

- WEBINAR -

Climate and Environmental Impacts of Agriculture

Solutions for a healthier planet



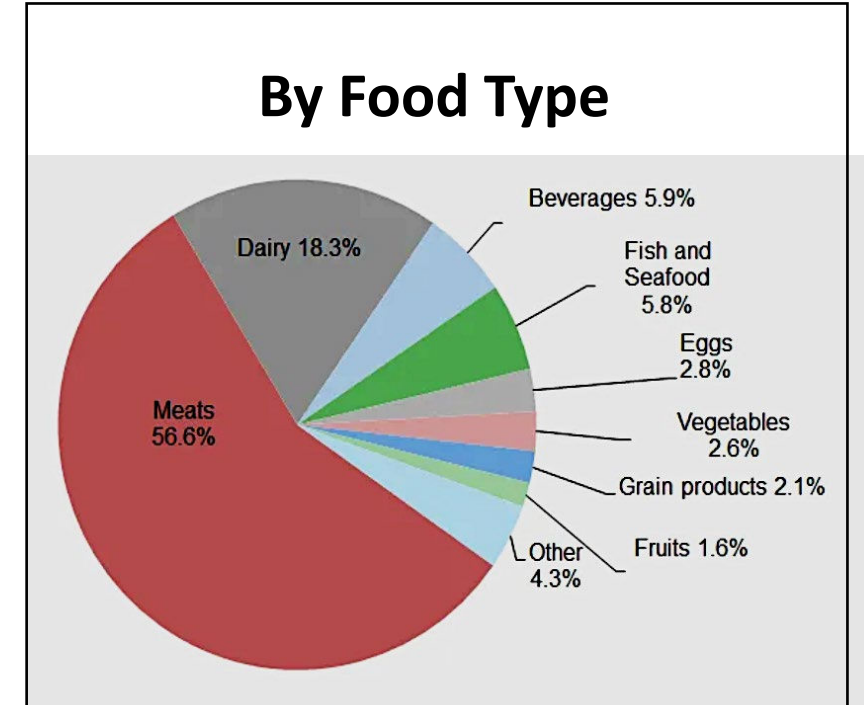
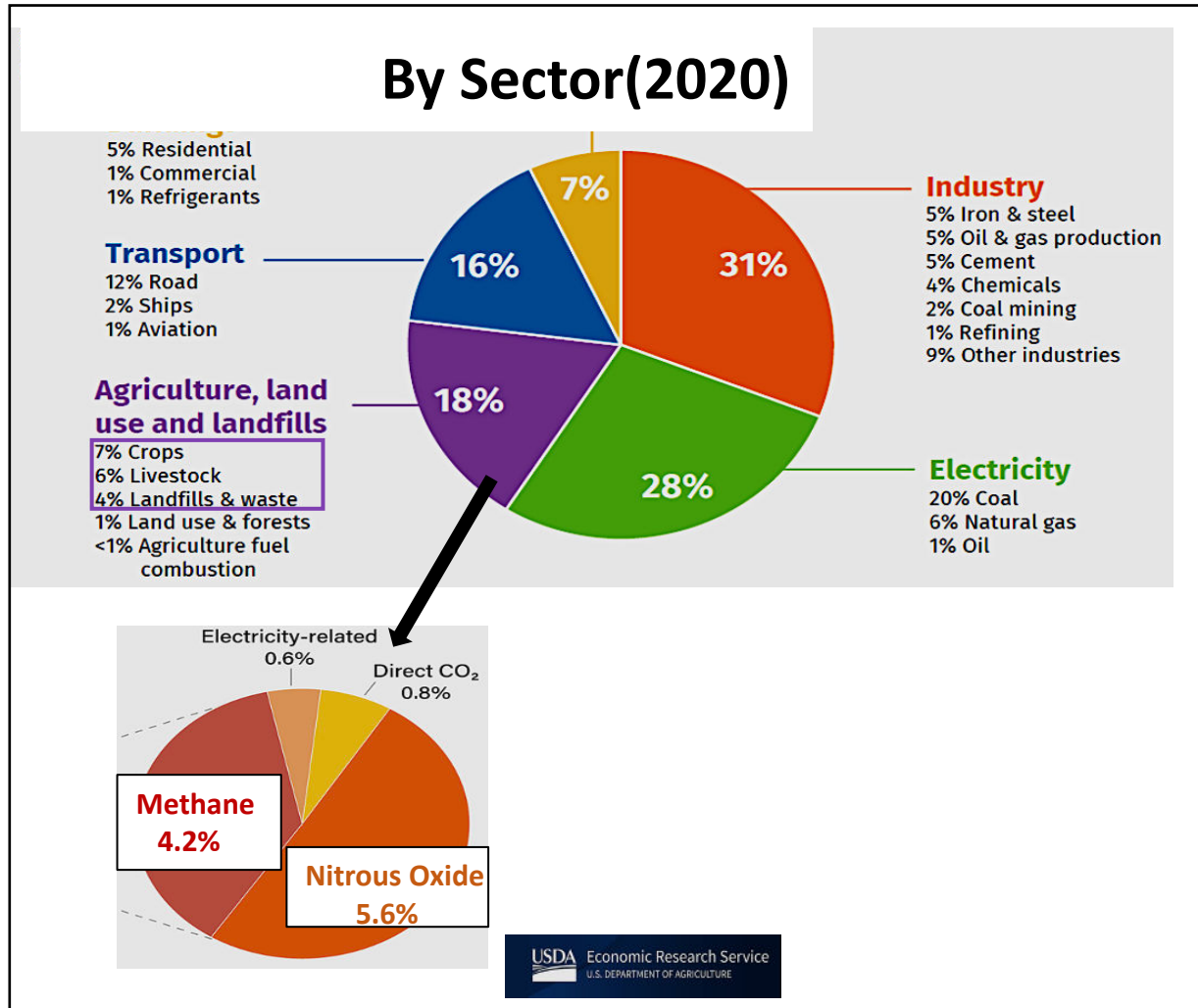
Speakers

- **Chandra Rosenthal JD**—Director of Rocky Mountain PEER
- **Sara Via, PhD**—Professor, University of Maryland
- **Kyla Bennett, PhD, JD**—Director of Science Policy and Northeast and Mid-Atlantic, PEER
- **Lydia Jahl, PhD**—Senior Scientist, Green Science Policy Institute

Questions from the Audience:

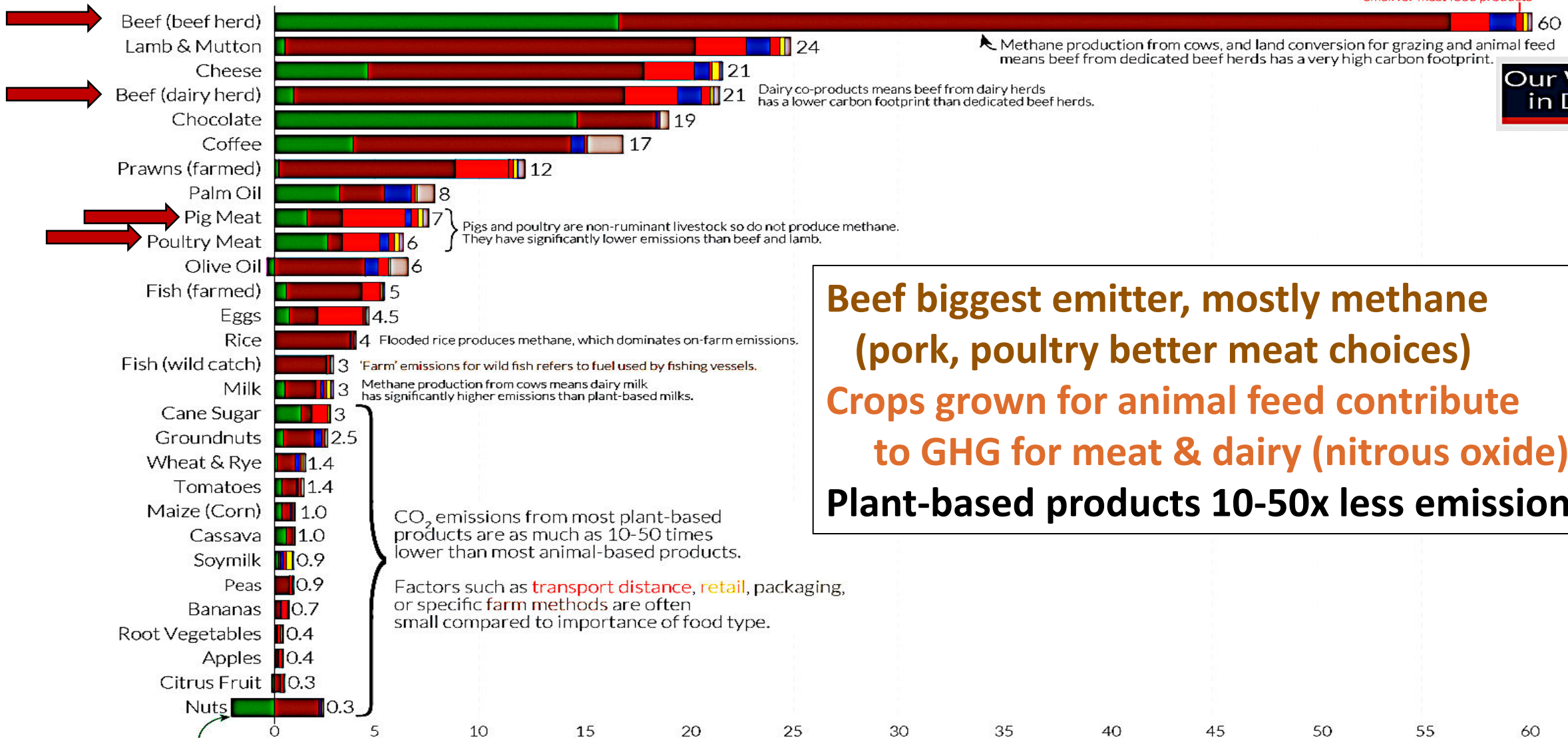
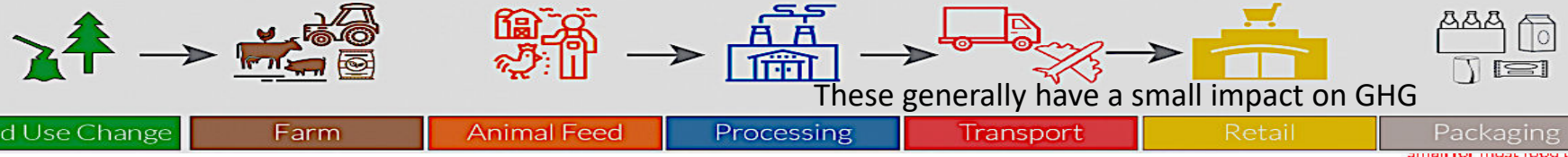
Please type your question in
the zoom Q&A function at the
bottom of your screen

