



Biodiversity Crises

Are we focusing on the right things?



Siti Nurleily Marliana, PhD
Biodiversity Exhibition 2023
3 September 2023



Contents

1 Defining biodiversity
Definition, scope & values

2 Biodiversity loss
The causes of today's problems

3 What you know might
not be the truth
Myths & hidden truths

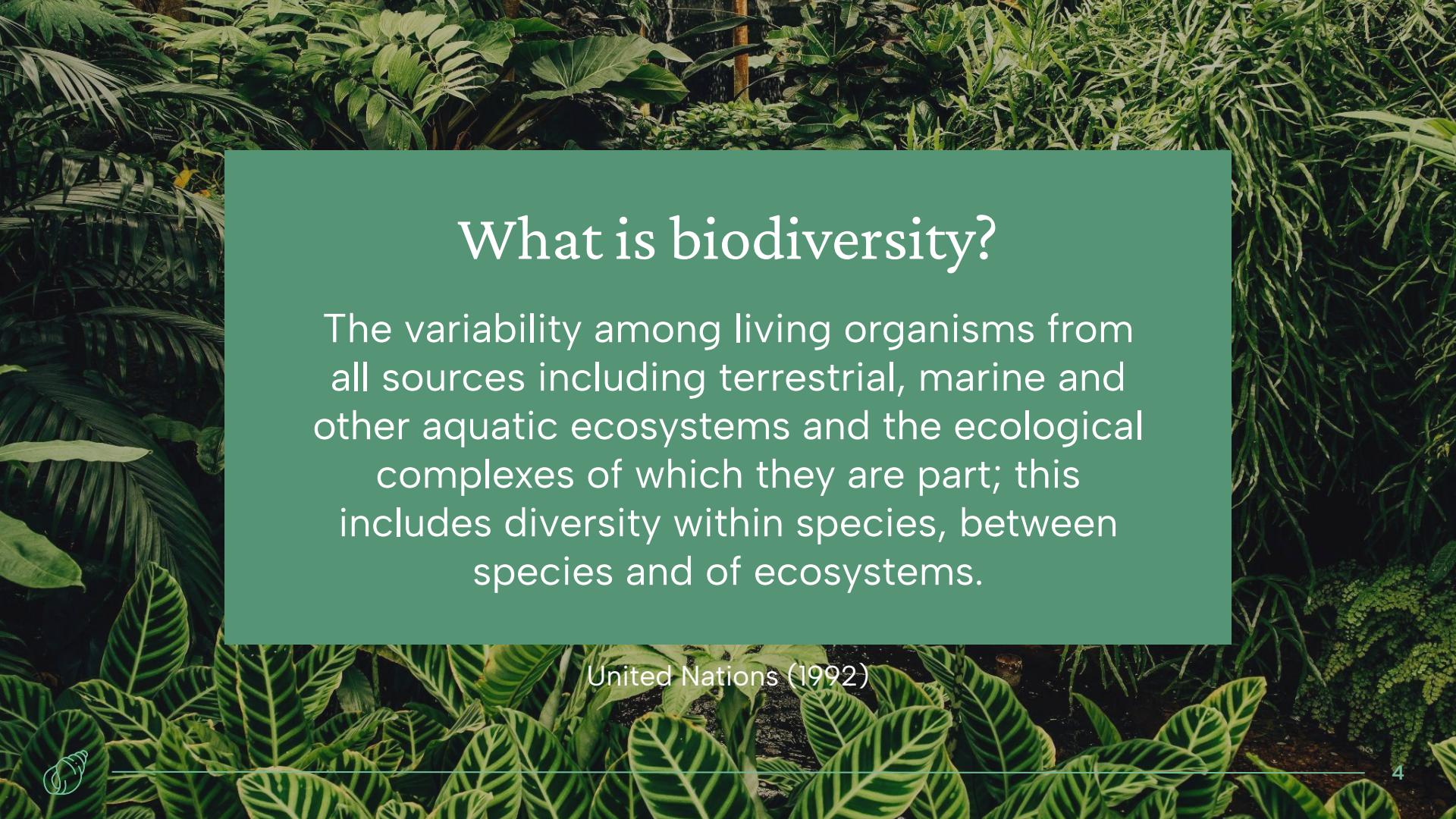
4 Our ecological
footprint
What we can do



1

Defining biodiversity





What is biodiversity?

The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

United Nations (1992)



The importance of biodiversity

- ✿ Biodiversity provides ecosystem goods and services
- ✿ Provides food, water, wood, biochemicals.
- ✿ Regulates climate, diseases, water.
- ✿ Shapes human culture, religion, aesthetics, sense of place.

Biodiversity values



Economic

- * Monetary value.
- * Resources including food.
- * Drugs and chemicals.
- * Genes for agriculture.



Utilitarian

- * Direct use.
- * Goods: wood, fodder, water.
- * Services: prevent erosion, purify water, cycle and nutrients, regulate climate.



Psychological

- * We derive pleasure from nature, directly or indirectly.
- * Beauty, forest bathing.



Intrinsic

- * Everything has value in and of itself, regardless of humans' views.
- * These are reasons enough for conservation.



The full extent of life is unknown

- ✿ We don't know the exact number of species on Earth.
 - ✿ ~2 million have been described.
 - ✿ Recent research suggests there are 563 million to 2.2 billion species on Earth (Li and Wiens 2023).
 - ✿ This means we've only documented 0.35% of life.

2

Biodiversity loss





Species extinction

- ✿ Extinction is when the last individual of a species dies.
- ✿ However, functional extinction is when the species still exists, but not enough individuals remain for a viable population.
- ✿ Many species are consequently closer to extinction than we realise.



Northern white rhino (*Ceratotherium simum* *cottoni*)

Sudan, the last male northern white rhino died in 2018, at the age of 44–45. Only two living females remain in the world, leaving the species functionally extinct.



Mass extinction

- ✿ Extinction is a historically natural process.
- ✿ The background extinction rate is 0.1–1 E/MSY*.
- ✿ This is extinction rate absent the presence of humans.

*Extinctions per million species per year.



Mass extinction

- ✿ Current extinction is difficult to estimate (Lamkin and Miller 2016), but—
 - ✿ It may be as high as 260 E/MSY, or 260,000 species in the past 500 years (Cowie et al. 2022), ~13% of all life.
- ✿ Meaning, we're in the midst of the **sixth mass extinction**, resulting from human activities.



What are the
main threats to
biodiversity?



HIPPO



(Not this kind)



- H** – Habitat destruction
- I** – Invasive species
- P** – Pollution
- P** – Population
- O** – Overharvesting



Habitat destruction



- ✿ Habitat destruction, degradation, and fragmentation are likely the most important causes of extinction today.
- ✿ E.g. 85% of population decline in birds and mammals.
- ✿ Deforestation, agricultural expansion, urban development, and mining are all examples of habitat destruction.



