy — 1871

TREES

Roystonea stellata
Cuba — 1939

Morrevedia linosta
Cuba — 1973

Banara wilsonii	Cuba	1938
Eschorium cubense	*	1924
Fasamea chiapensis	Mexico	1953
Hesperelaea palmeri	*	1875

AMPHIBIANS

Oophaga speciosa
Panama — 1997

Pseudoeurycea
exspectata
Guatemala — 1976

Atelopus chiriquiensis	Costa Rica, Panama	1996
Atelopus senex	Costa Rica	1986
Craugastor myllomylion	Guatemala	1978

Source: International Union for Conservation of Nature

*Approximate size

**Last seen

AFP

Espécies avaliadas: 169.420

Espécies ameaçadas: 47.187 (28%)

Lista Vermelha da
União Internacional para
a Proteção da Natureza
(IUCN Red List - Version 25.1)

TOTAL
169,420
47,187

Consumo de agrotóxicos em toneladas (t) por países e global, entre 2000 e 2021 e variações respectivas

País	2000	2010	2017	2021	Variação
Argentina	84.189	235.789	196.009	241.520	x 2,87
Bangladesh	3.170	13.251	15.144	15.506	x 4,9
Bolívia	3.771	12.969	21.655	18.307	x 4,85
Brasil	**141.130**	**360.735**	**514.844**	**719.507**	**x 5,1**
Chile	4.802	6.895	13.564	15.822	x 3,3
China	250.632	339.850	323.253	244.821	- 5.811
Colômbia	75.843	48.618	37.689	39.324	- 36.519
EUA	430.005	374.818	449.713	457.385	x 1,06
Mundo	2.178.696	2.993.063	3.320.366	3.535.375	x 1,62

FAO, World Food and Agriculture – Statistical Yearbook 2023. Roma, p. 136, Tabela 13.

Agrotóxicos liberados pelos governos brasileiros entre Fernando Henrique Cardoso (FHC 2) e Bolsonaro (1998 – 2022)

1998 – 2002 (FHC 2)	2003 – 2006 (Lula 1)	2007 – 2010 (Lula 2)	2011 – 2014 (Dilma)	2015 – 2018 (Dilma2/Temer)	2019 – 2022 (Bolsonaro)
250	**359**	**634**	**572**	**1.269**	**2.182**

Lula 2023 (555) e 2024 (663) = 1.218

Liberação de agrotóxicos bate recorde em 2024

João Rosa, da CNN, Brasília

28/01/25 às 15:40 | Atualizado 28/01/25 às 15:41

https://www.cnnbrasil.com.br/politica/liberacao-de-agrotoxicos-bate-recorde-em-2024/

“Taxas dramáticas de declínio que podem levar à extinção de 40% das espécies de insetos do mundo nas próximas décadas”

Our work reveals dramatic rates of decline that may lead to the extinction of 40% of the world's insect species over the next few decades

ELSEVIER

Biological Conservation

Volume 232, April 2019, Pages 8-27

Review

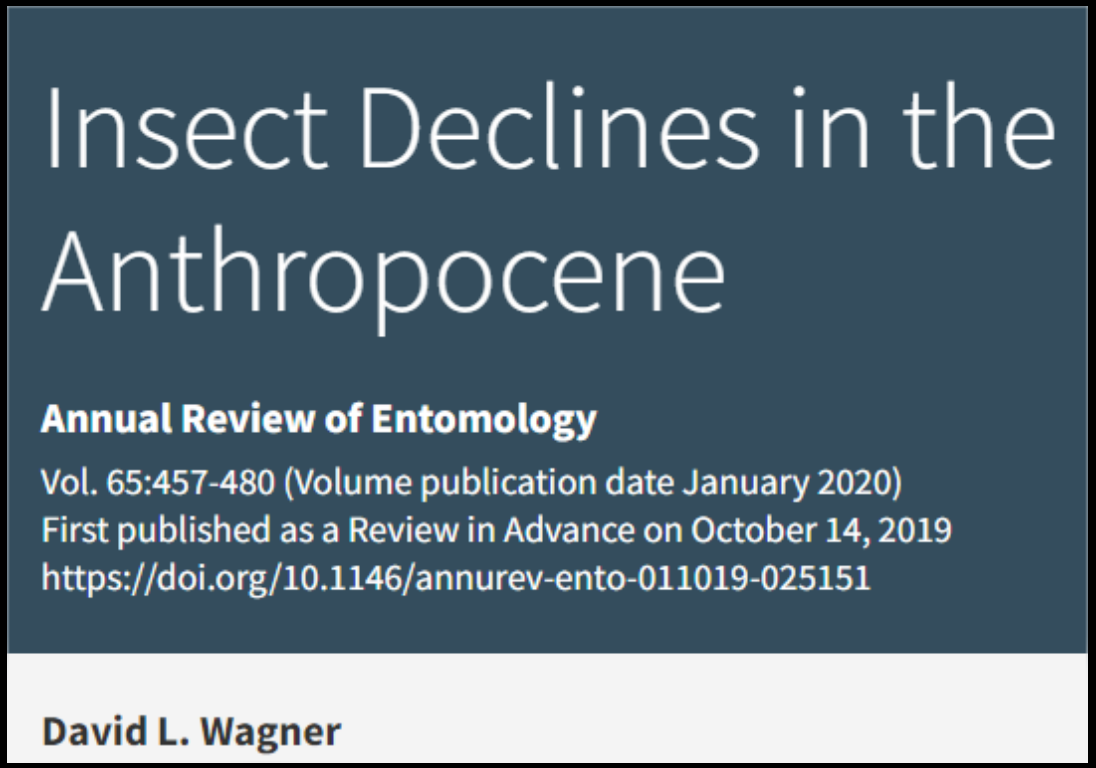
Worldwide decline of the entomofauna: A review of its drivers

Francisco Sánchez-Bayo [a], Kris A.G. Wyckhuys [b c d]

A agricultura e a saúde humana também colapsam:

"Mais de 80% das plantas com flores do mundo são consideradas dependentes de insetos para polinização. Cerca de 3/4 de todas as espécies cultivadas dependem da polinização por insetos".

More than 80% of the world's flowering plants are thought to be dependent on insects for pollination. Approximately three-quarters of all crop species are dependent on insect pollination.



Discussion Paper | Published: 09 May 2016

Pollinators and Global Food Security: the Need for Holistic Global Stewardship

Jeroen P. van der Sluijs & Nora S. Vaage

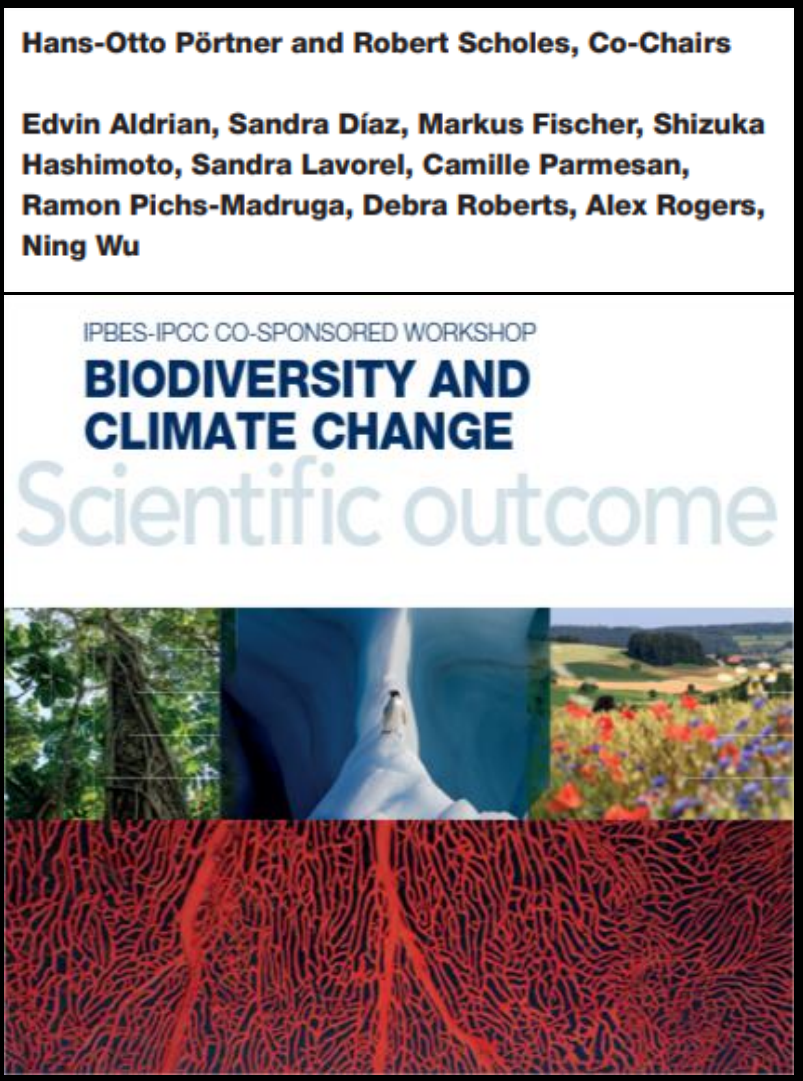
Food Ethics **1**, 75–91(2016) | Cite this article

Polinizadores fornecem:

>90% da vitamina C; 100% do licopeno; >70% da vitamina A...

"Pollinator mediated crops are of key importance in providing essential nutrients in the human food supply: in terms of nutrients in the human diet they account for more than 90 % of vitamin C, 100 % of Lycopene (...) vitamin A (>70 %)" etc.

Workshop IPBES / IPCC, *Scientific Outcome* (Junho de 2021)



Sem mitigação do aquecimento:

"projeta-se uma ruptura abrupta da estrutura, função e serviços ecológicos nos sistemas marinhos tropicais ***até 2030***, seguida pela ruptura das florestas tropicais e pelos sistemas de mais alta latitude até 2050".