Agriculture Causes 18% of Global GHG Emissions



Dr. Sara Via
Professor
University of Maryland
svia@umd.edu
www.climatecorner.org

GHG sources, different foods



Methane production from cows, and land conversion for grazing and animal feed means beef from dedicated beef herds has a very high carbon footprint.

Dairy co-products means beef from dairy herds has a lower carbon footprint than dedicated beef herds.

Pigs and poultry are non-ruminant livestock so do not produce methane. They have significantly lower emissions than beef and lamb.

Flooded rice produces methane, which dominates on-farm emissions.

'Farm' emissions for wild fish refers to fuel used by fishing vessels.

Methane production from cows means dairy milk has significantly higher emissions than plant-based milks.

CO₂ emissions from most plant-based products are as much as 10-50 times lower than most animal-based products.

Factors such as transport distance, retail, packaging, or specific farm methods are often small compared to importance of food type.

Nuts have a negative land use change figure because nut trees are currently replacing croplands; carbon is stored in the trees.

Beef biggest emitter, mostly methane (pork, poultry better meat choices)
Crops grown for animal feed contribute to GHG for meat & dairy (nitrous oxide)
Plant-based products 10-50x less emissions



<https://ourworldindata.org/food-choice-vs-eating-local>

Reducing Methane can Quickly Slow Warming & Decrease Acceleration of Climate Impacts

- CO₂ stays in atmosphere for 100s-1000s of years
- Methane 80x more warming power than CO₂ for first 20 years
- But methane's average stay in atmosphere only 12 years so its biggest impact is short term
- Methane expected to cause 50% of warming over next 20 years, so reducing methane emissions will really help over short term
- Could "buy time" to cut other fossil fuel emissions, decarbonize economy

Sources of Methane Emissions

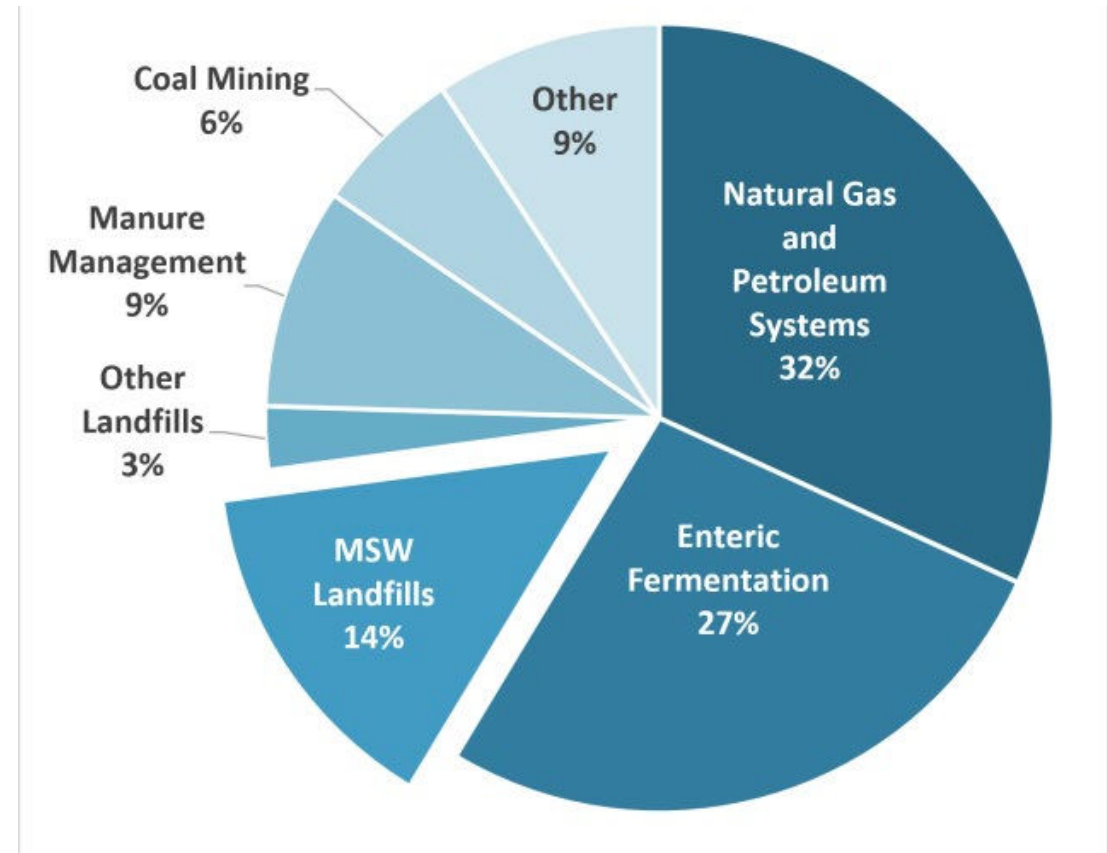
Livestock (cow burps & manure): **36%**

Natural Gas, Petroleum: **32%**

-flaring, leaks in transport & storage

Landfills: **14%**

-methane generated by anaerobic decomposition of food & yard waste
(better to compost!)



Livestock uses A LOT of land

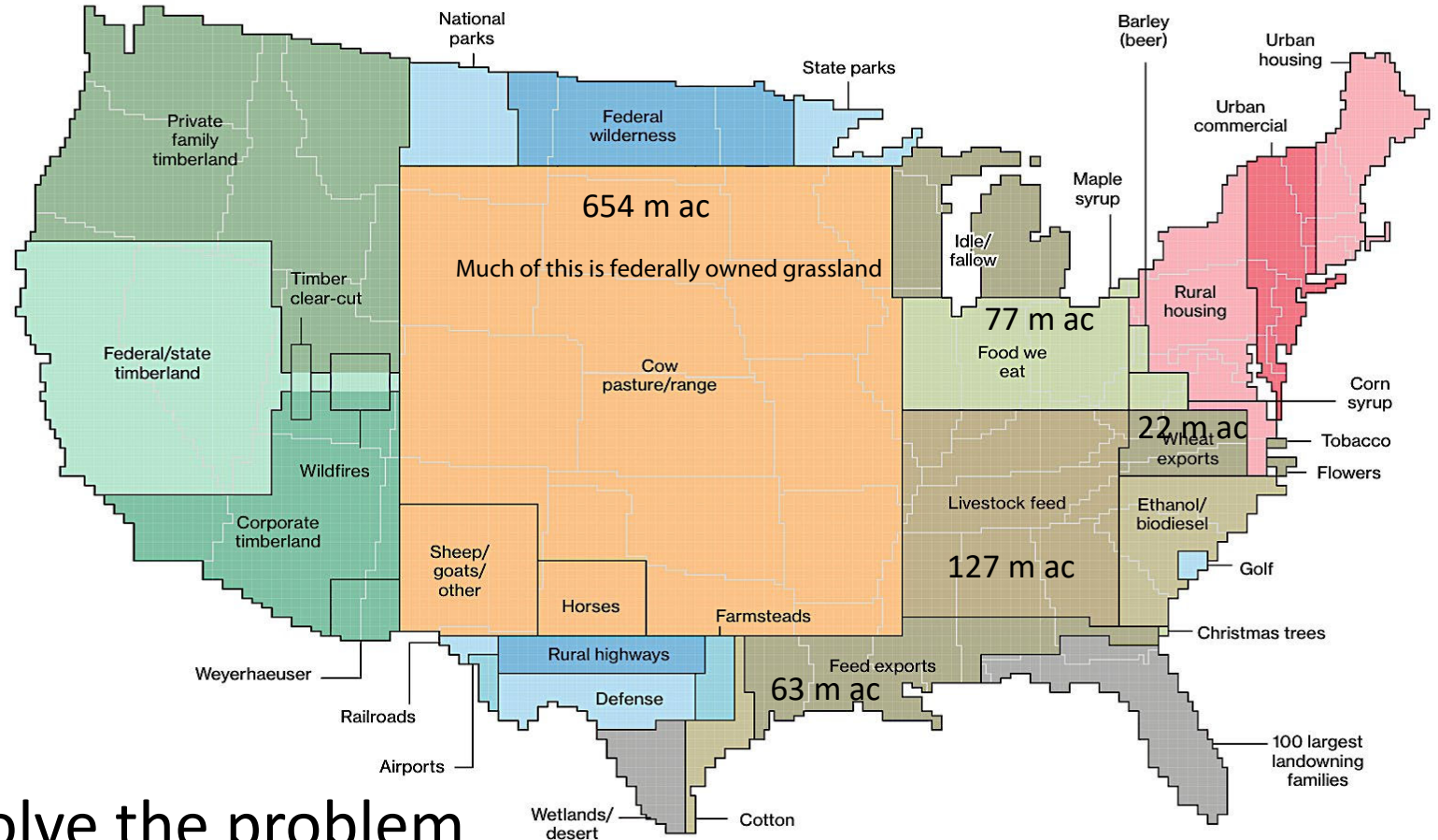
41% of all US land (83% of farmland)