The habitat destruction of Riau

A real view of deforestation
over the decades



Riau: 1992

Source: Google Earth



Riau: 2002

Source: Google Earth



Riau: 2012

Source: Google Earth



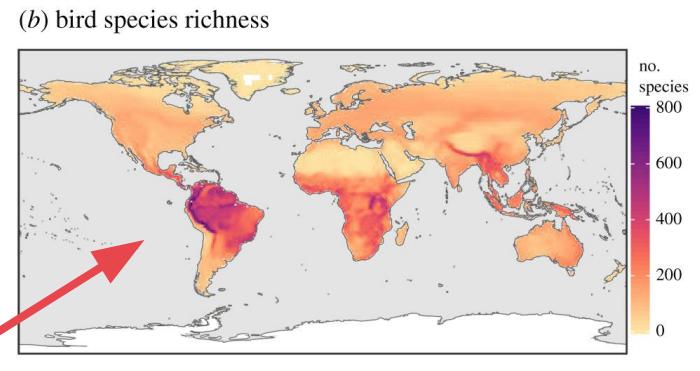
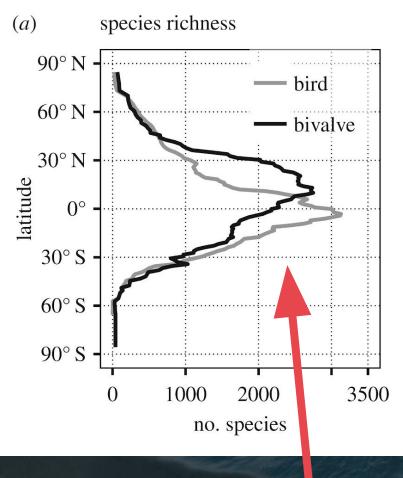
Riau: 2022

Source: Google Earth

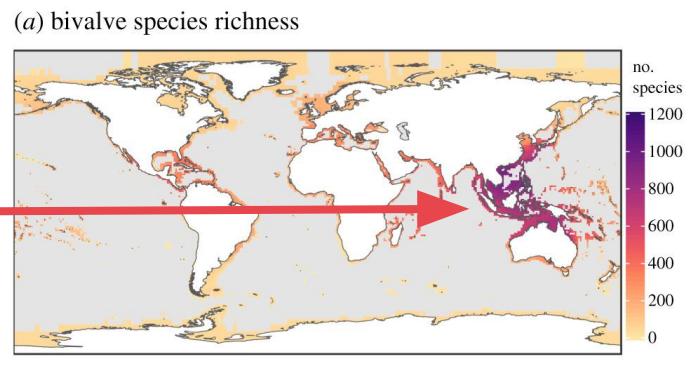


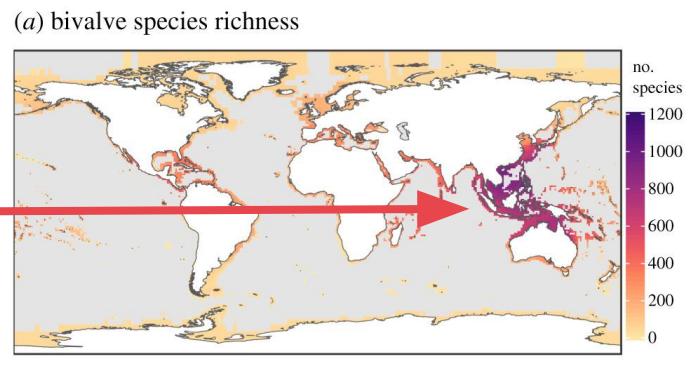
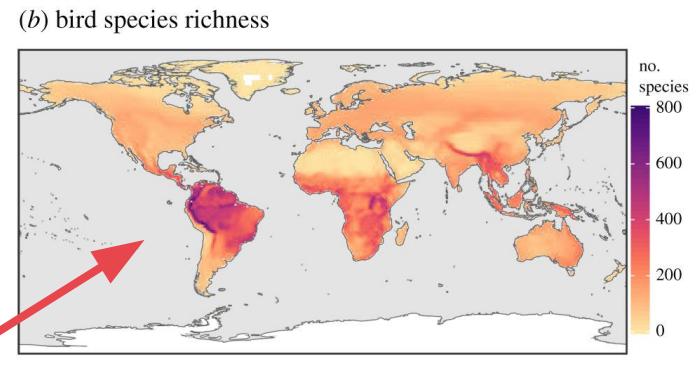
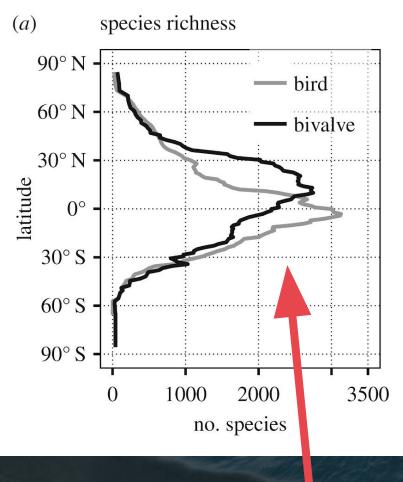
Why does the deforestation in Riau matter?

- * Species are not evenly distributed.
- * Some families are more abundant and diverse than others.
- * Some regions are also more abundant and diverse than others.



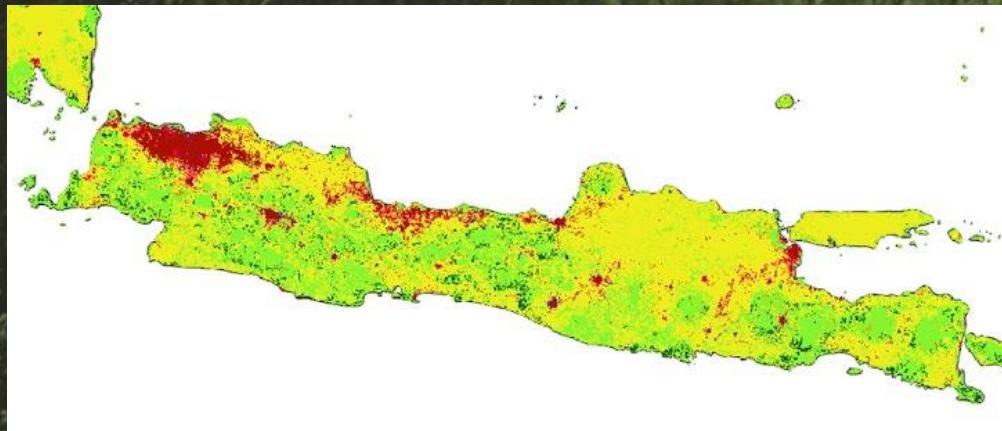
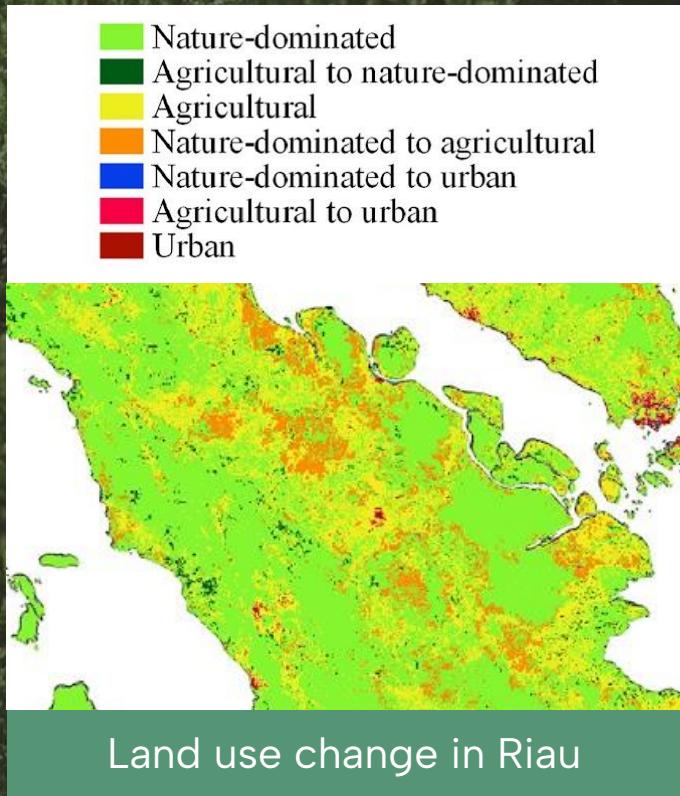
Species richness increases towards the equator.





These become biodiversity hotspots.





Land use change in Java

Biodiversity hotspots account for only 1.5% of land, but if these hotspots are lost, a third of Earth's species would go extinct.



Invasive species

- ✿ Humans often introduce exotic species to ecosystems.
- ✿ These species can become invasive, where they—
 - ✿ Prey, parasite, compete with, or transfer diseases to native species.
 - ✿ Disrupt stable relationships in ecosystems.
 - ✿ Harm the local economy.



Tilapia (Tilapiini tribe)

Actually native only to Africa and invasive everywhere else, including Indonesia.