Under warming scenarios associated with little successful climate mitigation (RCP 8.5), abrupt disruption of ecological structure, function and services is expected in tropical marine systems by 2030, followed by tropical rain forests and higher latitude systems by 2050 (p. 8)

https://www.ipbes.net/sites/default/files/2021-06/20210609_scientific_outcome.pdf

2001-2024: cobertura arbórea **-5,17 Milhões de km² (-13%)**

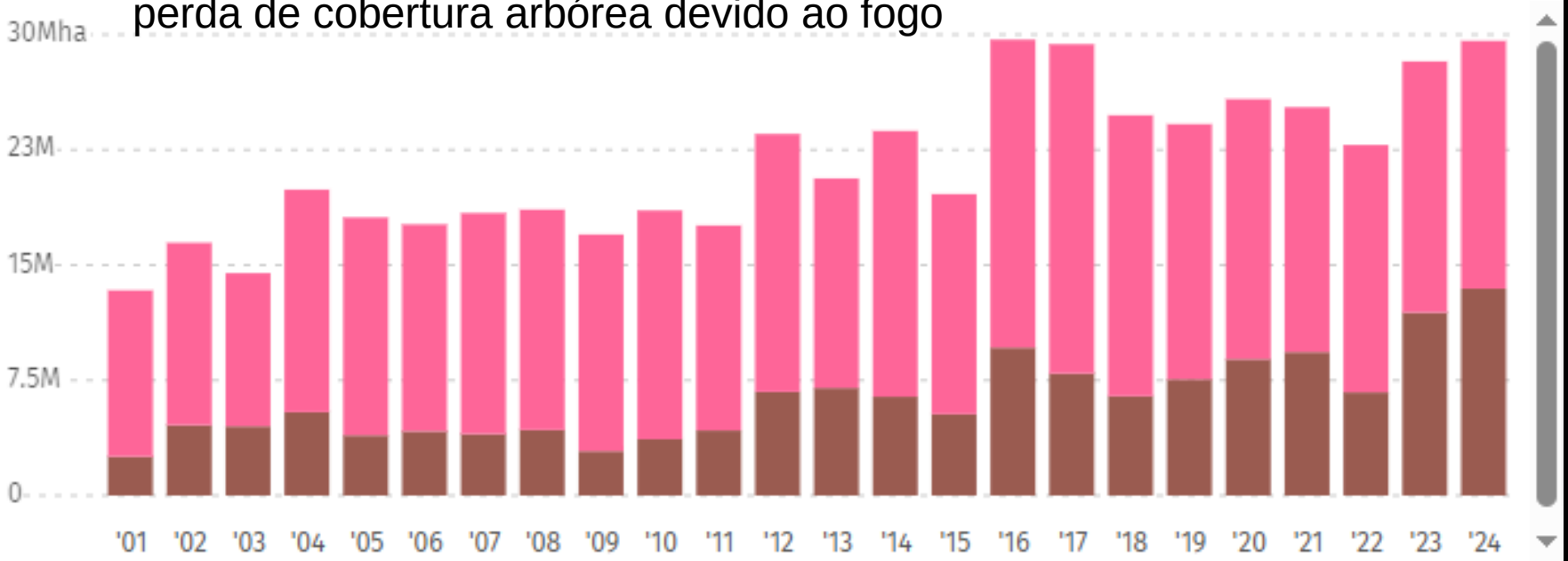
1,52 Milhão de km² por fogo (30%).

2024: perda por fogo 135 mil km² (45% dos 296 mil km²).

2001-2024 emissões por perda de cobertura vegetal = **220 $GtCO_2$**

From **2001** to **2024**, there was a total of **152 Mha tree cover lost from fires globally** and **366 Mha** from all other drivers of loss. The year with the most tree cover loss due to fires during this period was **2024** with **13.5 Mha** lost to fires — **45%** of all tree cover loss for that year.

O segmento inferior de cada coluna indica a perda de cobertura arbórea devido ao fogo



Incêndios em 2024:

WORLD RESOURCES INSTITUTE | GLOBAL FOREST REVIEW

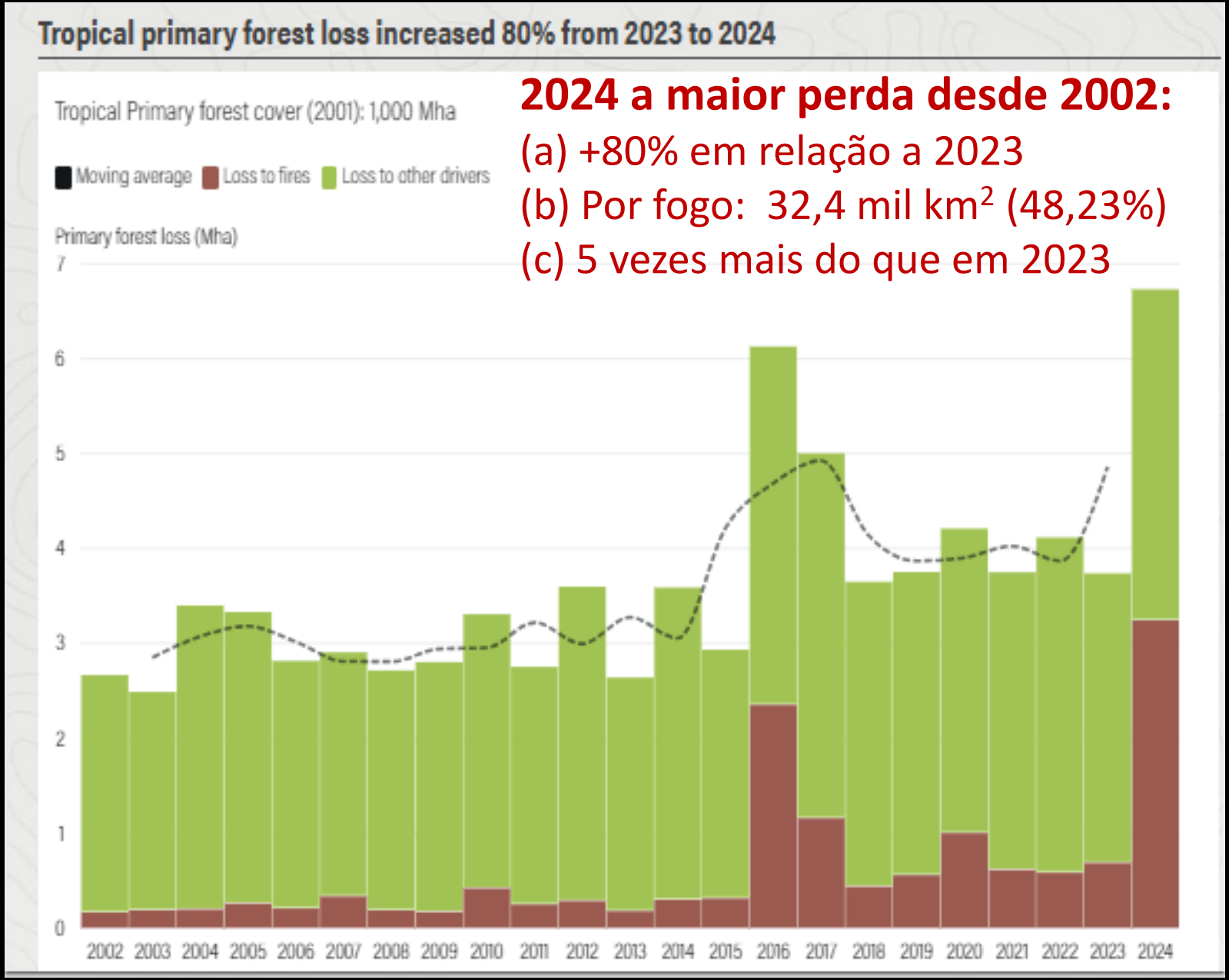
Incêndios levam a recorde de perda de floresta tropical em 2024

By Elizabeth Goldman, Sarah Carter, Michelle Sims

Last Updated on May 21, 2025

Perda de floresta primária explode na Amazônia brasileira devido a incêndios

2024: Perdas de florestas primárias tropicais: 67,3 mil km^2



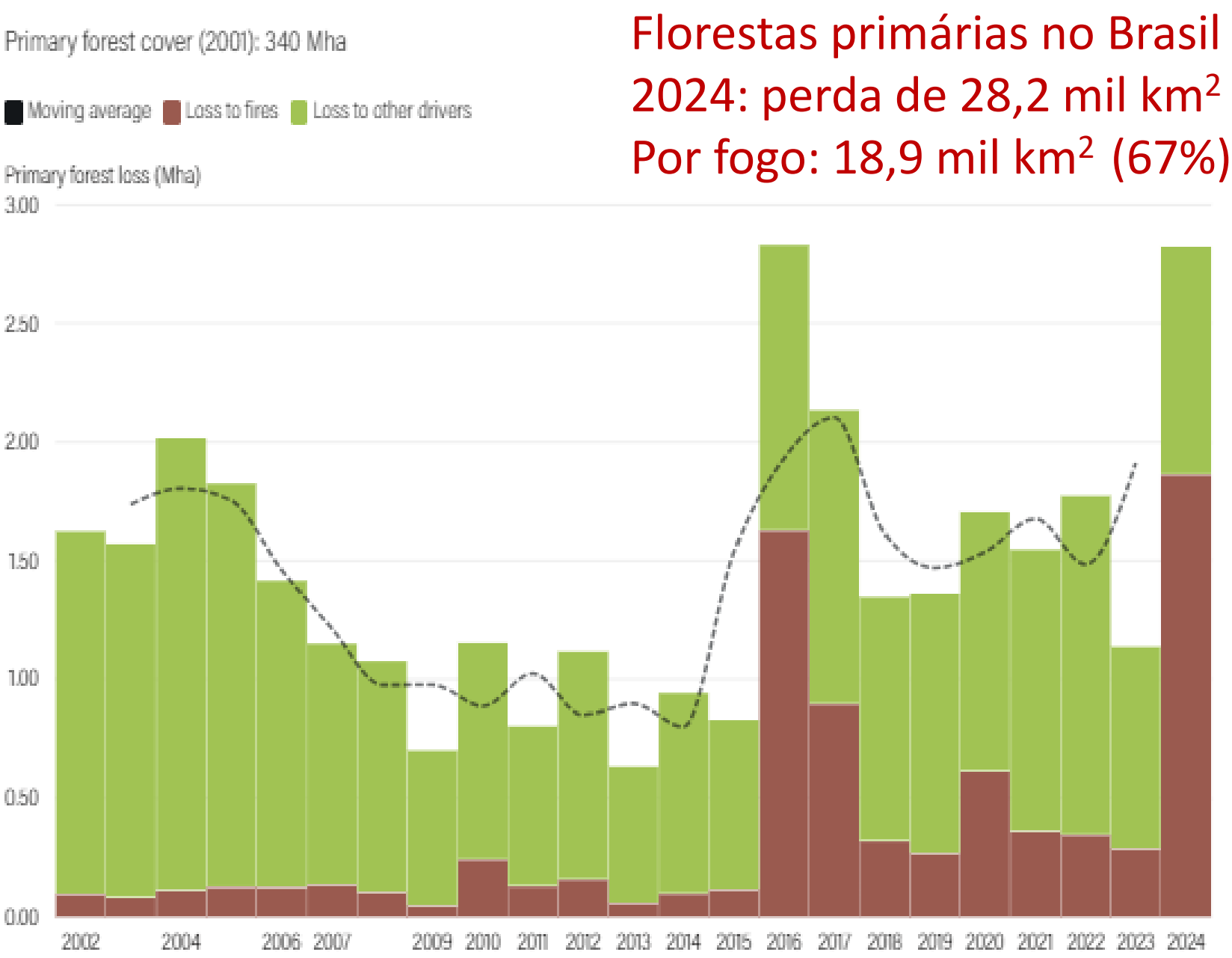
2024 a maior perda desde 2002:

(a) +80% em relação a 2023

(b) Por fogo: 32,4 mil km^2 (48,23%)

(c) 5 vezes mais do que em 2023

Brazil primary forest loss spiked in 2024, largely due to fire



Florestas primárias no Brasil

2024: perda de 28,2 mil km^2

Por fogo: 18,9 mil km^2 (67%)

1985-2024: perda de 1.170.000 km^2 de áreas naturais
Média de 29 mil km^2 / ano (Pará = 1.248.000 km^2)

https://brasil.mapbiomas.org/wp-content/uploads/sites/4/2025/08/Fact_Colecao10_22.08.2025_v9.pdf

Conclusão

Facts about our ecological crisis are incontrovertible. We must take action

The Guardian, 26 de out. 2018

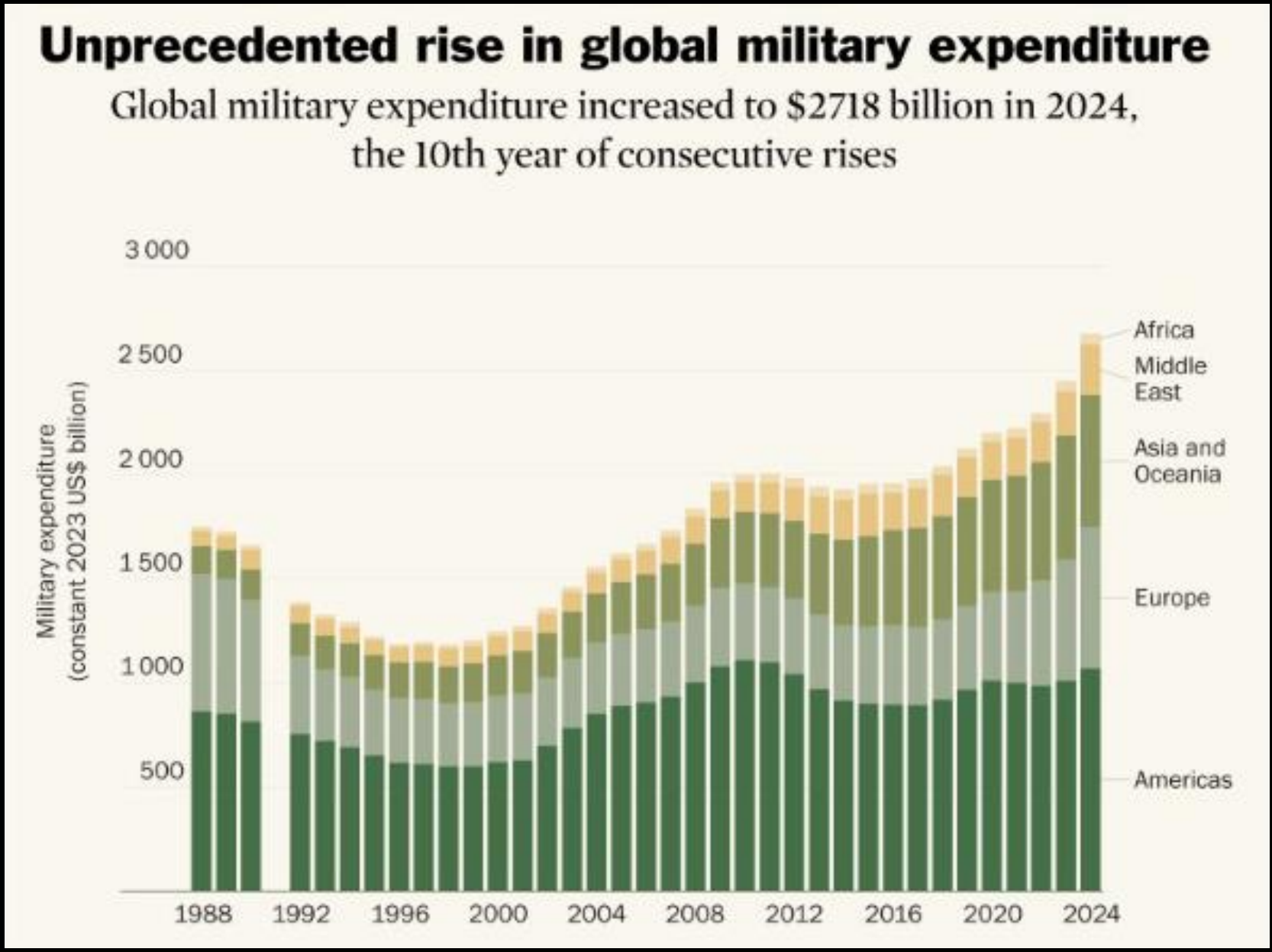
Humans cannot continue to violate the fundamental laws of nature or science with impunity, say 94 signatories including **Dr Alison Green** and **Molly Scott Cato MEP**

We are in the midst of the sixth mass extinction, with about 200 species becoming extinct each day. Humans cannot continue to violate the fundamental laws of nature or of science with impunity. If we continue on our current path, the future for our species is bleak.

Manifesto de 94 cientistas em 2018:

"Estamos em meio à sexta extinção em massa, ***com cerca de 200 espécies sendo extintas a cada dia***. Os humanos não podem continuar a violar as leis fundamentais da natureza ou da ciência impunemente. Se continuarmos nesse caminho, nosso futuro será sombrio.

2024: mais de US$ 2,7 trilhões em “defesa”



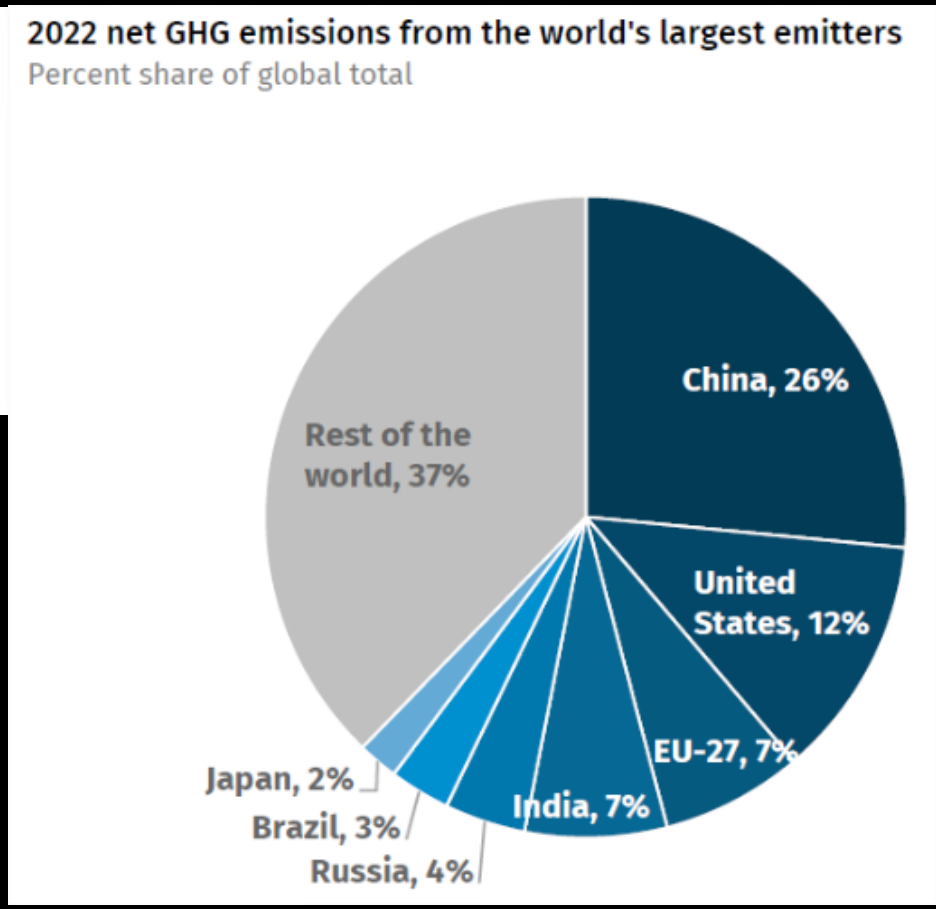
Scientists for Global Responsibility

Conflict and Environment Observatory

Estimating the Military's Global Greenhouse Gas Emissions

Acelerador do aquecimento:

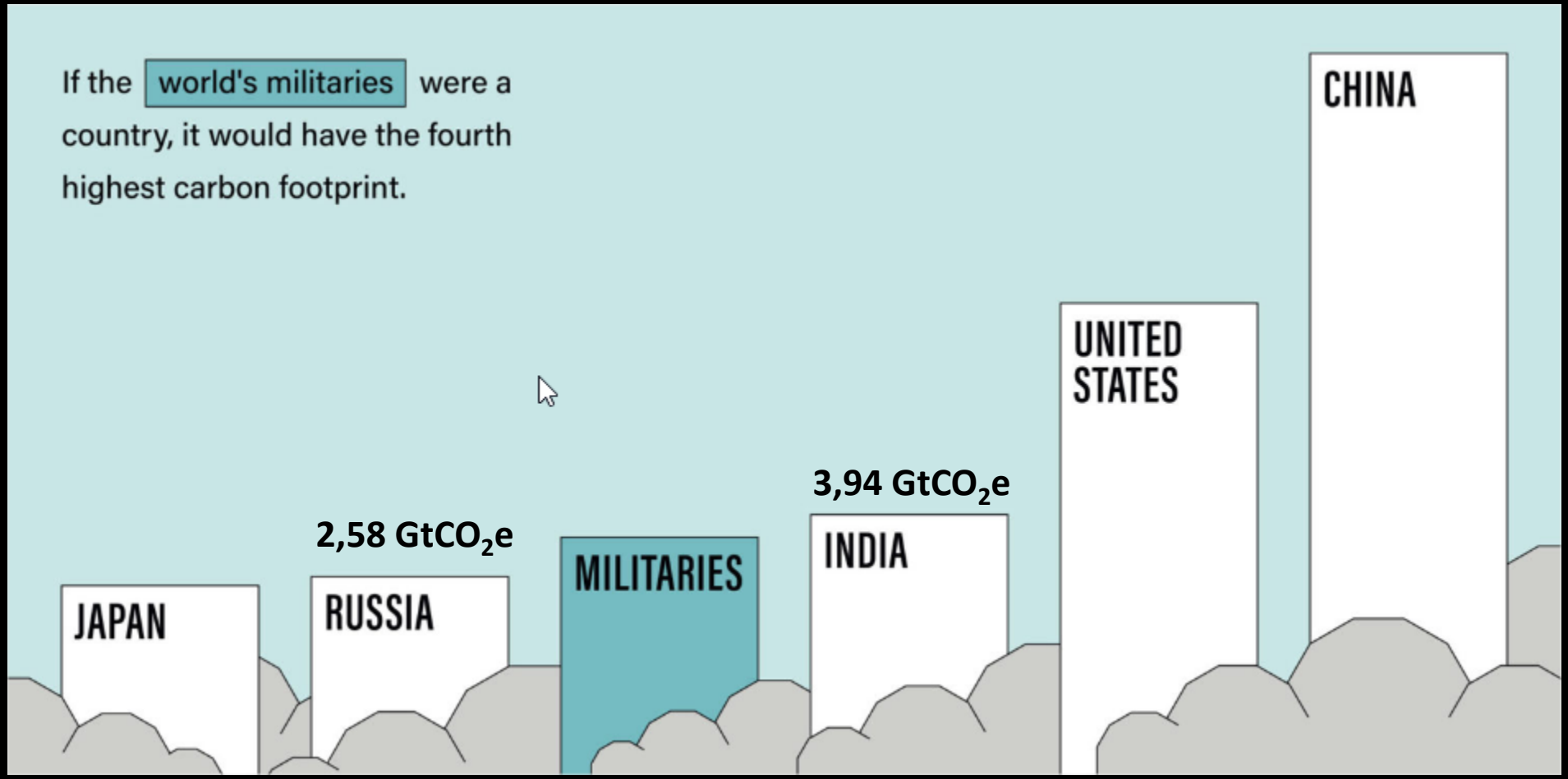
"A pegada militar de carbono é de ~5,5% [3,3% - 7%] das emissões globais" (2022).



The total military carbon footprint is approximately 5.5% of global emissions. If the world's militaries were a country, this figure would mean they have the fourth largest national carbon footprint in the world – greater than that of Russia.

https://ceobs.org/wp-content/uploads/2022/11/SGR-CEOBS_Estimating_Global_MIlitary_GHG_Emissions.pdf

“Se as forças armadas mundiais fossem um país, esse ‘país’ teria a 4ª maior pegada de carbono nacional do mundo – maior que a da Rússia”.



Sumário desta comunicação

I. Grande Aceleração, Antropoceno e a recusa do IUGS

II. A engrenagem do colapso socioambiental

1. Fracasso da UNFCCC, da CBD e da governança global (paz)
2. **Aquecimento médio global de 2 ^{o}C antes de 2040**
3. Trópicos inabitáveis até 2070

II - Propostas

Os últimos 10 anos (2015-2024) foram os mais quentes dos últimos 200 anos

2024 foi o 1º ano acima de 1,5 ºC

The New York Times

Earth's 10 Hottest Years on Record Are the Last 10

A report from the World Meteorological Organization confirms that 2024 was the hottest year on record and the first year to be more than 1.5 degrees Celsius above the preindustrial era.

https://www.nytimes.com/2025/03/18/climate/global-temperatures-wmo-report.html

2022 - 2025: ondas de calor entre 44,2 ºC e 52,3 ºC

Brasil em breve sofrerá 45 ºC

2022

Austrália **50,7 ºC**

Kuwait **> 50 ºC**

Irã **52,2 ºC**

2023

Brasil **44,8 ºC**

Vietnã **44,2 ºC**

2024

Mali **48,5 ºC**

Ar. Saudita **51,8 ºC**

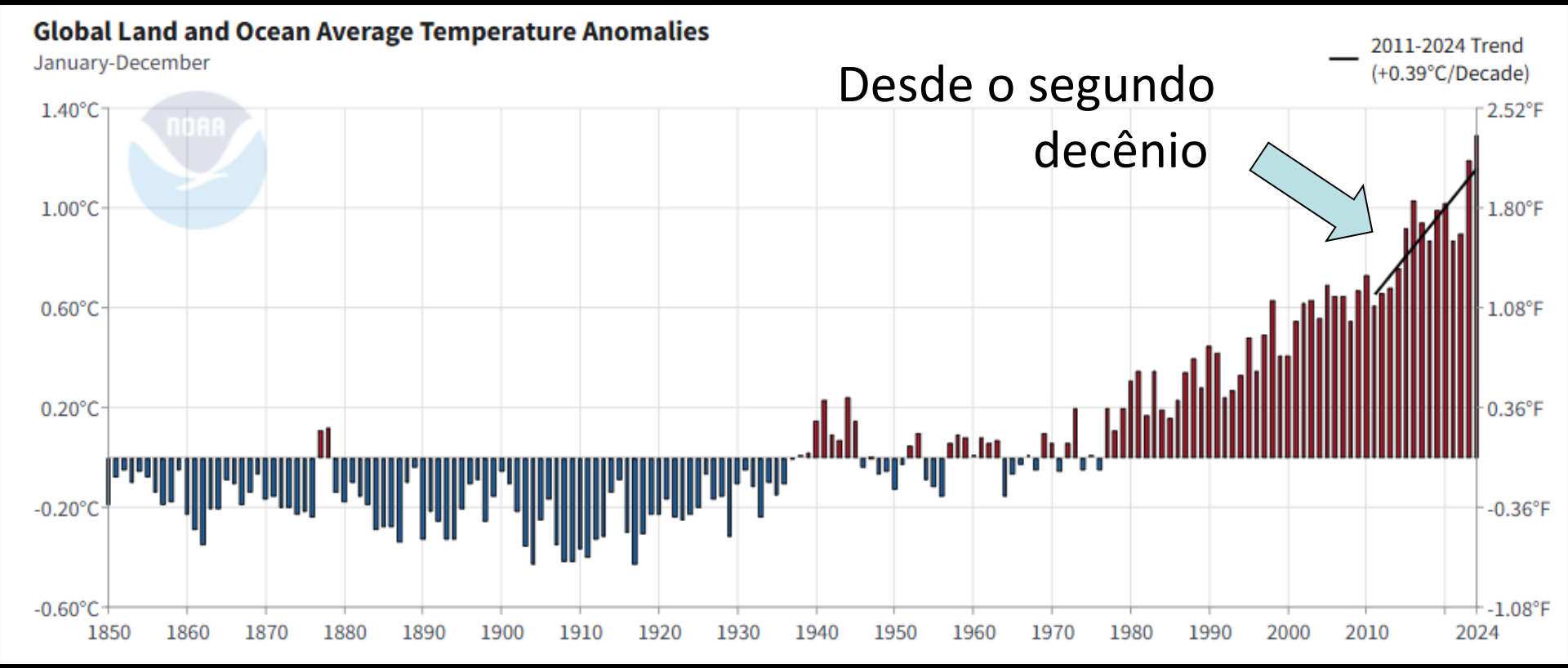
México **51,9 ºC**

Índia **52,3 ºC**

2025

EAU **50,4 ºC**

2011-2024: **0,39 ºC** por década



National Centers for Environmental Information
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Climate at a Glance Global Time Series

https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/globe/tavg/land_ocean/12/12/1850-2024?trend=true&trend_base=10&begtrendyear=1850&endtrendyear=2024

“O aquecimento global acelerou significativamente” (Preprint, 3 março 2025)

Global Warming has Accelerated Significantly

Stefan Rahmstorf

Stefan.Rahmstorf@pik-potsdam.de

PIK https://orcid.org/0000-0001-6786-7723

Grant Foster

retired

“Após 2015, a temperatura global aumentou mais rapidamente do que em qualquer decênio desde 1945”

Brief Communication

Keywords:

Posted Date: March 3rd, 2025

“After 2015, global temperature rose significantly faster than in any previous 10-year period since 1945

(1) Aquecimento em 2024 (excluído o efeito El Niño etc.)