We could use this land

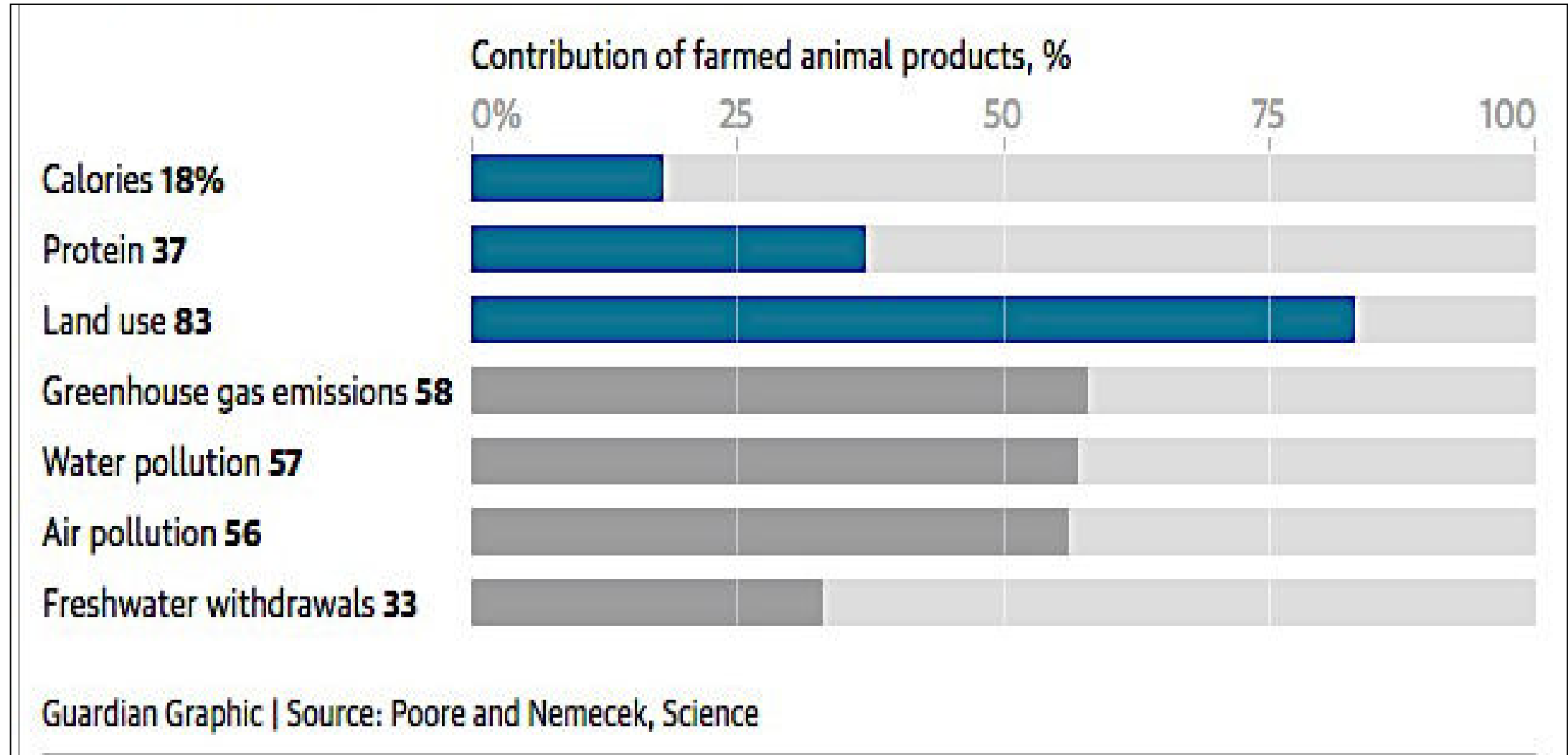
- to restore native grasslands & forests, boosting biodiversity, i.e., “rewilding”
- to grow plant foods for growing human population

Topic for another day:

- “grassfed” beef doesn’t solve the problem

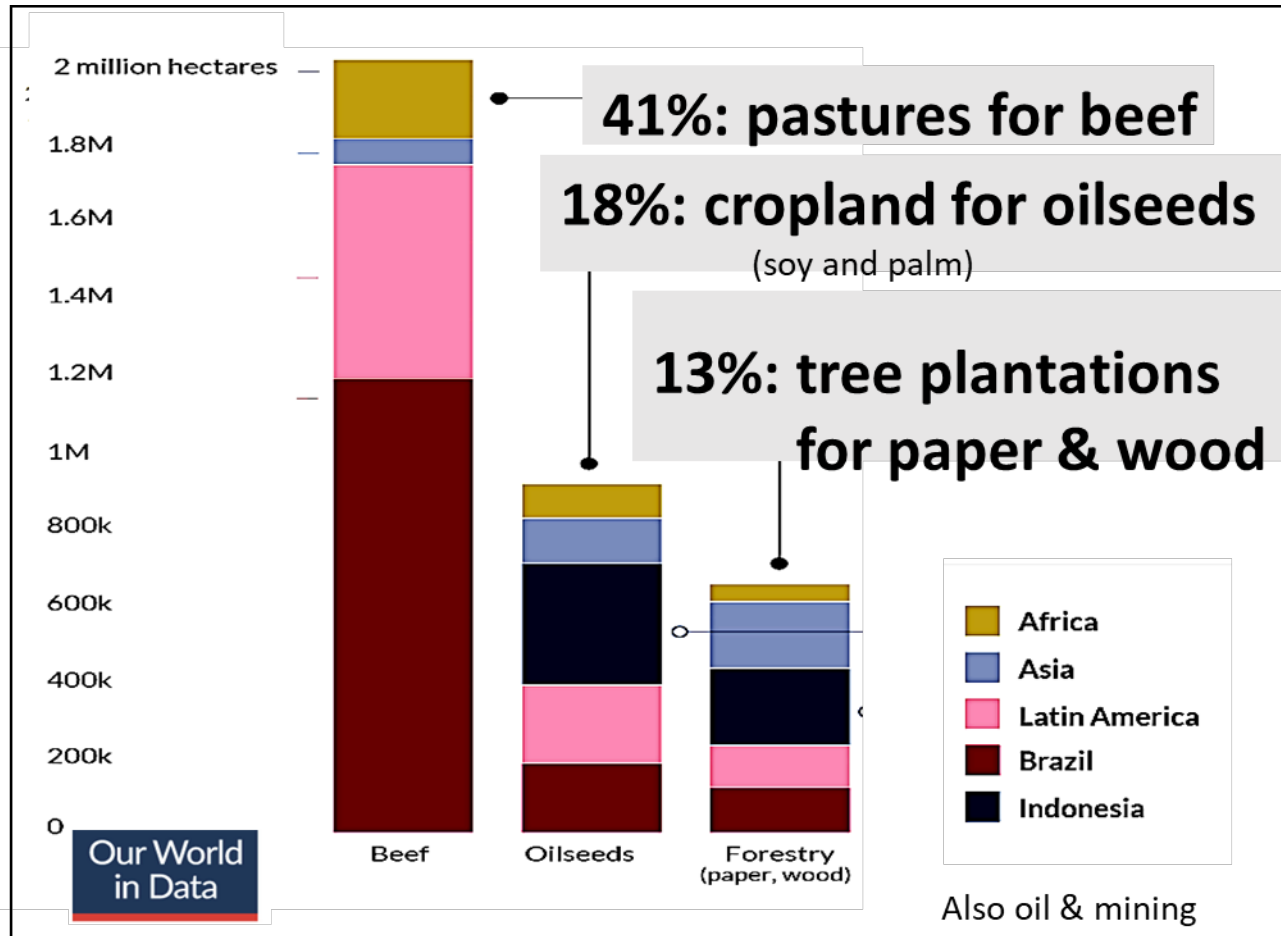


We don't get much food value for all the farmland used for livestock



Beef Causes 41% of all Tropical Deforestation

Tropical deforestation - causes



<https://www.washingtonpost.com/world/2022/03/14/amazon-rainforest-deforestation/>



<https://www.rainforest-rescue.org/topics/palm-oil/nestle>

Americans Buy Beef from Brazil Without Knowing It

Exclusive: US chains Walmart, Costco and Kroger selling Brazilian beef produced by JBS linked to destruction of Brazilian rainforest



▲ Walmart, Costco and Kroger are selling beef imported from Brazil by JBS subsidiary Smapco. Photograph: Brendan McDermid/Reuters

<https://www.theguardian.com/environment/2021/feb/13/walmart-selling-beef-from-firm-linked-to-amazon-deforestation>

Revealed: rampant deforestation of Amazon driven by global greed for meat



▲ Cowherders move cattle from farms in the Terra do Meio, where some ranchers have been found to flout embargos against deforestation. Photograph: João Laet/The Guardian

<https://www.theguardian.com/environment/2019/jul/02/revealed-amazon-deforestation-driven-global-greed-meat-brazil>

- USDA lifted ban on Brazilian beef in 2020.
- Now JBS supplies Brazilian beef to Walmart, Costco, Kroger & Albertsons.
- It is labeled “Product of USA” due to Country of Origin Laws (COOL) watered down by USDA in 2016 to exclude beef.
- Other foreign meats can be labelled as from US if “processed” in any way.