Cats (*Felis catus*)

Cats are a globally invasive species and have driven many native fauna to extinction.



Burmese python (*Python bivittatus*)

Imported as a pet and escaped into the Florida Everglades, killing over 99% of some species.



Pollution

- ✿ Direct discharge of pollutants into the environment or atmosphere.
- ✿ Has no boundaries—i.e. our neighbors often pay the price for our waste.
- ✿ Alters habitats to the point where some plants and animals cannot adapt.
- ✿ What pollution doesn't destroy can end up in our food and eventually our bodies.
 - ✿ Bioaccumulation/biomagnification.

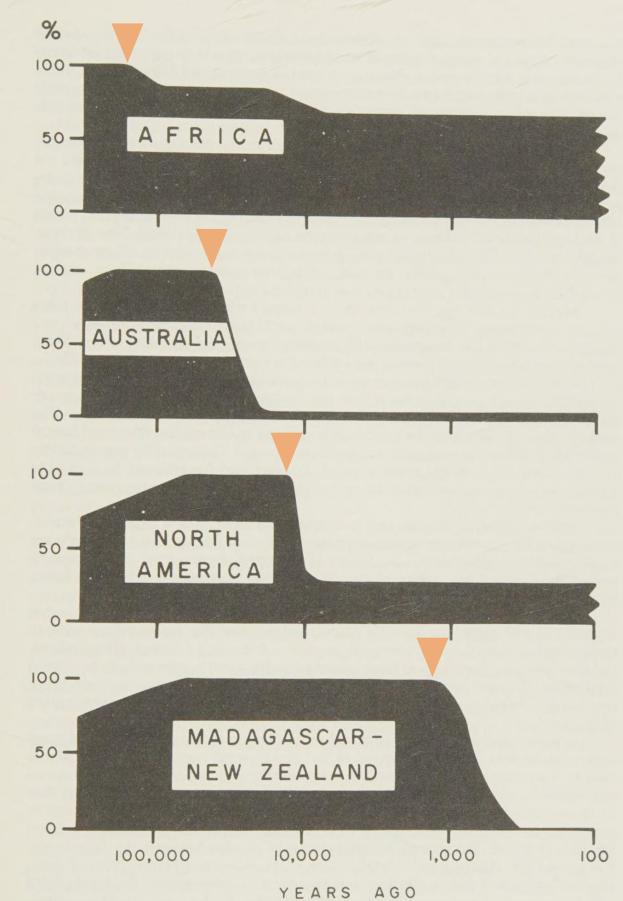




Population (of humans)

- ✿ This was as true 15,000 years ago as it is today: humans have a significant impact on the environment and the animals around them.





■ Arrival of humans

Humans vs. large mammals

Historically, mass extinction tends to follow us wherever we go.

Martin and Klein (1984)





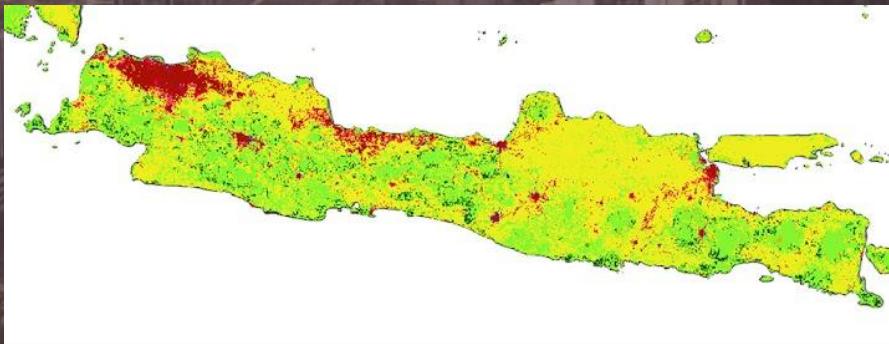
Population (of humans)

- ✿ As populations increase, so does the demand for food, water, shelter, and fuel.
- ✿ Exacerbating our impact on the environment.
- ✿ Compounding HIPPO.
- ✿ This inevitably means further expansion into—and exploitation of—high biodiversity areas.



The erosion of Java: urbanization and loss of nature

As humans expand, more and more land is converted to satisfy our needs, sacrificing existing ecosystems.



Buchori et al. (2017)





Overharvesting

- ✿ Essentially overexploitation, with both overharvesting and overconsumption.
- ✿ Harvesting at rates that exceed a population's ability to rebound.
 - ✿ Overhunting, overfishing, unsustainable logging.
- ✿ Excessive use of natural resources; taking more than we need.



Overharvesting

- ✳ Overexploitation is a major cause of the emptying of the world's oceans (Rocha et al. 2014).
- ✳ Top carnivores are affected by our exploitation, because we take their prey.
- ✳ It's not just about taking resources:
 - ✳ More energy demand means more mining, drilling, and even more space necessary for renewables.

3

What you know might not be the truth





What you know might not be the truth

- * The following slides should not discourage you or make you feel bad.
- * This is not about dunking on people trying to do good.
- * Instead they warn against complacency, half-measures, and false solutions.



We cannot save every species

Conservation is always a lower priority than human progress, so we don't have enough time, money, or manpower to save every species.



Which species
would you
choose to save?





A giant panda is seen from behind, sitting on a weathered wooden log. It is surrounded by green bamboo leaves and stems. The panda's black and white fur is prominent against the brown wood and greenery.

How do we decide if
a species is more
“important” than
another?

What is “worth” saving
depends on our values.



Would you
rather save the
orangutan or
have enough oil
for gorengan?

It depends on how
much we value
exploiting Earth's
resources.



“Green” energy is a misnomer

All forms of energy have emissions—including renewables. Building renewable energy arrays requires mined resources.



The background image shows a vast solar farm in a desert, with numerous solar panels arranged in long rows under a clear blue sky. In the distance, mountains are visible. A small circular logo with a stylized symbol is located in the bottom left corner.

“Green” energy is a misnomer

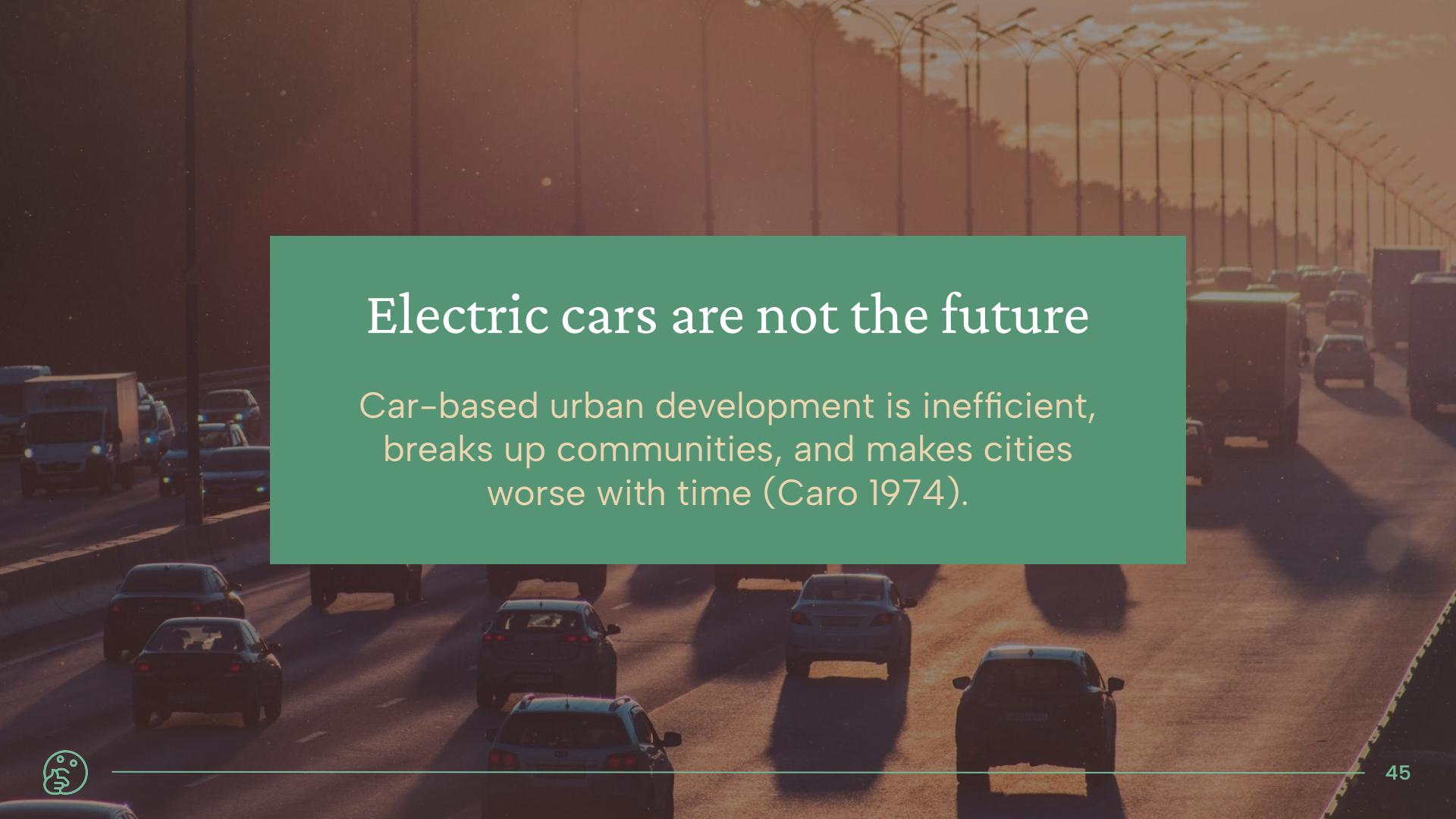
Renewables also require massive tracts of land, with ecosystem-level effects. Land must be cleared and animals displaced.