(2) Taxas de aquecimento por década = 0,42 ºC a 0,48 ºC

(3) Projeções: **2 ºC = 2037** / **3 ºC = 2060** / **4 ºC = 2084**

Global Warming has Accelerated Significantly

Grant Foster and Stefan Rahmstorf (2025 preprint)

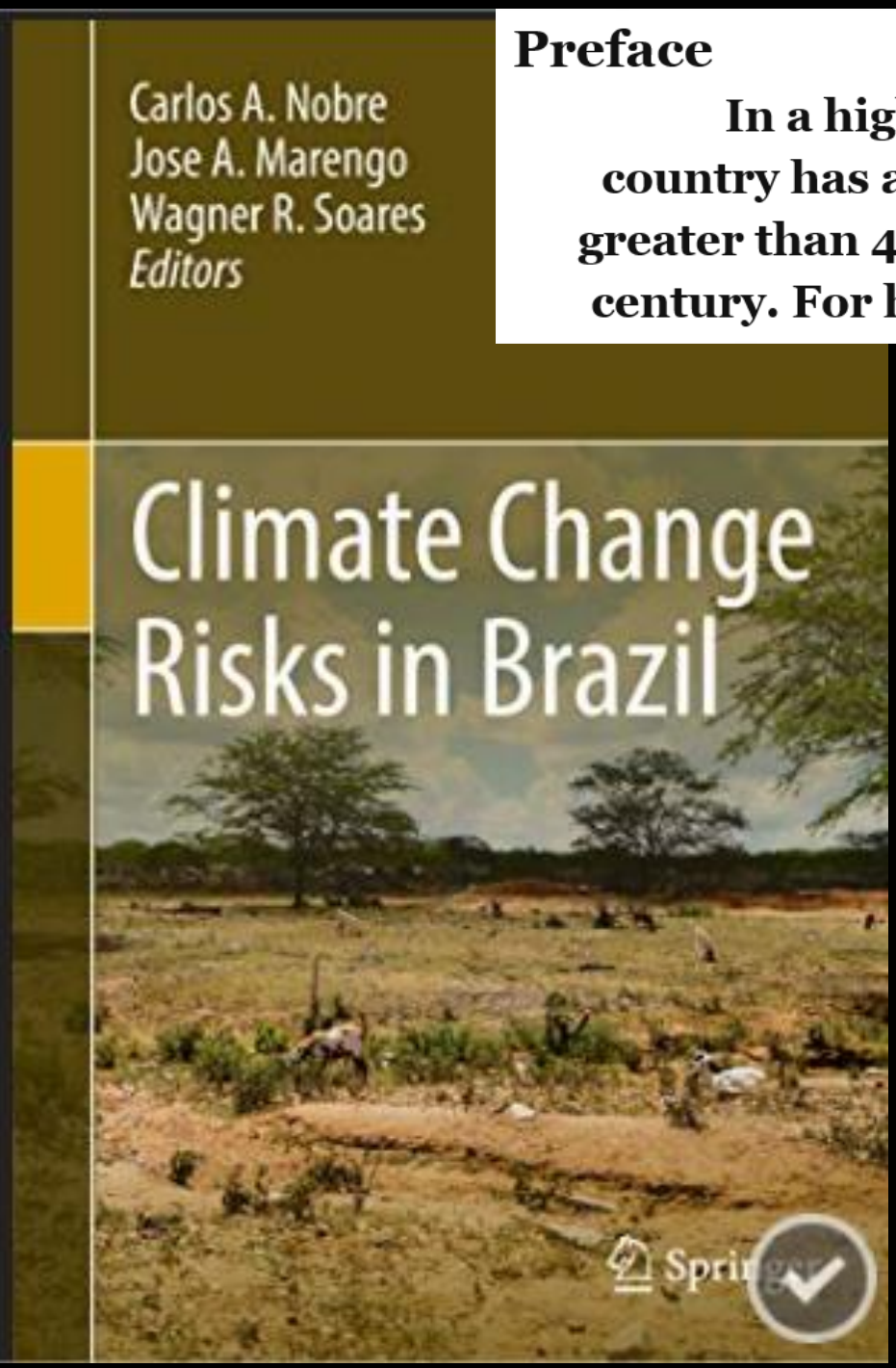
Table 1 Ending value in °C, rate in °C/decade

Data	value	rate	cross +1.5°C	cross +2.0°C	cross +2.5°C	cross +3.0°C	cross +3.5°C	cross +4.0°C
NASA	1.45	0.42	2026	2037	2049	2061	2073	2085
NOAA	1.45	0.42	2026	2037	2049	2061	2073	2085
HadCRU	1.42	0.39	2026	2039	2052	2065	2077	2090
Berkeley	1.45	0.43	2026	2037	2048	2060	2072	2083
ERA5	1.54	0.48	2024	2034	2044	2054	2065	2075
Average	1.46	0.43	2026	2037	2048	2060	2072	2084

'The most important insight from these adjusted data is that there is no longer any doubt regarding a recent increase in the warming rate. Although the world may not continue warming at such a fast pace [~0.43/dec], it could likewise continue accelerating to even faster rates.'

Extrapolated presented warming rates linearly after +1.5°C to show additonal cross points, by Leon Simons

https://x.com/LeonSimons8/status/1924198062039437325/photo/1

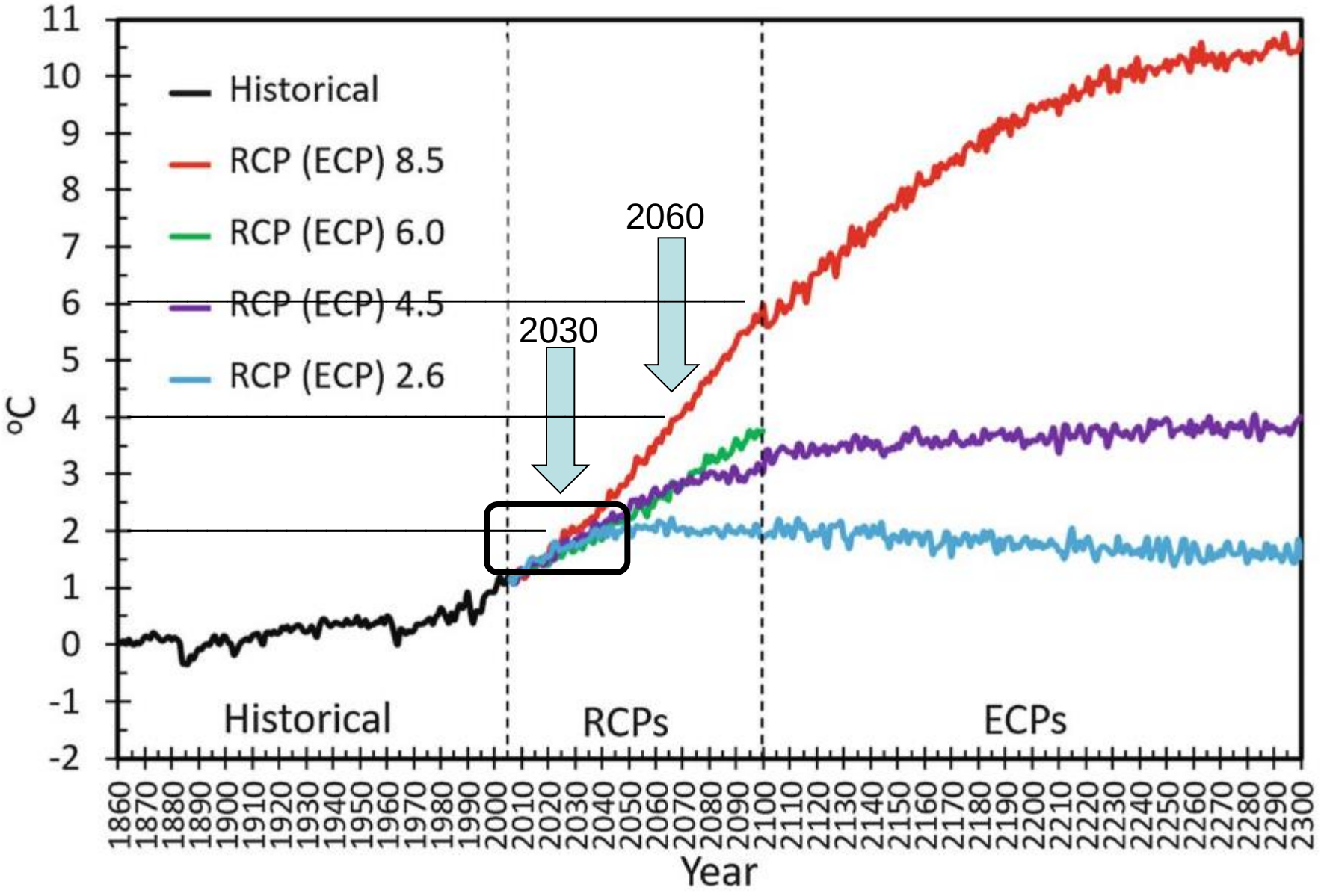


Preface

In a high greenhouse gas emissions scenario, the country has a high likelihood (over 70%) of suffering a greater than 4°C temperature rise before the end of the century. For high degrees of global warming exceeding

Brasil:

"Em um cenário de altas emissões de GEE, o país tem alta probabilidade (acima de 70%) de sofrer aquecimentos maiores que 4 °C antes do fim do século".


Historical
RCP (ECP) 8.5
RCP (ECP) 6.0
RCP (ECP) 4.5
RCP (ECP) 2.6
2060
2030
°C
Historical
RCPs
ECPs
Year

Key findings of the 2023 report of the *Lancet* Countdown on health and climate change

If temperature rise reaches 2°C already by mid century:

Heat-related deaths are projected to **increase by 370%**

Heat-related labour loss is projected to **increase by 50%**

524·9 million additional people are projected to experience moderate-to-severe food insecurity

The transmission potential for dengue is projected to **increase by up to 37%**

3 ºC após 2050

Mantida a atual trajetória, um aquecimento médio global de 3 ºC será atingido por volta de 2060 (2054-2065)

Uma adaptação a esse nível catastrófico de aquecimento é improvável. Ainda que ocorra, seus impactos produzirão imenso sofrimento.

cross +3.0°C
2061
2061
2065
2060
2054
2060

Jean Jouzel
ex-vice-presidente do IPCC:

“Penso que não poderemos nos adaptar a um aquecimento de 3 ºC e que viveremos conflitos maiores”.