Top Three Actions to Reduce the Climate Impacts of Your Diet

1. **Reduce your consumption of beef (& lamb) as much as possible.** Start small to ensure success. Think of beef as a “garnish” within a stir-fry or casserole rather than as 1/3 of your plate. Don’t switch to grassfed beef.

Outcomes: Land released for “rewilding”; reduced deforestation; better health.

2. **When you want to eat meat, choose poultry or pork over beef.**

Outcome: Less GHG emissions, but air pollution & water quality issues remain.

3. **Get your family involved in learning new ways to enjoy food as you *taper* off beef.** Kids can help you find recipes and make new things.

Outcome: Everything is easier if kids and partners are involved in the project.

Questions

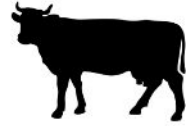
Animal Agriculture Impacts on Biodiversity and Water Quantity/Quality



Kyla Bennett PhD, JD
kbennett@peer.org

How many animals get slaughtered for meat every day?

Our World
in Data



900,000 cows



1.4 million goats



1.7 million sheep



3.8 million pigs



12 million ducks



202 million chickens

This means that every average minute
140,000 chickens get slaughtered



Hundreds of millions of fish*

Data: Food and Agriculture Organization. The icons are from the Noun Project.
The numbers are based on the global totals for 2021. To express them for the average day the totals were divided by 365.



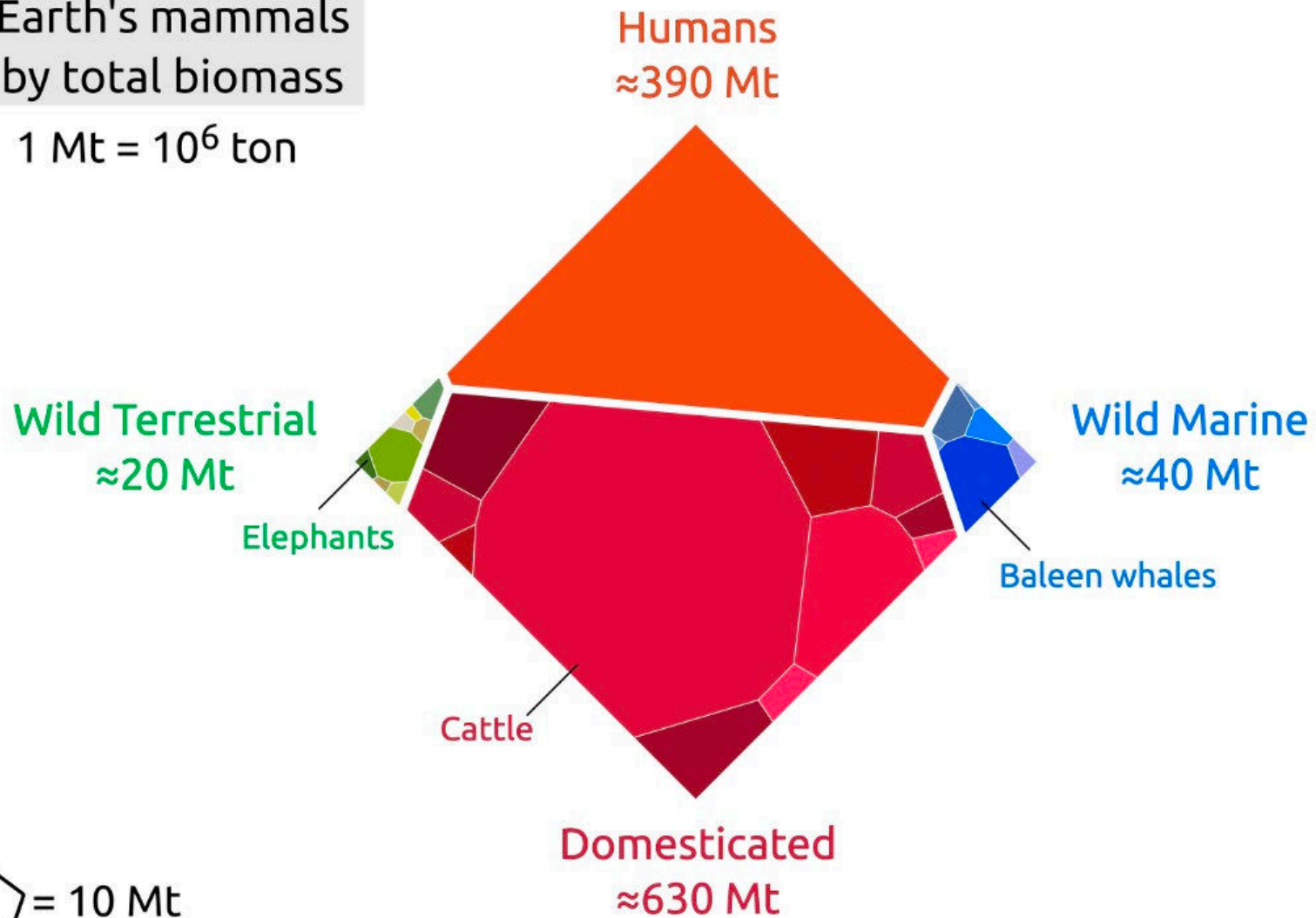
*Estimates of the number of fish killed are, unfortunately, very uncertain. But while the uncertainty is high, it is clear that the number of fish killed is extremely large. Hundreds of millions of fish are certainly killed every day.
This is discussed in the accompanying article: ourworldindata.org/how-many-animals-get-slaughtered-every-day
Research is needed to close the existing gaps in our statistical understanding of how many animals are killed by humans.

OurWorldinData.org — Research and data to make progress against the world's largest problems.

Licensed under [CC-BY](https://creativecommons.org/licenses/by/4.0/) by Max Roser