Photos: Goncalves and Pereira (2022)

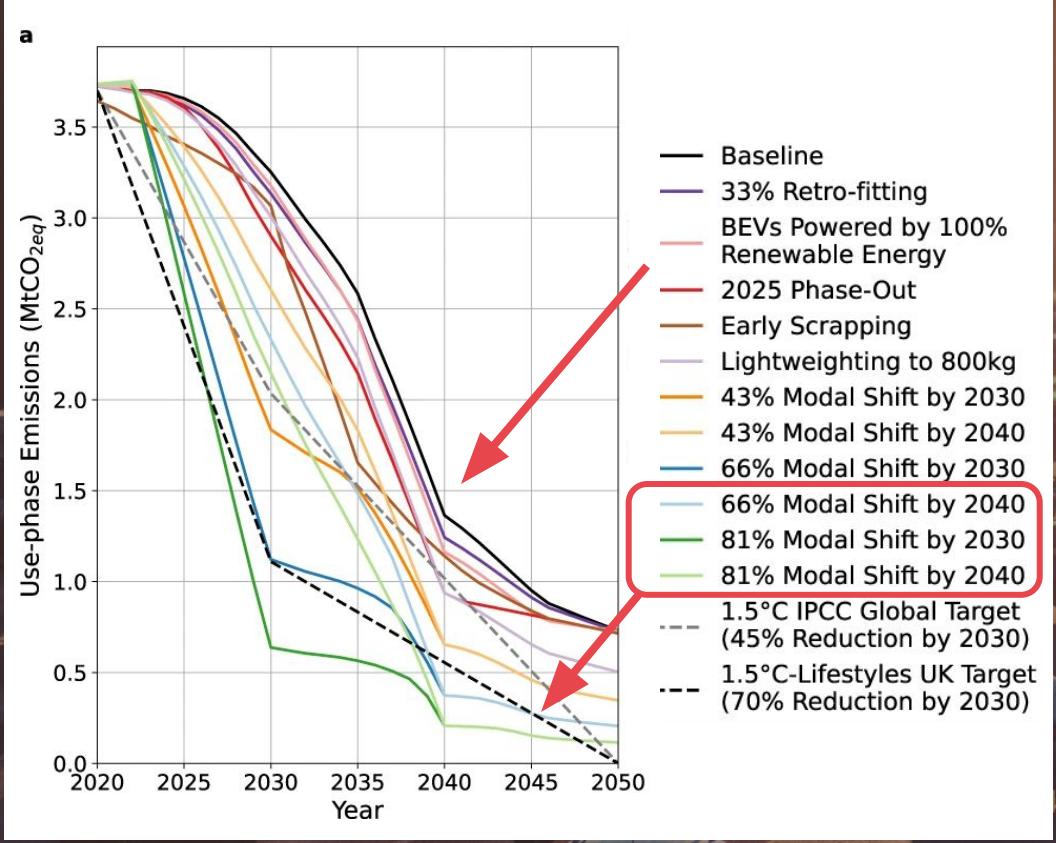
“Green” energy
is a misnomer

Floating solar panels
solve the land
availability problem,
but... what happens to
aquatic species?

A photograph of a multi-lane highway during sunset or sunrise. The sky is a warm orange and yellow. Numerous streetlights line both sides of the road, their light reflecting off the asphalt. In the foreground, several cars are visible from behind, moving away from the viewer. The background shows more of the highway stretching into the distance.

Electric cars are not the future

Car-based urban development is inefficient,
breaks up communities, and makes cities
worse with time (Caro 1974).



Winkler et al. (2023)

Electric cars are not the future

A UK study suggests we must abandon the status quo and change our transportation habits radically—more than a 100% switch to EVs.





Countries in the Global South struggle to meet development and climate goals because they are drained by the North

Southern resources are used to service Northern consumption, creating ecologically unequal exchange.

“

“In 2015 the North net appropriated from the South [\$10.8 trillion] – enough to end extreme poverty 70 times over.”

“For every dollar [countries] receive in aid they lose resources worth 30 dollars through drain.”

Hickel et al. (2022)

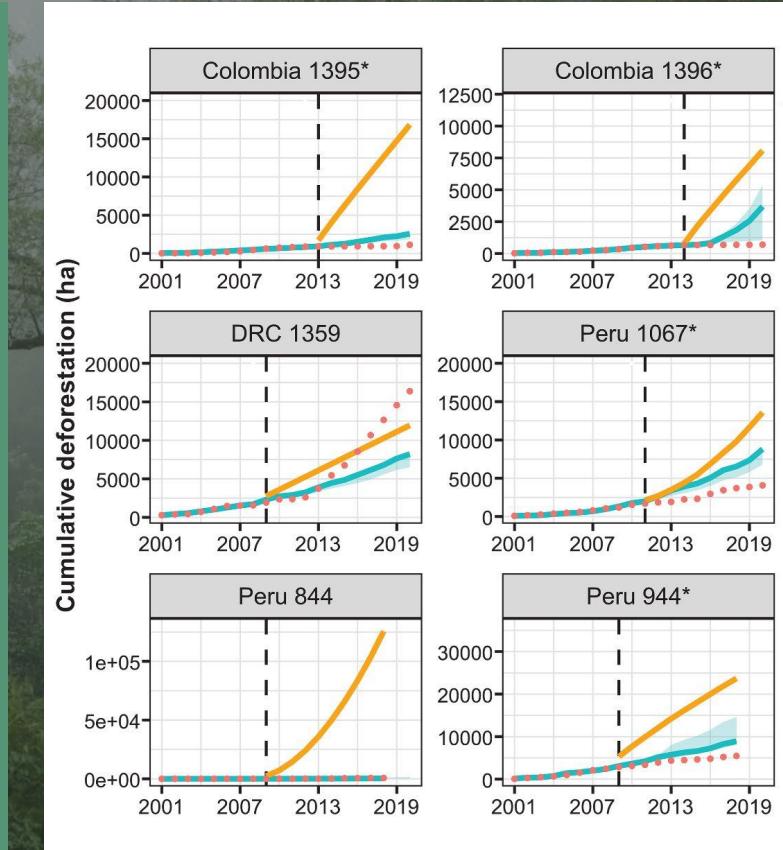


We will feel climate change more than others, but Indonesia has a global responsibility

Under a 2.7°C scenario, over 100 million Indonesians will suffer from unprecedented heat exposure (Lenton et al. 2023). It might be unfair, but as a biodiversity hotspot, protecting forests is not just a national responsibility.