Citado por Pierre Le Hir, “Réchauffement climatique: la bataille des 2 ºC est presque perdue”. *Le Monde*, 31/XII/2017: “Je pense que nous ne pourrons pas nous adapter à un réchauffement de 3 °C et que nous vivrons des conflits majeurs.”

Pesquisa de opinião dos cientistas do 6º Relatório do IPCC

Nature Opinion Poll of 233 IPCC Scientists AR6, 2021: "Expected Warming in your lifetime"

NEWS FEATURE | 01 November 2021

Top climate scientists are sceptical that nations will rein in global warming

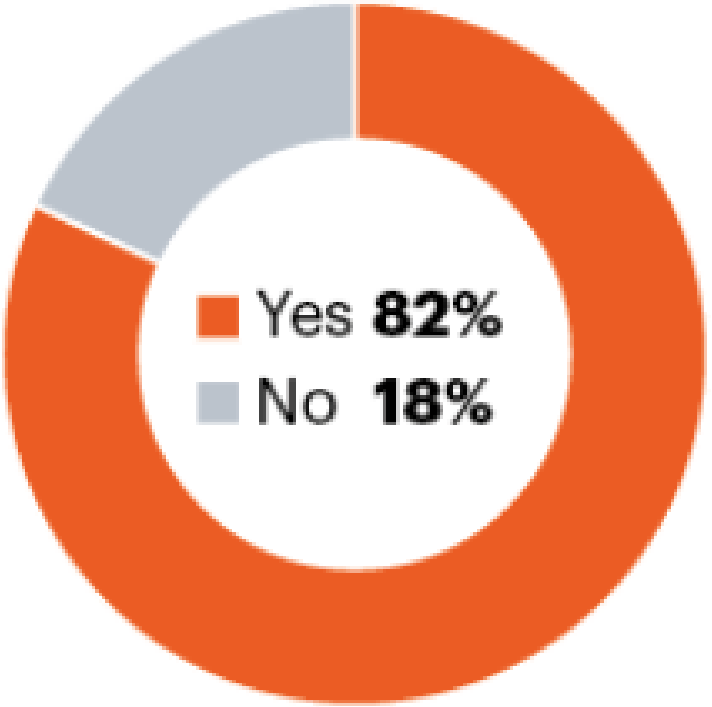
A *Nature* survey reveals that many authors of the latest IPCC climate-science report are anxious about the future and expect to see catastrophic changes in their lifetimes.

Jeff Tollefson

https://www.nature.com/articles/d41586-021-02990-w

Você pensa que verá impactos catastróficos das mudanças climáticas?

Do you think you will see catastrophic impacts of climate change in your lifetime?



Source: *Nature* analysis

Sumário desta comunicação

I. Grande Aceleração, Antropoceno e a recusa do IUGS

II. A engrenagem do colapso socioambiental

1. Fracasso da UNFCCC, da CBD e da governança global (paz)
2. Aquecimento médio global de 2 ^{o}C antes de 2040
3. **Trópicos inabitáveis até 2070**

II - Propostas

Future of the human climate niche

Chi Xu, Timothy A. Kohler, Timothy M. Lenton, +1, and Marten Scheffer Authors Info & Affiliations

Contributed by Marten Scheffer, October 27, 2019 (sent for review June 12, 2019; reviewed by Victor Galaz and Luke Kemp)

May 4, 2020 | 117 (21) 11350-11355 | https://doi.org/10.1073/pnas.1910114117

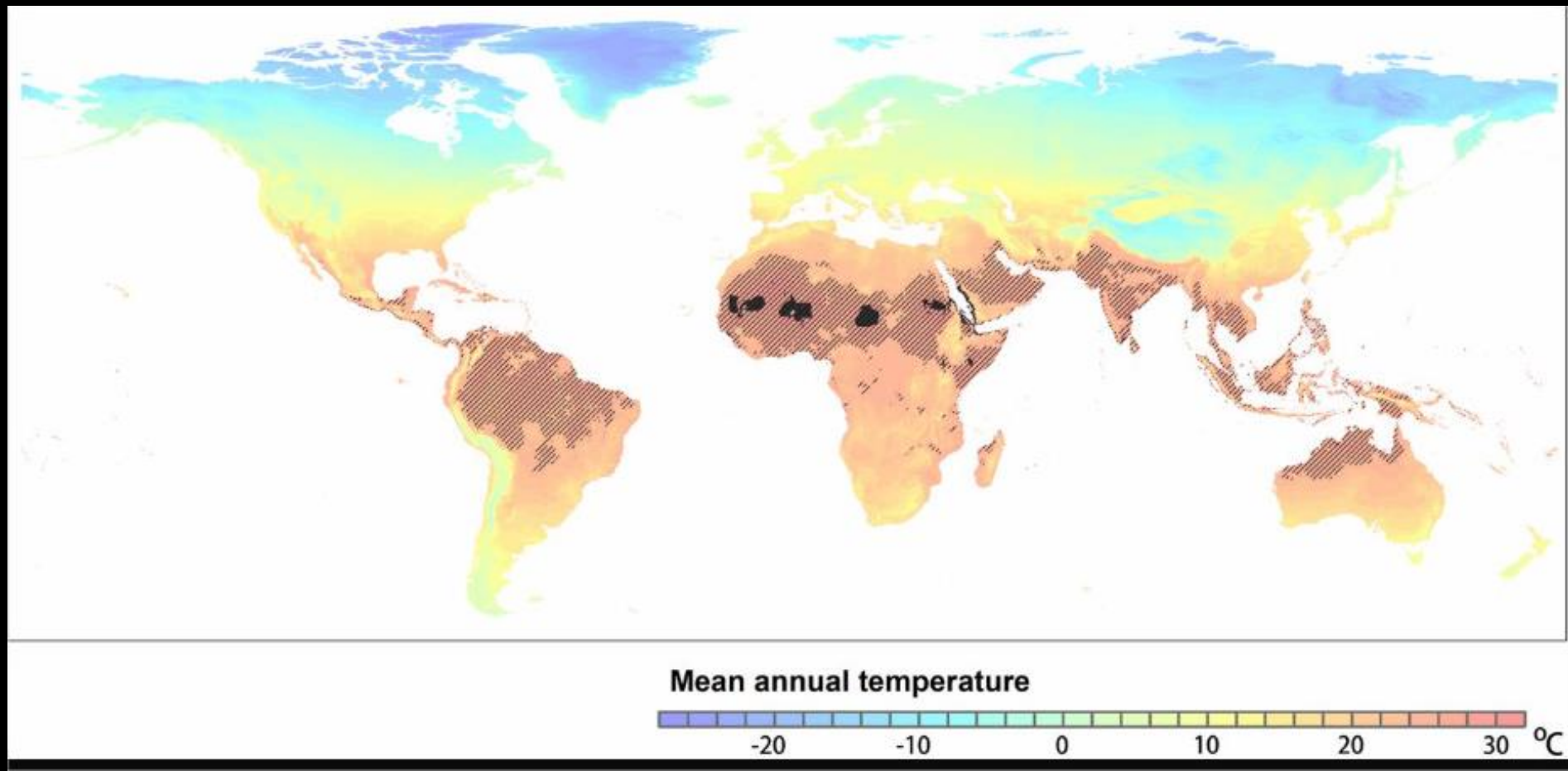
Durante milênios, o nicho climático humano situou-se em uma temperatura média anual entre 11 °C e 15 °C (~13 °C). [válido para os últimos 6 mil anos]

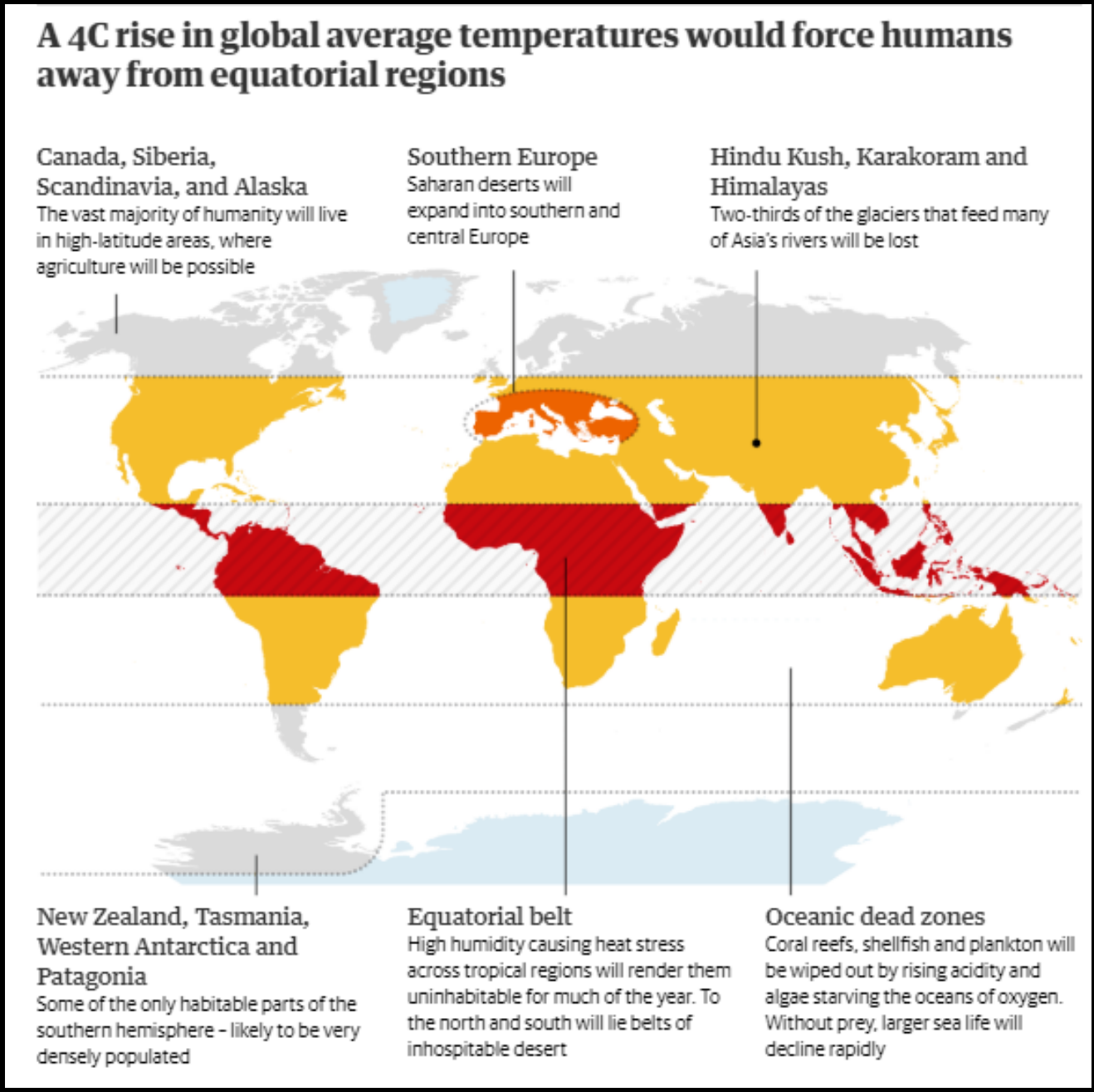
"For millennia, human populations have resided in the same narrow part of the climatic envelope available on the globe, characterized by a major mode around ~11 °C to 15 °C mean annual temperature".