Earth's mammals
by total biomass

1 Mt = 10^6 ton

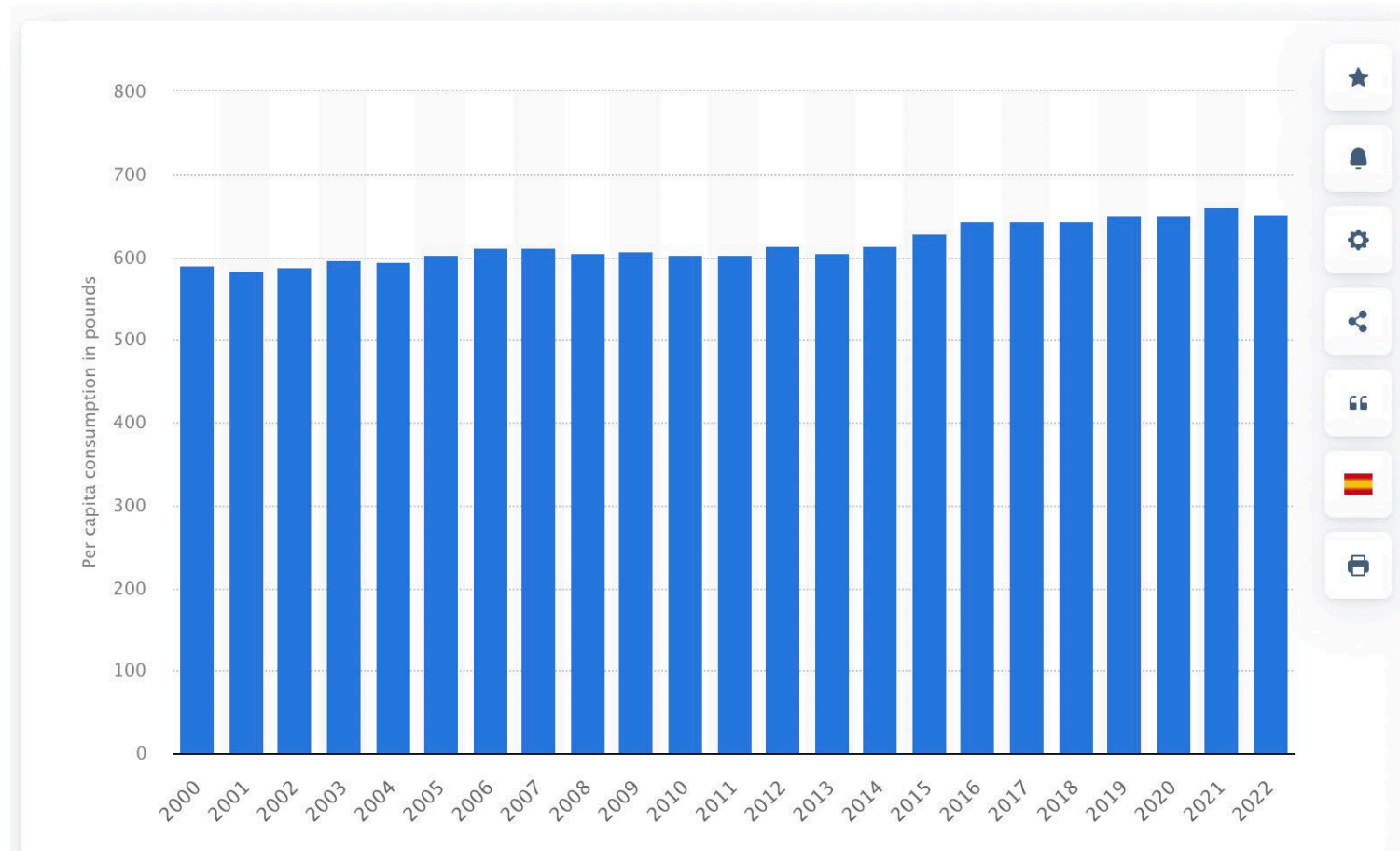


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And It's Not Just Meat...



Per Capita Dairy Consumption in Pounds



Dairy Also Results in Huge Environmental Impacts

Environmental footprints of dairy and plant-based milks

Our World
in Data

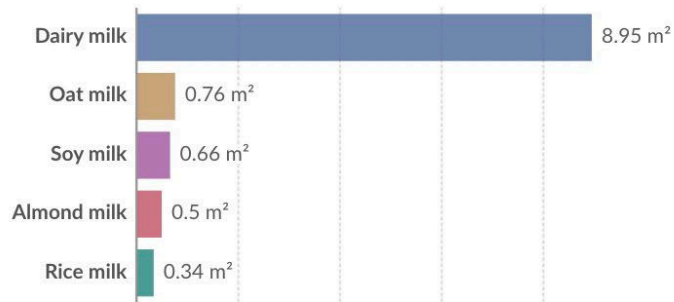
Impacts are measured per liter of milk. These are based on a meta-analysis of food system impact studies across the supply chain which includes land use change, on-farm production, processing, transport, and packaging.

Table

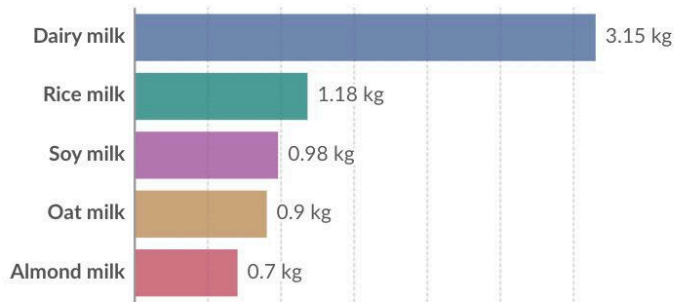
Chart

Settings

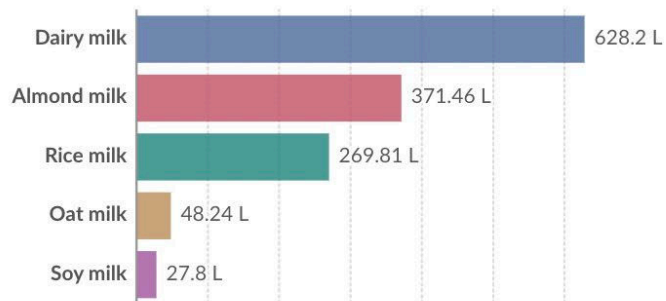
Land use



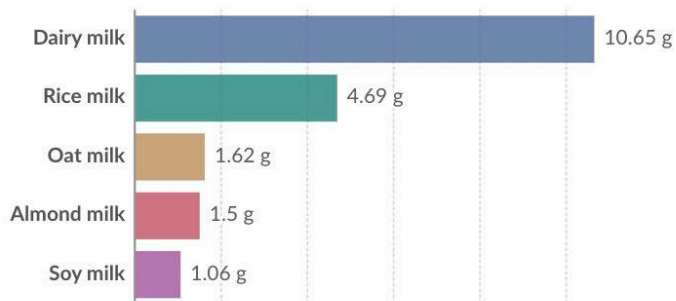
Greenhouse gas emissions



Freshwater use



Eutrophication



Data source: Joseph Poore and Thomas Nemecek (2018). – [Learn more about this data](#)
OurWorldInData.org/environmental-impacts-of-food | CC BY



Loss of Intact Ecosystems Results in Loss of Biodiversity

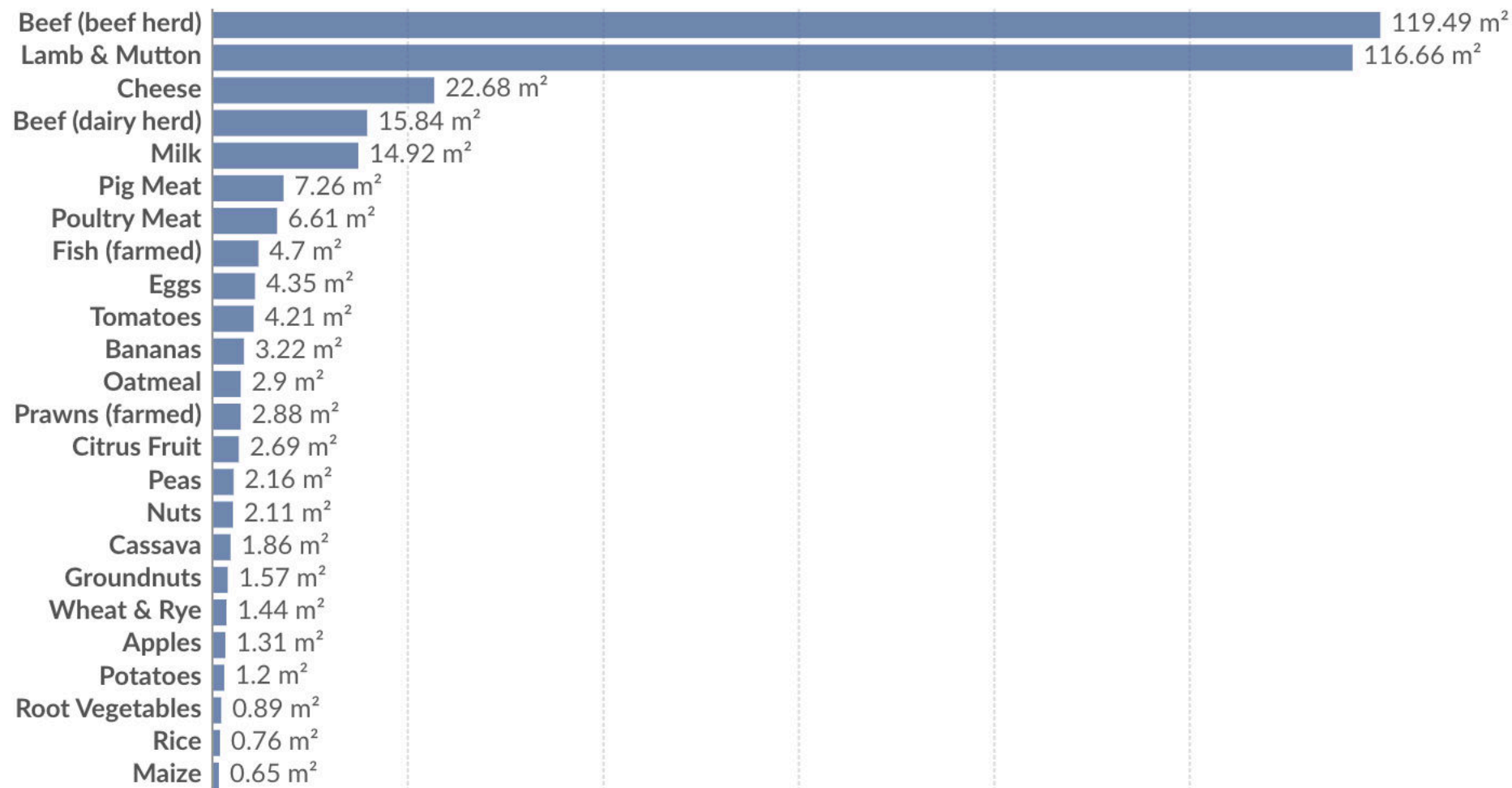
- Agriculture accounts for 70-80% of tropical *deforestation* (the permanent conversion of forested land to another land use).*
- Beef, soy and palm oil are responsible for 60% of tropical deforestation.**
 - 76% of soy is used to feed livestock, not people; another 4% is used in industry
- Over the past 50 years, the conversion of natural ecosystems for crop production or pasture has been the principal cause of habitat loss, in turn, reducing biodiversity.

Land use of foods per 1000 kilocalories

Land use is measured in meters squared (m²) required to produce 1000 kilocalories of a given food product.