Carbon offsets feel good but have mostly failed

94% of carbon credits are worthless (Greenfield 2023); REDD+ projects have struggled to actually reduce deforestation (West et al. 2023), can harm forest communities (Poudyal 2018), and may create a false sense of security.



West et al. (2023)





We're
underestimating
the impact of
consuming meat
and dairy

Where people rank the biggest contributors to global warming



Biggest contributor



Smallest contributor

% ranked 1st (biggest contributor)

USA

UK

DE

FR

BR

Fossil fuels (coal, oil and gas)

Deforestation

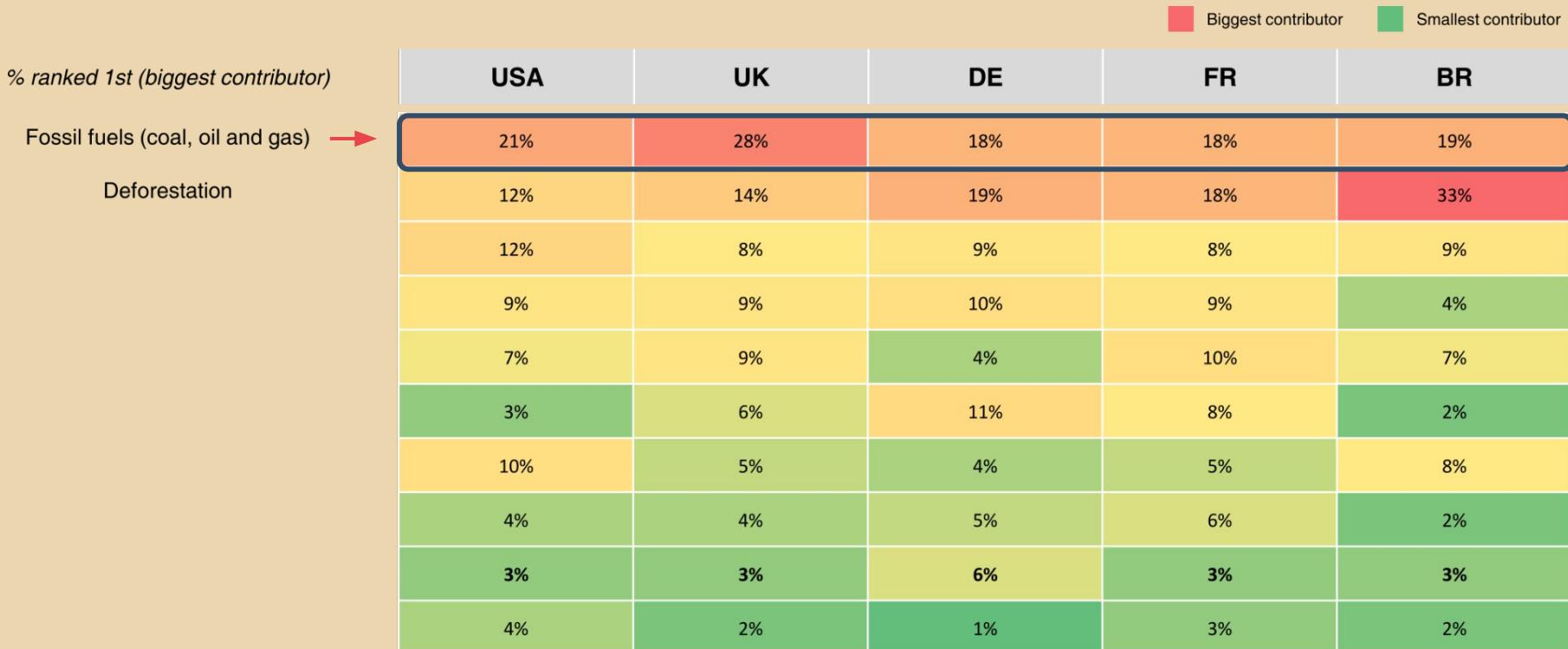


	USA	UK	DE	FR	BR
Fossil fuels (coal, oil and gas)	21%	28%	18%	18%	19%
Deforestation	12%	14%	19%	18%	33%
	12%	8%	9%	8%	9%
	9%	9%	10%	9%	4%
	7%	9%	4%	10%	7%
	3%	6%	11%	8%	2%
	10%	5%	4%	5%	8%
	4%	4%	5%	6%	2%
	3%	3%	6%	3%	3%
	4%	2%	1%	3%	2%

Northstar (2023)



Where people rank the biggest contributors to global warming



Northstar (2023)



Where people rank the biggest contributors to global warming



Biggest contributor



Smallest contributor

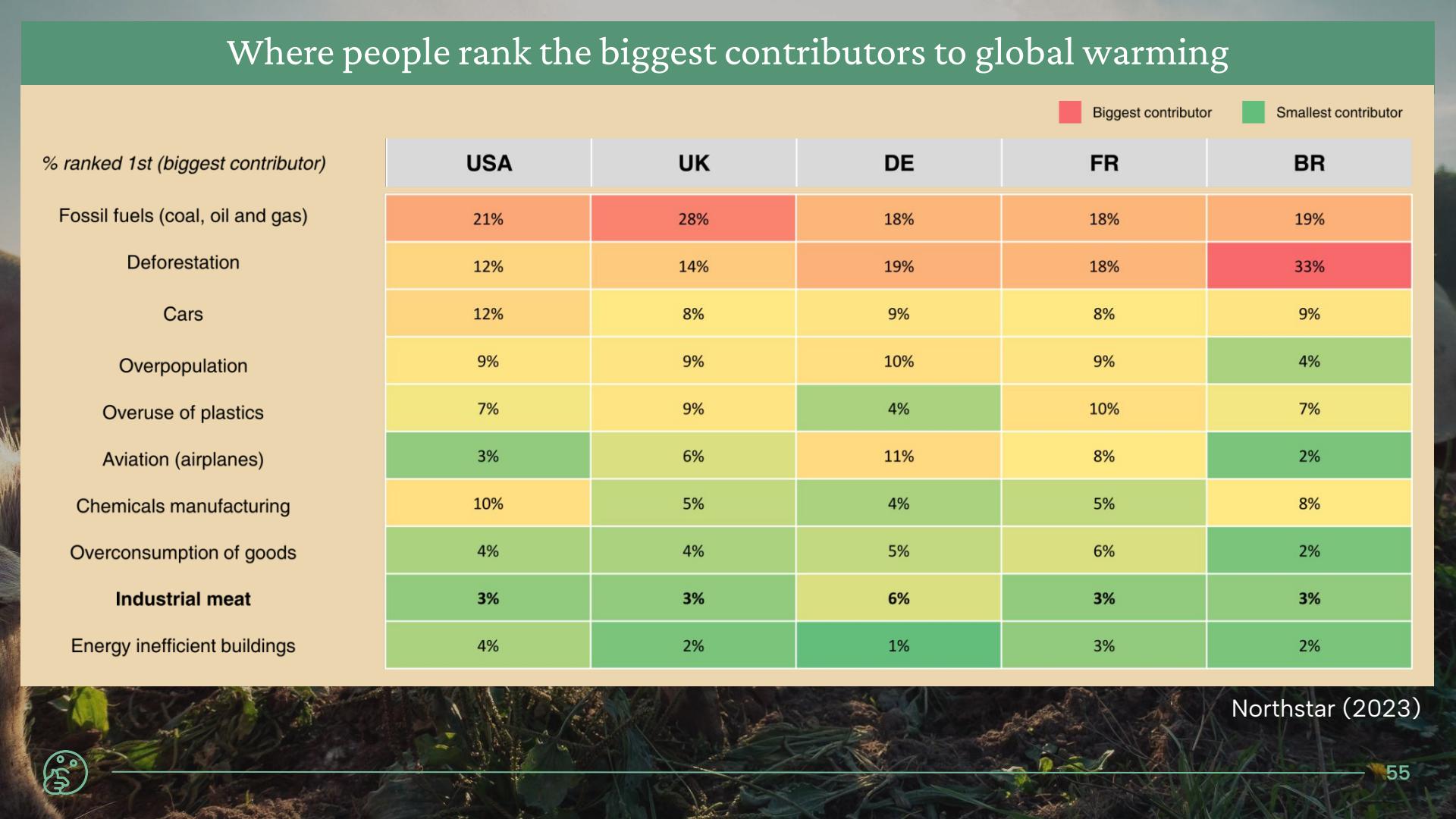
% ranked 1st (biggest contributor)