Na trajetória atual, 1 a 3 bilhões de pessoas viverão até 2070 em lugares tão quentes quanto o Sahara hoje

Temperatura Média Anual ≥29,0 °C.

2020 = 0,8% da superfície terrestre (Sahara); 2070 = 19%





+4 ºC tornará o **cinturão equatorial inabitável**

O deserto do Saara avançará sobre a Europa meridional e central e a Turquia

2/3 do gelo do Himalaia perdido

Oceanos ácidos e anóxicos: declínio dos exoesqueletos e do plâncton

https://www.theguardian.com/environment/2019/may/18/climate-crisis-heat-is-on-global-heating-four-degrees-2100-change-way-we-live

Sumário desta comunicação

I - Evidências: observações e projeções

1. Fracasso da UNFCCC, da CBD e da governança global (paz)
2. Aquecimento médio global de 2 ^{o}C antes de 2040
3. Pontos de não retorno a <2 ^{o}C
4. Trópicos inabitáveis até 2070

II - Propostas

Proposta 1: **Imperativo de radicalidade em direção a uma ruptura civilizacional**

Dada a situação sem precedentes na história de nossa espécie, qualquer projeto político ou econômico que tergiverse sobre o imperativo de radicalidade é uma forma de negacionismo.

The heat is on over the climate crisis. Only radical measures will work

Gaia Vince

Sat 18 May 2019 16.00 BST

Crosses topple in the cemetery at Quinhagak in the Yukon delta, Alaska. Permafrost in the region is thawing. Photograph: Mark Ralston/AFP/Getty Images

https://www.theguardian.com/environment/2019/may/18/climate-crisis-heat-is-on-global-heating-four-degrees-2100-change-way-we-live

Proposta 2: Fazer entender que atenuar o colapso socioambiental em curso neste segundo quarto do século supõe construir consenso sobre uma política:

(a) cientificamente informada

(b) Focada na diminuição das desigualdades e na descontinuação do sistema energético-agroexportador.

(c) atenta aos ensinamentos de outras civilizações (indígenas, de matriz africana etc.)

Proposta 3: Construir uma globalização política democrática e desmantelar a globalização econômica

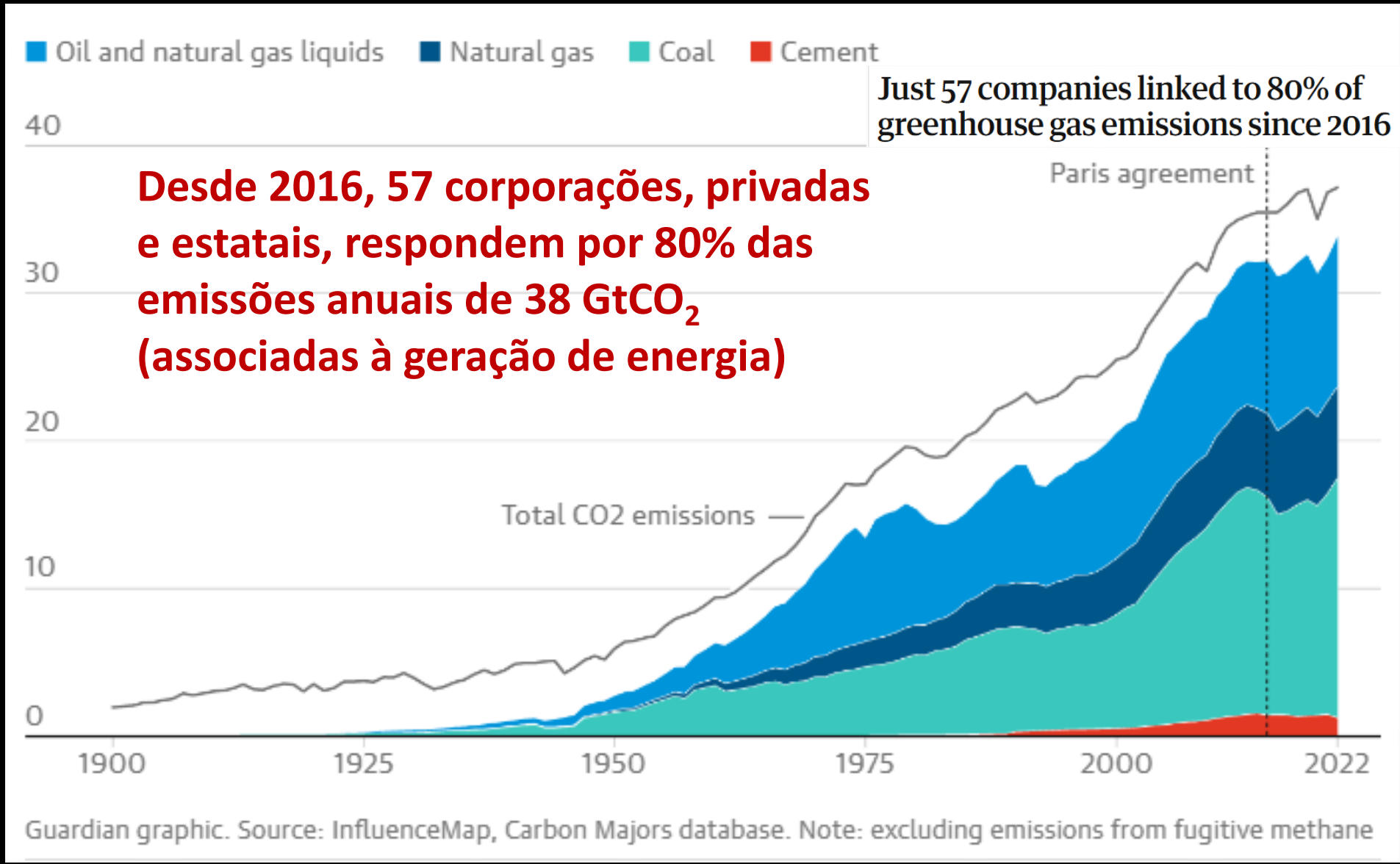
"A única via para que um Acordo em 2015 possa conter o aquecimento em 2ºC é desmantelar a economia global"

Yvo de Boer

Ex-secretário executivo da Convenção-Quadro das Nações Unidas sobre as Mudanças Climáticas

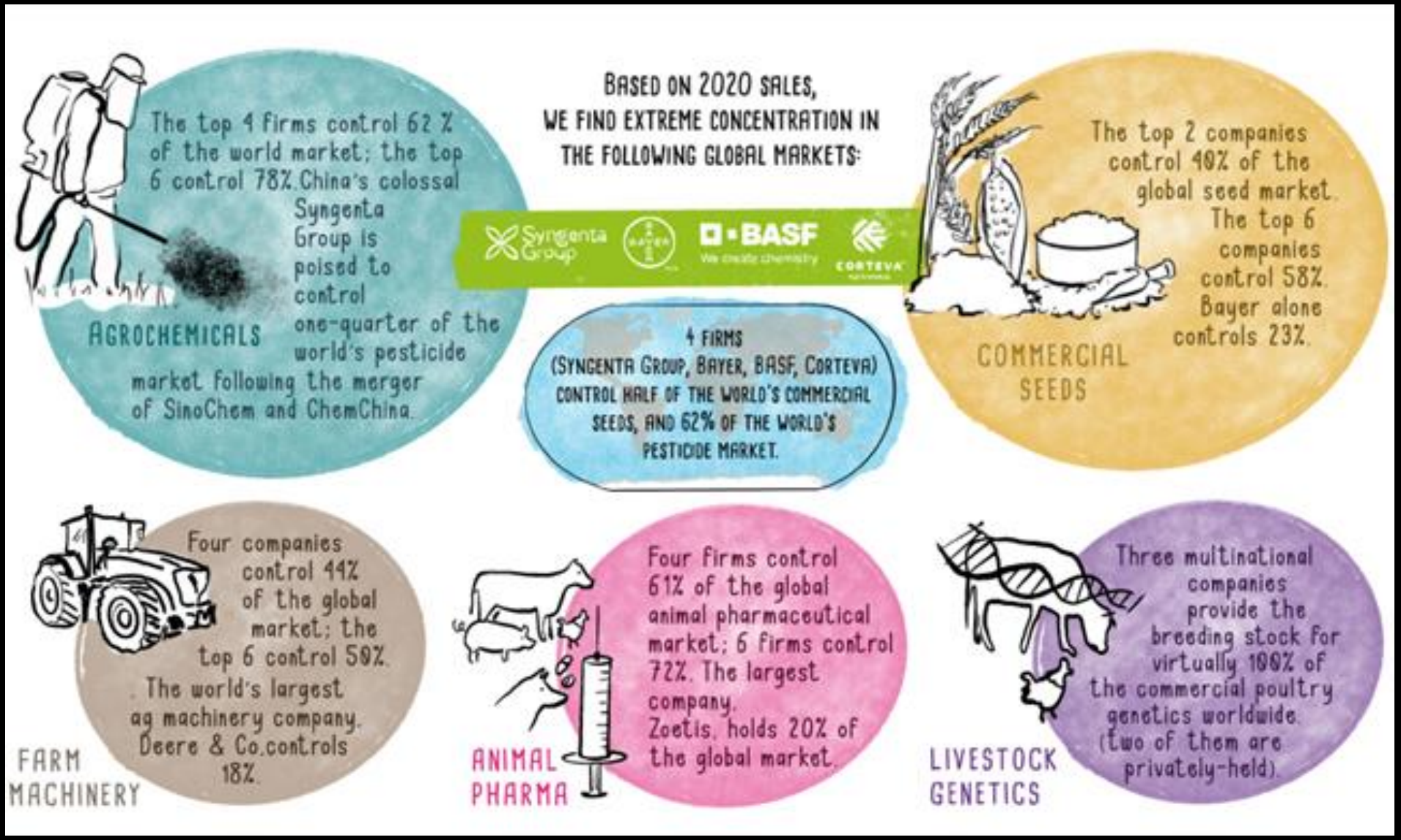
"The only way that a 2015 Agreement can achieve a 2ºC goal is to shut down the whole global economy"