Table Chart

Edit foods



Data source: Joseph Poore and Thomas Nemecek (2018). Additional calculations by Our World in Data. – [Learn more about this data](#)

Note: The median year of the studies involved in this research was 2010.

OurWorldInData.org/environmental-impacts-of-food | CC BY



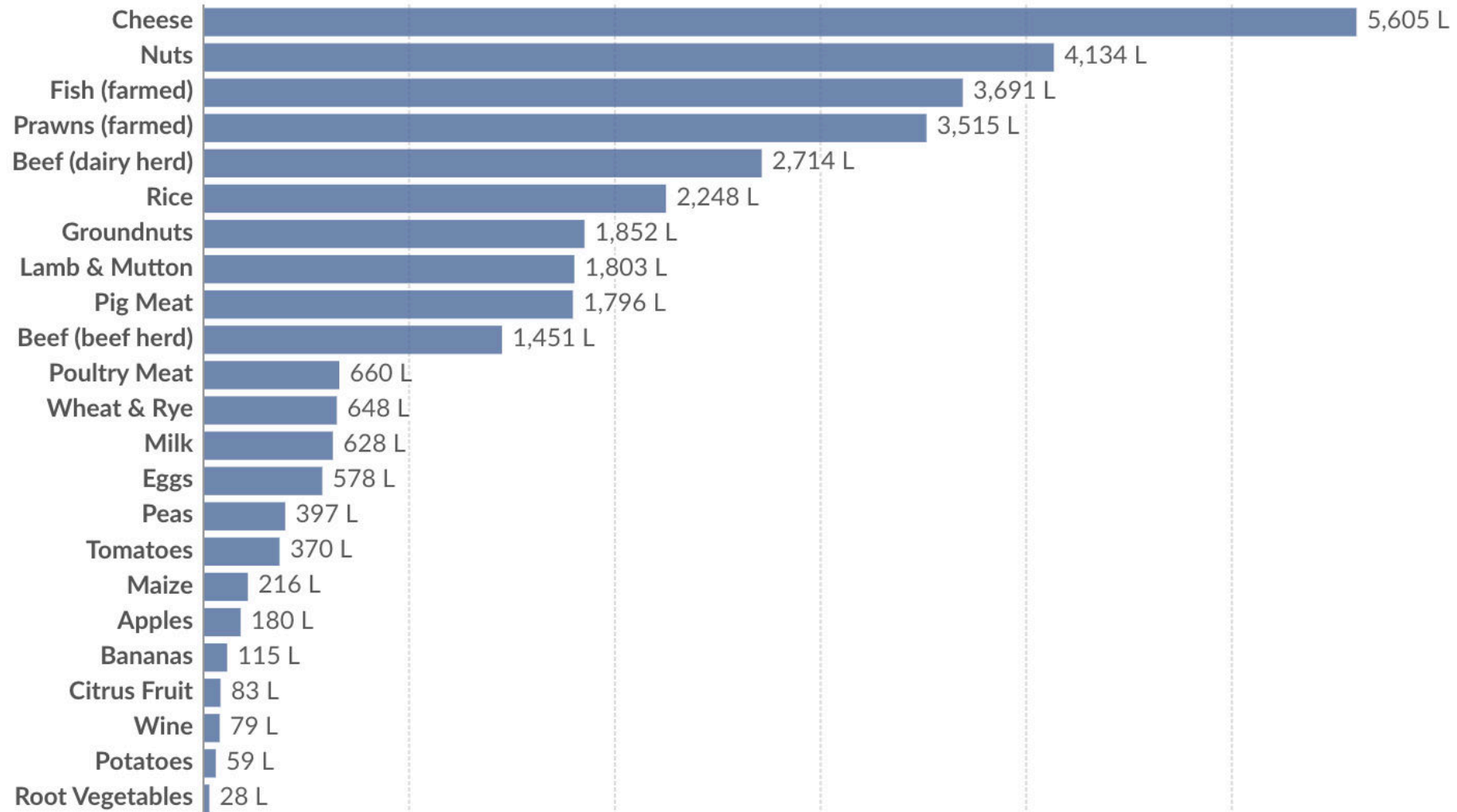
Freshwater withdrawals per kilogram of food product

Our World
in Data

Freshwater withdrawals are measured in liters per kilogram of food product.

Table Chart

Edit foods



Data source: Joseph Poore and Thomas Nemecek (2018). – [Learn more about this data](#)

OurWorldInData.org/environmental-impacts-of-food | CC BY



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Animal Agriculture Uses a Lot of Water

- 20 farming families use more water From the Colorado River than some western states.*
 - In 2022, they used 387 billion gallons, or 1 in every 7 drops
 - The bulk of the water was used to grow hay for livestock
- Agriculture uses 70% of freshwater reserves; 40% is just for meat and dairy.**
 - Animal products only account for 18% of calories

*<https://www.reviewjournal.com/local/local-nevada/20-farming-families-use-more-water-from-the-colorado-river-than-some-states/>

**<https://www.openaccessgovernment.org/devastating-water-footprint-animal-agriculture/163485/>

Impacts on Water *Quality*



Confined Animal Feeding Operations (CAFOs)

- A single large CAFO (at least 700 dairy cows, or 2,500 swine weighing 55 pounds or more) can generate as much waste as a city
 - This waste is not treated
 - Discharged into lagoons
 - As of 2012, large CAFOs generated 404 million tons of manure (over 20 times the amount of fecal wet mass produced by all humans living across the US)



What's in the Lagoons?

- Nutrients
- Pathogens
- Veterinary medicines/antibiotics
- Heavy metals (e.g., zinc and copper)
- Hormones
- Pesticides
- And, in the air: ammonia, hydrogen sulfide, methane, and particulate matter



Water Quality Impacts:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817674/>

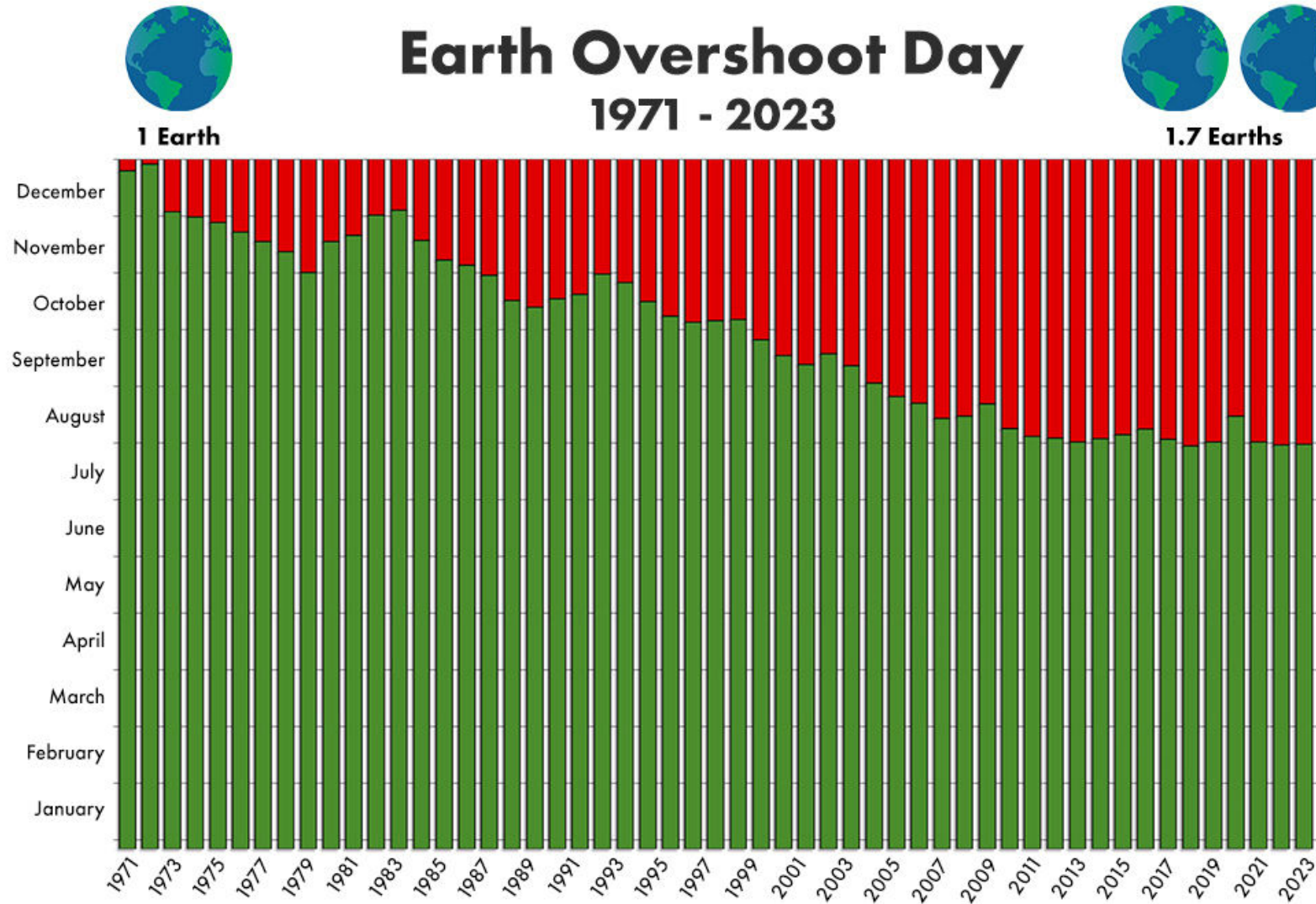
Air Quality Impacts:
https://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf

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Climate Change is Not the Problem

- Climate change is a *symptom* of ecological overreach/overshoot (human demand exceeds the regenerative capacity of our natural ecosystems).
- Human consumption drives loss of biodiversity, climate change, extinction, pollution, and water scarcity.
- Animal agriculture is a huge part of this overreach.