	USA	UK	DE	FR	BR
Fossil fuels (coal, oil and gas)	21%	28%	18%	18%	19%
Deforestation	12%	14%	19%	18%	33%
	12%	8%	9%	8%	9%
	9%	9%	10%	9%	4%
	7%	9%	4%	10%	7%
	3%	6%	11%	8%	2%
	10%	5%	4%	5%	8%
	4%	4%	5%	6%	2%
Industrial meat	3%	3%	6%	3%	3%
	4%	2%	1%	3%	2%



Northstar (2023)

Where people rank the biggest contributors to global warming



A heatmap showing the percentage of people ranking various factors as the biggest contributor to global warming across five countries: USA, UK, DE, FR, and BR. The factors are listed on the left, and the percentage values are in the cells. A color scale indicates the ranking: orange/yellow for highest (biggest contributor), green for middle, and red for lowest (smallest contributor).

% ranked 1st (biggest contributor)	USA	UK	DE	FR	BR
Fossil fuels (coal, oil and gas)	21%	28%	18%	18%	19%
Deforestation	12%	14%	19%	18%	33%
Cars	12%	8%	9%	8%	9%
Overpopulation	9%	9%	10%	9%	4%
Overuse of plastics	7%	9%	4%	10%	7%
Aviation (airplanes)	3%	6%	11%	8%	2%
Chemicals manufacturing	10%	5%	4%	5%	8%
Overconsumption of goods	4%	4%	5%	6%	2%
Industrial meat	3%	3%	6%	3%	3%
Energy inefficient buildings	4%	2%	1%	3%	2%

Northstar (2023)



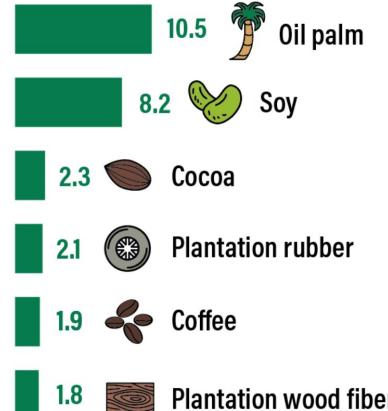


Deforestation (2001-15, million hectares)

45.1



Cattle
(pasture as land use)



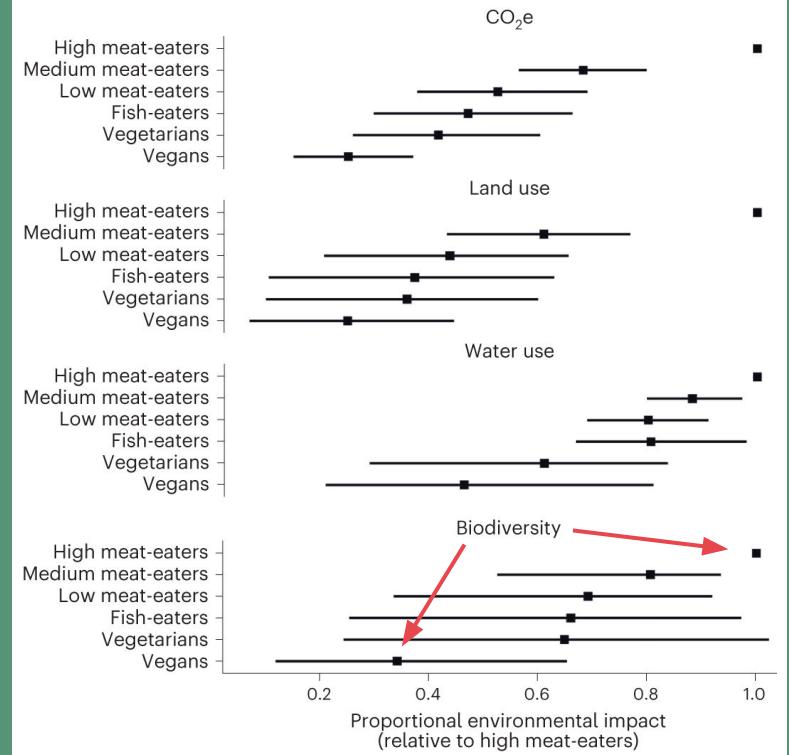
Source: Global Forest Review

21.02.09



WORLD RESOURCES INSTITUTE

More than palm oil and soy production, cattle ranching is by far the primary cause of forest replacement (Goldman 2020).



A non-meat diet is consistently less harmful to the environment
(Scarborough et al. 2023).

4

Our ecological footprint





What can we do?

- ✳ Everyone has a carbon footprint... but before we can act, we must highlight the most harmful people on the planet: **billionaires**.
- ✳ Billionaires' carbon footprint is hundreds to thousands of times that of yours.

Roman Abramovich

Emitted ~34,000 metric tons of
CO₂... equal to 8,500 people.

Annual emissions in 2018, based on Wilk and Barros (2021).



Bill Gates

Emitted ~7,500 metric tons of
CO₂... equal to 1,875 people.

Annual emissions in 2018, based on Wilk and Barros (2021).



Elon Musk

Emitted ~2,100 metric tons of
CO₂... equal to 525 people.

Annual emissions in 2018, based on Wilk and Barros (2021).





What can we do?

- ✳ It helps to reduce meat, dairy, and energy consumption, but...
- ✳ Without addressing the emissions of the world's richest people, focusing on our personal footprint is meaningless.
- ✳ We have to work together, and advocate societal changes.



Two potential ways

- ✿ Green growth:
 - ✿ It's possible to maintain economic growth *and* ensure a sustainable future; e.g. with better technology.
- ✿ Degrowth (or post-growth):
 - ✿ A sustainable future means we must slow economic growth, consumption, and energy usage (Hickel et al. 2022).
- ✿ No consensus on best way (Boston 2022).



What we can do!

- ✿ With degrowth, we acknowledge the *intrinsic* value of Earth and our place in it.
- ✿ Scale down the destructive industries.
- ✿ End planned obsolescence, encourage reuse and longer-lasting products.
- ✿ Universal public services.
 - ✿ Healthcare, education, housing, food, internet, energy.



What we can do!

- ✿ Train and mobilize labour towards restoration, retrofitting, and social care.
- ✿ Protect and support forest communities so they don't depend on exploitation.
- ✿ Reduce working time, so people can focus on rehabilitative tasks.
- ✿ Debt Jubilee focused on the poorest nations, ending the uneven exchange (Graeber 2011).
- ✿ And finally... we can organize.

Billionaires
don't want to
become
millionaires.



Corporations don't want to stop.

"We can't stop oil today. We can't stop oil in the next 10 to 20 to 30 years, and in fact, we don't need to ever stop oil because it's really about the emissions, it's not about the fuel source," Hollub said. "We believe that using CO₂ and enhanced oil recovery provides a means to generate net zero-carbon oil so that we can help to decarbonize aviation and maritime industries."

Johnson (2022)





Organize!

- * We must accept that the greatest polluters won't change willingly.
- * And also that we will have to change our own lifestyles and habits.
- * But working alone won't get it done.
- * If we develop community resilience, whatever hardship comes, we will be able to tackle it together.