Proposta 4: Identificar os adversários principais:
(a) a rede estatal-corporativa (Big Oil)



Desde 2016, 57 corporações, privadas e estatais, respondem por 80% das emissões anuais de 38 $GtCO_2$ (associadas à geração de energia)

Proposta 4: Identificar os adversários principais:
(b) a rede estatal-corporativa (Big Ag)



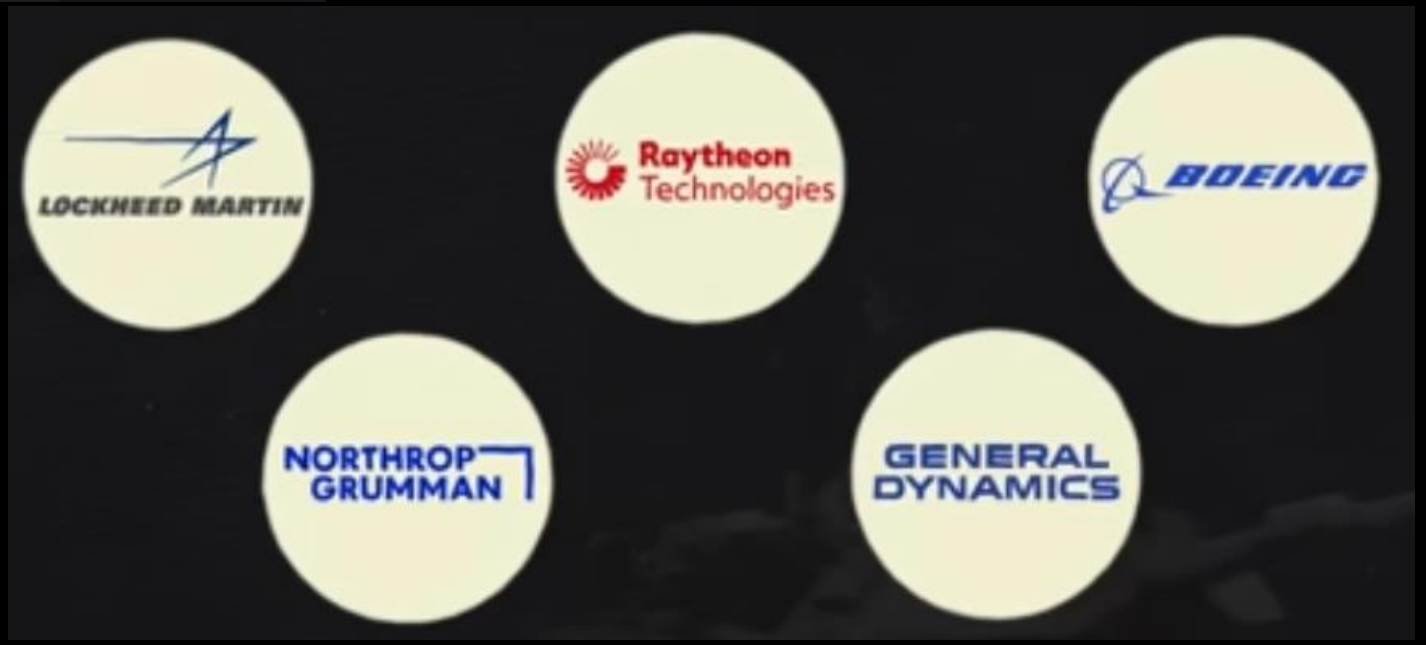
https://www.etcgroup.org/files/files/food-barons-2022-full_sectors-final_16_sept.pdf

Proposta 4: Identificar os adversários principais:

(c) O complexo industrial-militar

2025: orçamento militar dos EUA:

US$ 1 trilhão



https://www.youtube.com/watch?v=lDB3L23UMCQ

(d) Os 10% mais ricos

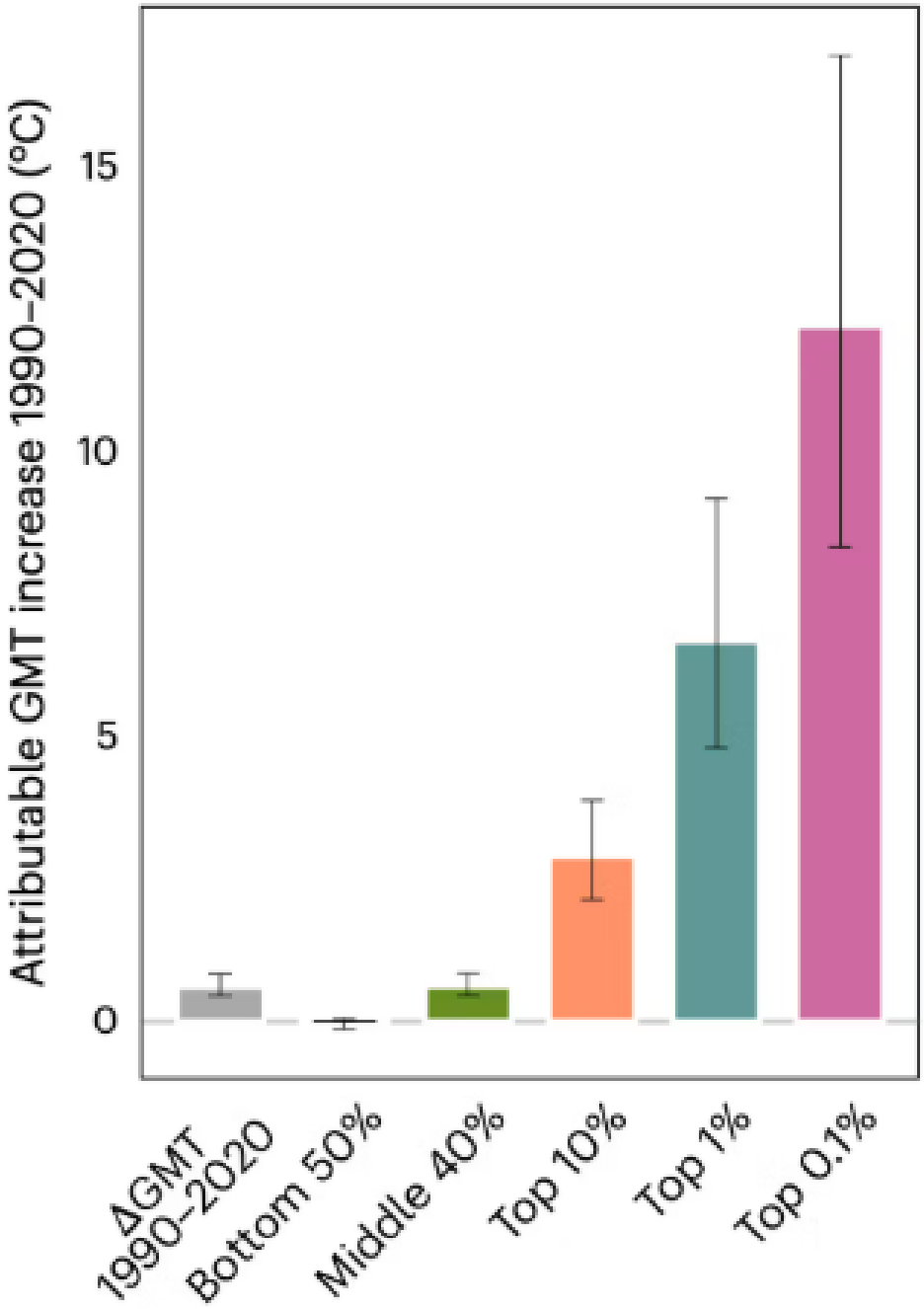
As emissões de GEE dos 10% mais ricos são globalmente responsáveis por 65% dos extremos climáticos entre 1990 e 2020

Article | Open access | Published: 07 May 2025

High-income groups disproportionately contribute to climate extremes worldwide

Sarah Schöngart, Zebedee Nicholls, Roman Hoffmann, Setu Pelz & Carl-Friedrich Schleussner

Nature Climate Change (2025) | Cite this article



Quanto a temperatura média global teria aumentado entre 1990 e 2020 se todos emitissem tanto quanto os 50% mais pobres, os 40% da classe média, os **10%, 1% e 0,1% mais ricos**?

A barra cinza mostra o quanto as temperaturas médias globais aumentaram (~1,5 ºC)

Os traços verticais mostram os intervalos de confiança (5-95)

“A questão é se alguma civilização pode travar uma guerra implacável contra a vida sem se destruir e sem perder o direito de se chamar civilizada”.

Rachel Carson
Primavera silenciosa (1962)

1907 - 1964