Conclusion



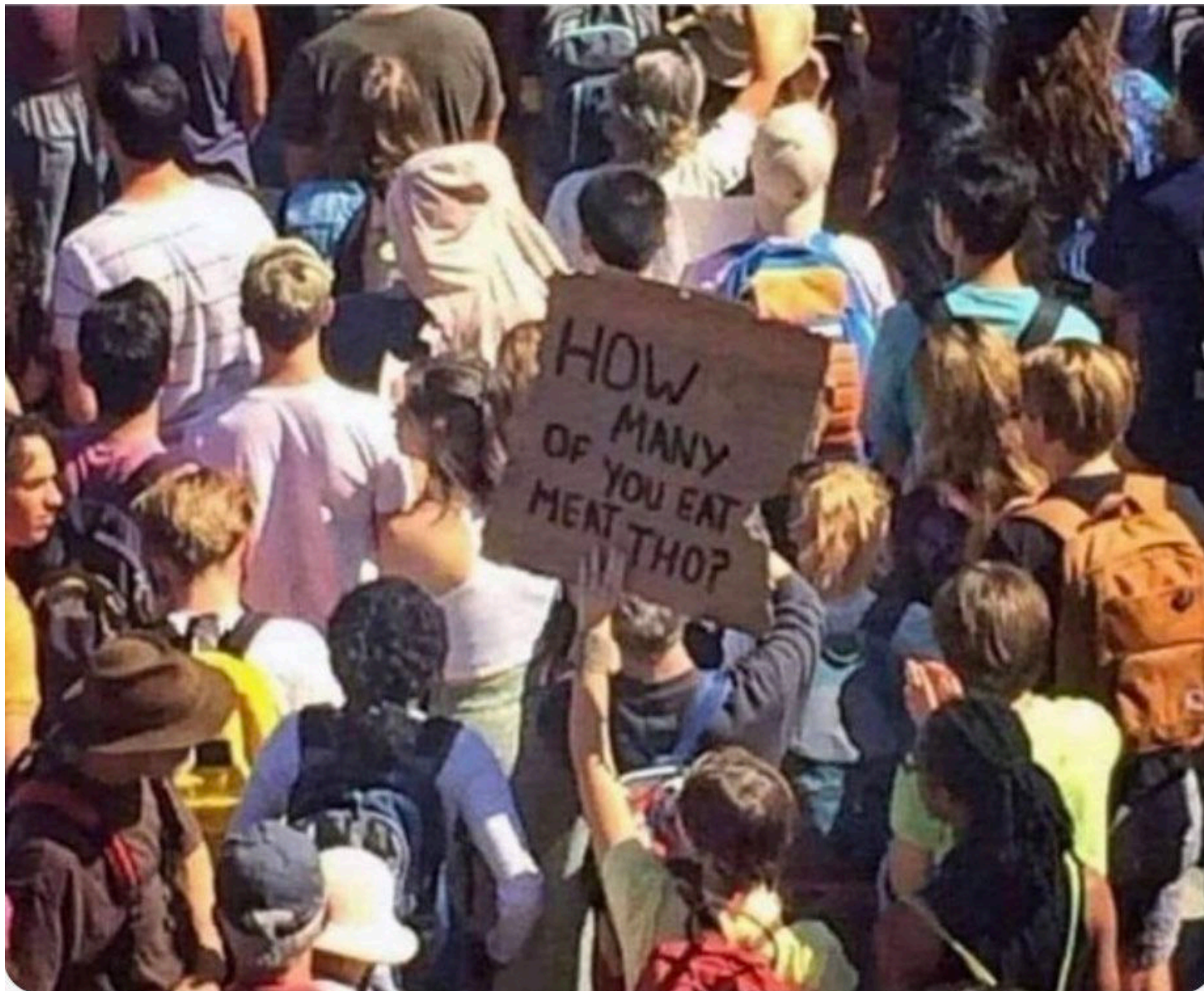
**EARTH
OVERSHOOT
DAY**

fodafo
FOOTPRINT DATA FOUNDATION



Source: National Footprint and Biocapacity Accounts 2023 Edition
data.footprintnetwork.org

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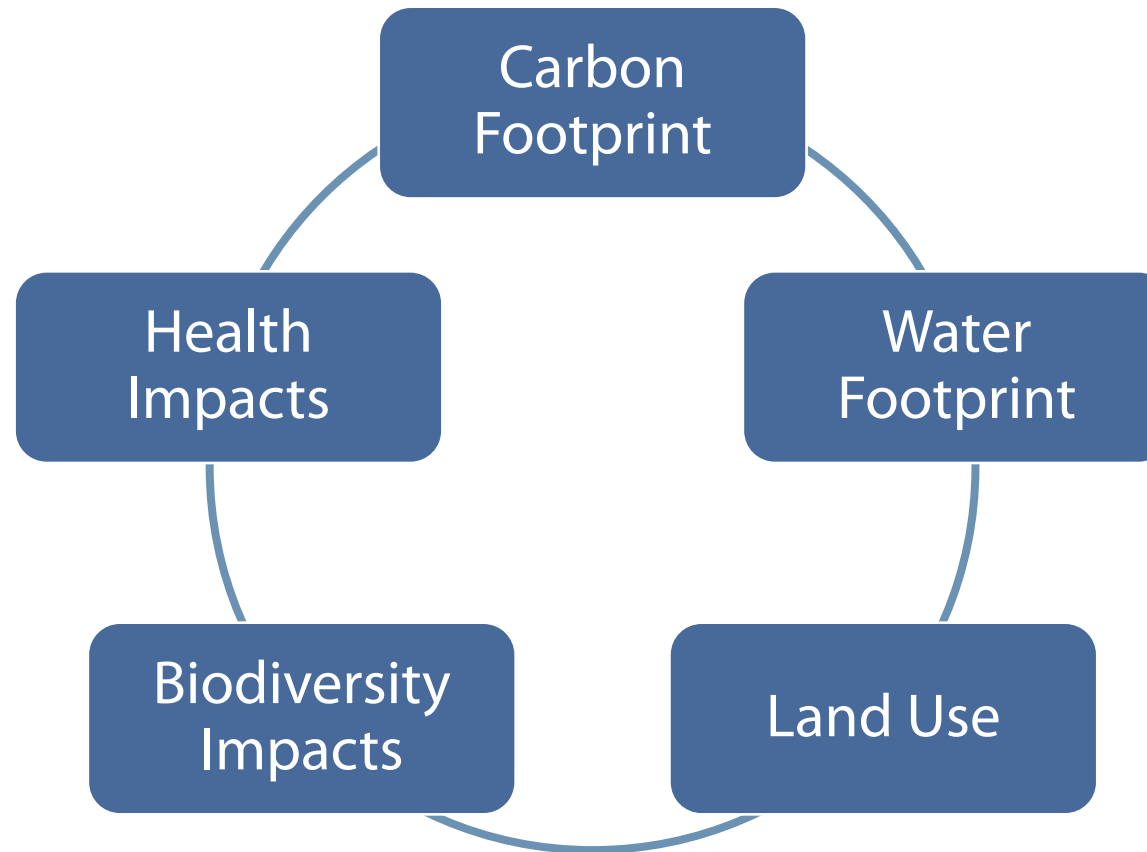
Questions