Thank you



<https://allisfoundintime.com>



@LellyBaeta

cc This presentation is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International license](#).

References

- Boston J. 2022. Living within biophysical limits: green growth versus degrowth. *Policy Q.* 18(2):81–92. doi:[10.26686/pq.v18i2.7578](https://doi.org/10.26686/pq.v18i2.7578).
- Buchori I, Sugiri A, Maryono, Pramitasari A, Pamungkas ITD. 2017. Theorizing spatial dynamics of metropolitan regions: a preliminary study in Java and Madura Islands, Indonesia. *Sustainable Cities Soc.* 35:468–482. doi:[10.1016/j.scs.2017.08.022](https://doi.org/10.1016/j.scs.2017.08.022).
- Caro R. 1974. *The power broker*. New York: Knopf.
- Cowie RH, Bouchet P, Fontaine B. 2022. The Sixth Mass Extinction: fact, fiction or speculation? *Biol Rev.* 97:640–663. doi:[10.1111/bry.12816](https://doi.org/10.1111/bry.12816).
- Goldman E, Weisse MJ, Harris N, Schneider M. 2020. “Estimating the role of seven commodities in agriculture-linked deforestation: oil palm, soy, cattle, wood fiber, cocoa, coffee, and rubber. Washington, DC: World Resources Institute.
<https://files.wri.org/s3fs-public/estimating-role-seven-commodities-agriculture-linked-deforestation.pdf>.
- Goncalves S, Pereira M. 2022. Portugal set to start up Europe's largest floating solar park. *World Economic Forum* and *Reuters*; [accessed 2023 Aug 29].
<https://www.weforum.org/agenda/2022/05/portugal-europe-floating-solar-farm-renewable-energy>.
- Graeber D. 2011. *Debt: the first 5,000 years*. New York: Melville House.



References

- Greenfield P. 2023. Revealed: more than 90% of rainforest carbon offsets by biggest certifier are worthless, analysis shows. *The Guardian*; [accessed 2023 Aug 29].
<https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe>.
- Hickel J, Dorninger C, Wieland H, Suwandi I. 2022. Imperialist appropriation in the world economy: Drain from the global South through unequal exchange, 1990–2015. *Global Environ Change*. 73:102467.
doi:[10.1016/j.gloenvcha.2022.102467](https://doi.org/10.1016/j.gloenvcha.2022.102467).
- Hickel J, Kallis G, Jackson T, O'Neill DW, Schor JB, Steinberger JK, Victor PA, Ürge-Vorsatz D. 2022. Degrowth can work — here's how science can help. *Nature* 612:400–403. doi:[10.1038/d41586-022-04412-x](https://doi.org/10.1038/d41586-022-04412-x).
- Johnson L. 2022. New US law to accelerate Oxy's DAC build-out. *Energy Intelligence*; [accessed 2023 Aug 20].
<https://www.energyintel.com/00000183-a796-dd9a-abb7-b7df92190000>.
- Kong X, Zhou Z, Jiao L. 2021. Hotspots of land-use change in global biodiversity hotspots. *Resour Conserv Recycl*. 174:105770. doi:[10.1016/j.resconrec.2021.105770](https://doi.org/10.1016/j.resconrec.2021.105770).
- Lamkin M, Miller AI. On the challenge of comparing contemporary and deep-time biological-extinction rates. *BioScience*. 66(9):785–789. doi:[10.1093/biosci/biw088](https://doi.org/10.1093/biosci/biw088).
- Lenton TM, Xu C, Abrams JF, Ghadiali A, Loriani S, Sakschewski B, Zimm C, Ebi KL, Dunn RR, Svenning J-C, Scheffer M. 2023. Quantifying the human cost of global warming. *Nat Sustain*. doi:[10.1038/s41893-023-01132-6](https://doi.org/10.1038/s41893-023-01132-6).



References

- Li X, Wiens JJ. 2023. Estimating global biodiversity: the role of cryptic insect species. *Syst Biol.* 72(2):391–403. doi:[10.1093/sysbio/syac069](https://doi.org/10.1093/sysbio/syac069).
- Martin PS, Klein RG, editors. 1984. Quaternary extinctions: a prehistoric revolution. Tucson: University of Arizona Press.
- Northstar. 2023. Tackling industrial meat: understanding public attitudes, concerning issues and impactful solutions. Madre Brava; [accessed 2023 Aug 20].
https://madrebrava.org/media/pages/insight/people-don-t-see-industrial-meat-as-a-key-cause-of-global-warming-pol/f945535138-1678895057/madre-brava_industrial-meat-production_northstar-public-survey_version-for-publication-media.pdf.
- Poudyal M, Jones JP, Rakotonarivo OS, Hockley N, Gibbons JM, Mandimbiniaina R, Rasoamanana A, Andrianantenaina NS, Ramamonjisoa BS. 2018. Who bears the cost of forest conservation?. *PeerJ.* 6:e5106. doi:[10.7717/peerj.5106](https://doi.org/10.7717/peerj.5106).
- Rocha RC, Clapham PJ, Ivashchenko YV. 2014. Emptying the oceans: a summary of industrial whaling catches in the 20th century. *Mar Fish Rev.* 76(4):37–48.
<https://www.whalingmuseum.org/wp-content/uploads/2021/04/mfr7643-Emptying-the-Oceans.pdf>.
- Scarborough P, Clark M, Cobioc L, Papier K, Knuppel A, Lynch J, Harrington R, Key T, Springmann M. 2023. Vegans, vegetarians, fish-eaters and meat-eaters in the UK show discrepant environmental impacts. *Nat Food.* 4:565–574. doi:[10.1038/s43016-023-00795-w](https://doi.org/10.1038/s43016-023-00795-w).



References

Schumm M, Edie SM, Collins KS, Gómez-Bahamón V, Supriya K, White AE, Price TD, Jablonski D. 2019. Common latitudinal gradients in functional richness and functional evenness across marine and terrestrial systems. Proc R Soc B. 286:20190745. doi:[10.1098/rspb.2019.0745](https://doi.org/10.1098/rspb.2019.0745).

United Nations. 1992. Convention on Biological Diversity. United Nations; [accessed 2023 Aug 25].
<https://www.cbd.int/doc/legal/cbd-en.pdf>.

West TAP, Wunder S, Sills EO, Börner J, Rifai SW, Neidermeier AN, Frey GP, Kontoleon A. 2023. Action needed to make carbon offsets from forest conservation work for climate change mitigation. Science. 381(6660):873–877. doi:[10.1126/science.adc3535](https://doi.org/10.1126/science.adc3535).

Wilk R, Barros B. 2021. Private planes, mansions and superyachts: what gives billionaires like Musk and Abramovich such a massive carbon footprint. *The Conversation*; [accessed 2023 Aug 30].
<https://theconversation.com/private-planes-mansions-and-superyachts-what-gives-billionaires-like-musk-and-abramovich-such-a-massive-carbon-footprint-152514>.

Wilson EO. 2002. The future of life. New York: Knopf.

Winkler L, Pearce D, Nelson J. 2023. The effect of sustainable mobility transition policies on cumulative urban transport emissions and energy demand. Nat Commun. 14:2357. doi:[10.1038/s41467-023-37728-x](https://doi.org/10.1038/s41467-023-37728-x).



Image credits

"Silhouette of trees covered by fog," Paul Pastourmatzis, https://unsplash.com/photos/KT3WlrL_bsq, Unsplash license.

"Group of reindeer in grass field during sunrise," Lareised Leneseur, <https://unsplash.com/photos/2tmgPS-WVAc>, Unsplash license.

"Aerial view of green trees and river during daytime," Ivars Utināns, <https://unsplash.com/photos/vkQgbIIZZPQ>, Unsplash license.

"Green plants and trees near water falls," Kyle Cleveland, <https://unsplash.com/photos/VDPFEyIrAn0>, Unsplash license.

"Orange and white clownfish hiding in sea anemone," Sebastian Pena Lambarri, https://unsplash.com/photos/poly_hmhwJs, Unsplash license.

"Clown fish on coral reef," David Clode, <https://unsplash.com/photos/HDVmdzQxAds>, Unsplash license.

"Insects and fruit," provided by Rijksmuseum via Europeana, https://unsplash.com/photos/lP_rsdwdx0c, public domain.

"Squirrel nut bin," Charlotte Harrison, <https://unsplash.com/photos/qvYYiCcHccQ>, Unsplash license.

"Just a T-Rex at the beach," Hannah Pemberton, https://unsplash.com/photos/3d82e5_ylGo, Unsplash license.

Image credits

"A close up of a tree with green leaves," Ivan Lopatin, <https://unsplash.com/photos/tevlhPwRZFk>, Unsplash license.

"Sudan (*Ceratotherium simum cottoni*)," Make it Kenya/Stuart Price, [https://commons.wikimedia.org/wiki/File:Sudan_\(Ceratotherium_simum_cottoni\)_2015-05-22.jpg](https://commons.wikimedia.org/wiki/File:Sudan_(Ceratotherium_simum_cottoni)_2015-05-22.jpg), public domain.

"Hippo and calf in the Mara River i Masai Mara, Kenya," Henrik Hansen, <https://unsplash.com/photos/e3DC7S0WFL8>, Unsplash license.

"Hippo Car," Francesco Ungaro, <https://unsplash.com/photos/ViNS4X3sBoU>, Unsplash license.

"Green trees and brown soil," Justus Menke, <https://unsplash.com/photos/Xywi2MePIYQ>, Unsplash license.

"Pile of brown wood logs," Justus Menke, <https://unsplash.com/photos/fltWcgh69-8>, Unsplash license.

"Ocean texture in Tenerife," Kamil Molendys, https://unsplash.com/photos/meDPb_qB-Go, Unsplash license.

"Textured green plant leaves," Ivan Lopatin, <https://unsplash.com/photos/uLlhgnelFNk>, Unsplash license.

"Northern Pacific seastar (*Asterias amurensis*), Lycoo, <https://commons.wikimedia.org/wiki/File:%E6%B5%B7%E6%98%9F%EF%BC%88%E6%AD%A3%E9%9D%A2%EF%BC%89.JPG>, public domain.

"Barking up the right tree," Jude Infantini, <https://unsplash.com/photos/ml-QcAP95Ok>, Unsplash license.

Image credits

"*Oreochromis mossambicus* or Mozambique Tilapia at the Cincinnati Zoo," Greg Hume,
https://en.wikipedia.org/wiki/Mozambique_tilapia#/media/File:Oreochromis_mossambicus.JPG, CC BY-SA.

"Joaquim with Caramel," Joaquim Baeta, CC BY.

"*Python bivittatus*, Burmese python (juvenile)," Rushen/Thai National Parks,
[https://commons.wikimedia.org/wiki/File:Python_bivittatus,_Burmese_python_\(juvenile\)_-_Kaeng_Krachan_National_Park_\(26928549504\).jpg](https://commons.wikimedia.org/wiki/File:Python_bivittatus,_Burmese_python_(juvenile)_-_Kaeng_Krachan_National_Park_(26928549504).jpg), CC BY-SA.

"NYC," Thijs Stoop, https://unsplash.com/photos/A_AQxGz9z5I, Unsplash license.

"The Exchange 106 Tower (TRX)," Izuddin Helmi Adnan, <https://unsplash.com/photos/30GHFbRbgZA>, Unsplash license.

"Yellow fishing nets," David Clode, <https://unsplash.com/photos/qix13-hfGFs>, Unsplash license.

"Assorted color cattles," Robert Bye, <https://unsplash.com/photos/dOEIUitX2Do>, Unsplash license.

"Puffin looking over cliff," Nicholas Kampouris, https://unsplash.com/photos/H_M4dX_FlQ, Unsplash license.

"Maine coon on wood floor," Kanashi, <https://unsplash.com/photos/zCFkafZ5tCQ>, Unsplash license.

"A crocodile jumping from a river in Darwin, Northern Territory, Australia," Simon Watkinson,
<https://unsplash.com/photos/qdq2Hxyjz4M>, Unsplash license.

Image credits

"Panda sitting on log," Li Jiangang, https://unsplash.com/photos/b4IS_gXkQp0, Unsplash license.

"Majestic male Orangutan, Borneo," Simone Millward, https://unsplash.com/photos/nKGio_6E_4k, Unsplash license.

"Frying spring rolls," Joshua Hoehne, https://unsplash.com/photos/30-l5M0v_m8, Unsplash license.

"Solar panels under blue sky," American Public Power Association, <https://unsplash.com/photos/XGAZzyLzn18>, Unsplash license.

"Aerial photo of creek under white clouds during daytime," Steven Sepulveda, https://unsplash.com/photos/_HuYhsnbdhw, Unsplash license.

"Cars on a highway," Aleksandr Popov, https://unsplash.com/photos/Xbh_OGLRfUM, Unsplash license.

"Dollar bills," Alexander Grey, <https://unsplash.com/photos/8lnbXtxFGZw>, Unsplash license.

"Fire in the Journalista Roberto Marinho Avenue that hit the 'favela do Piolho,'" Denys Argyriou, <https://unsplash.com/photos/VU03qDREAqU>, Unsplash license.

"Mountain forest," Lingchor, <https://unsplash.com/photos/lDyIK7RkLeA>, Unsplash license.

"Luckypig," Pascal Debrunner, https://unsplash.com/photos/b-zyMn_e_R4, Unsplash license.

Image credits

“MOOOOOOOO,” Subtle Cinematics, <https://unsplash.com/photos/V4Mo8UYKRvY>, Unsplash license.

“Pig looking at camera,” Dan Renco, <https://unsplash.com/photos/Y06imaOLycY>, Unsplash license.

“Two Indonesian males clean the beach on behalf of ocean cleanup group,” OCG Saving The Ocean, <https://unsplash.com/photos/xch7jXAaqqo>, Unsplash license.

“Red footprint on a wooden stump in a forest near a walking trail,” Grant Durr, https://unsplash.com/photos/gPc_gwYGv7U, Unsplash license.

“Underwater and bubbles,” Cristian Palmer, <https://unsplash.com/photos/3leBubkp5hk>, Unsplash license.

“Roman Abramovich,” Amir Hosseini, [https://commons.wikimedia.org/wiki/File:Roman_Abramovich_2_\(cropped\).png](https://commons.wikimedia.org/wiki/File:Roman_Abramovich_2_(cropped).png), CC BY.

“Bill Gates 2017,” Kuhlmann/MSC, [https://commons.wikimedia.org/wiki/File:Bill_Gates_2017_\(cropped\).jpg](https://commons.wikimedia.org/wiki/File:Bill_Gates_2017_(cropped).jpg), CC BY.

“Elon Musk Colorado 2022”, Trevor Cokley for U.S. Air Force, [https://commons.wikimedia.org/wiki/File:Elon_Musk_Colorado_2022_\(cropped2\).jpg](https://commons.wikimedia.org/wiki/File:Elon_Musk_Colorado_2022_(cropped2).jpg), public domain.

“A glass jar filled with coins and a plant,” Towfiq Barbhuiya, https://unsplash.com/photos/joqWSI9u_XM, Unsplash license.

“Bosco verticale 121,” Ricardo Gomez Angel, <https://unsplash.com/photos/WsEAiVwGrwo>, Unsplash license.

Image credits

"Russ Hanneman (Chris Diamantopoulos) in Silicon Valley," from *Silicon Valley* (2015), used under fair use rationale.

"Rainbow oil patch on tarmac," John Rourke, <https://unsplash.com/photos/5iZWUKSh0Rc>, Unsplash license.

"Team building at RGB Parkour Tour," Shane Rounce, <https://unsplash.com/photos/DNkoNXQtI3c>, Unsplash license.

"Lelly during lecture," Joaquim Baeta, [CC BY](#).