Harmful Chemicals in our Food Supply

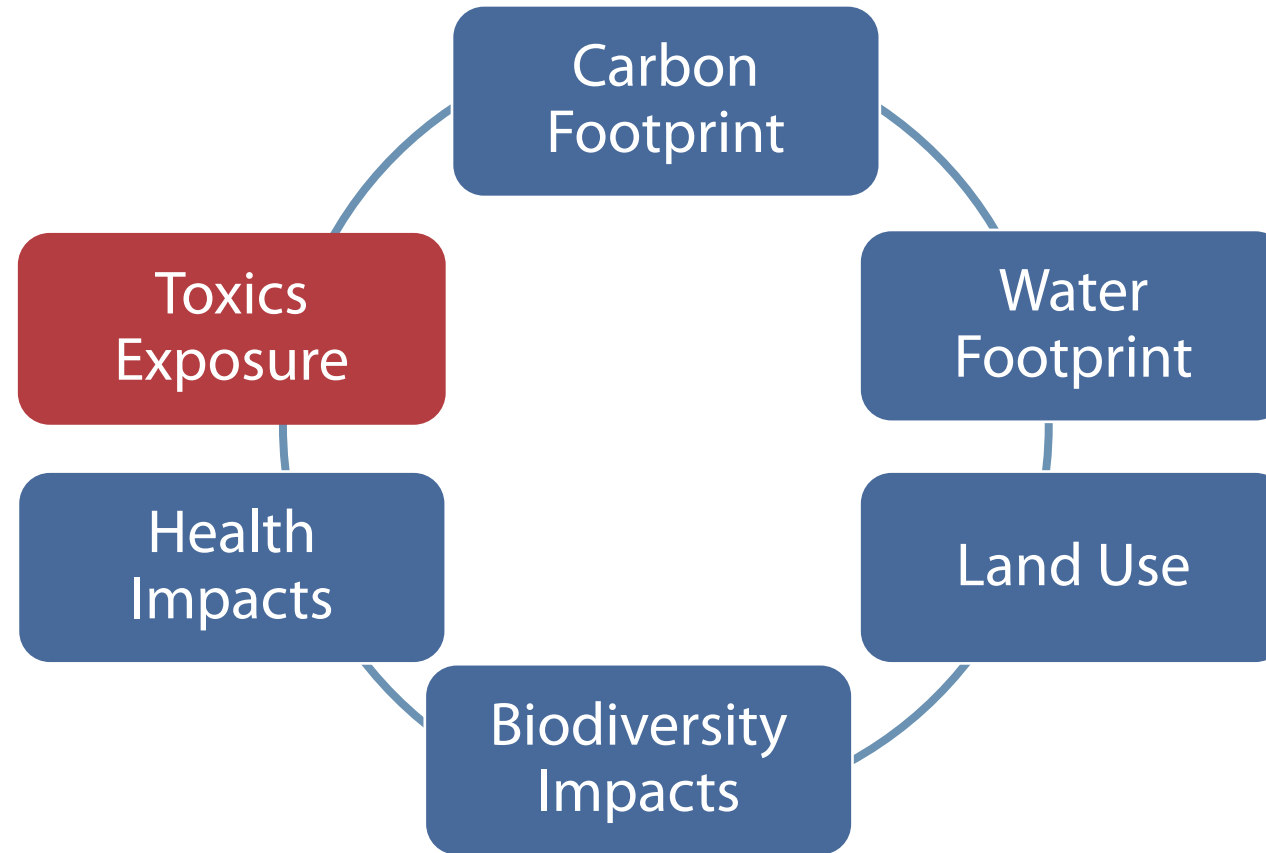
Lydia Jahl, PhD

Lydia@GreenSciencePolicy.org


A wide range of considerations for the food you choose 3+ times a day:



A Wide Range of Considerations for the Food you Choose 3+ Times a Day:



Toxics in Food: Pathways to Exposure

- Directly: {
- For plants: In soil, rainwater, irrigation water, fertilizers
 - For animals: In soil, water, feed
- Indirectly: {
- Ingredient processing
 - Food packaging
- 



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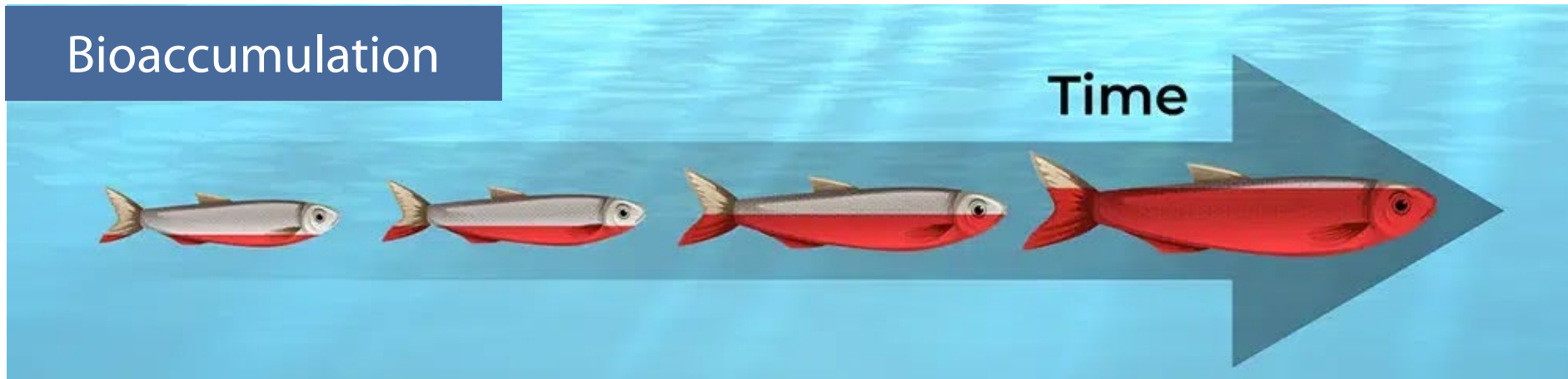


Animal-based foods tend to accumulate toxic chemicals

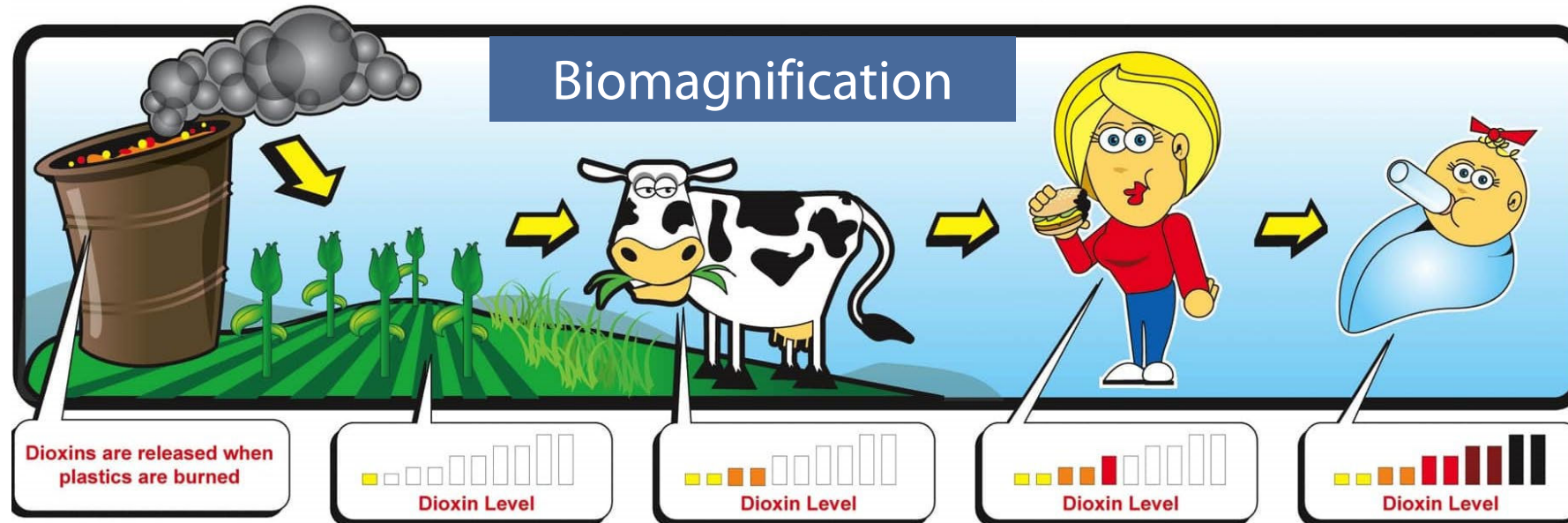
- Many contaminants are lipophilic and therefore concentrate in fats
 - E.g. flame retardants, dioxins, DDT
- Others can concentrate in blood or associate with proteins
 - PFAS
- Many concentrate due to animal physiology, like in animal livers or filter feeders like clams or oysters



Bioaccumulation

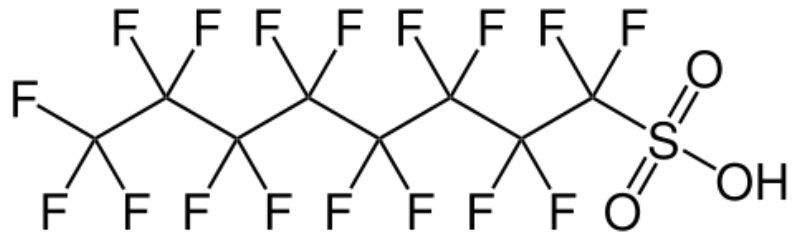


Credit: geeksforgeeks.org



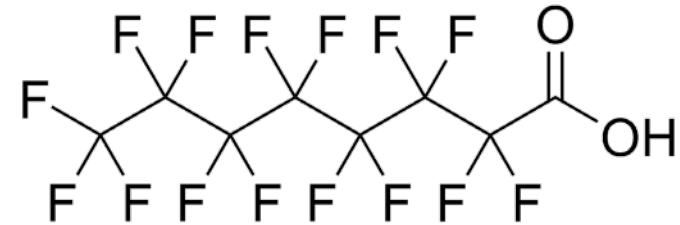
Credit: Adapted from Marion County, Oregon

PFAS: per- and polyfluoroalkyl substances



PFOS

PFOA



- Contain many strong carbon-fluorine bonds
- Aka “forever chemicals”
- Associated with a plethora of health issues:
 - Certain cancers, immune dysfunction, reproductive effects, developmental effects in children, increased cholesterol, increased obesity, & more

PFAS: per- and polyfluoroalkyl substances

- Countless papers demonstrating high levels in fish
- Associated with consumption of certain foods in studies of pregnant women:



PFOA
PFOS
PFUdA
PFDeA



PFOA
PFNA
PFHxS



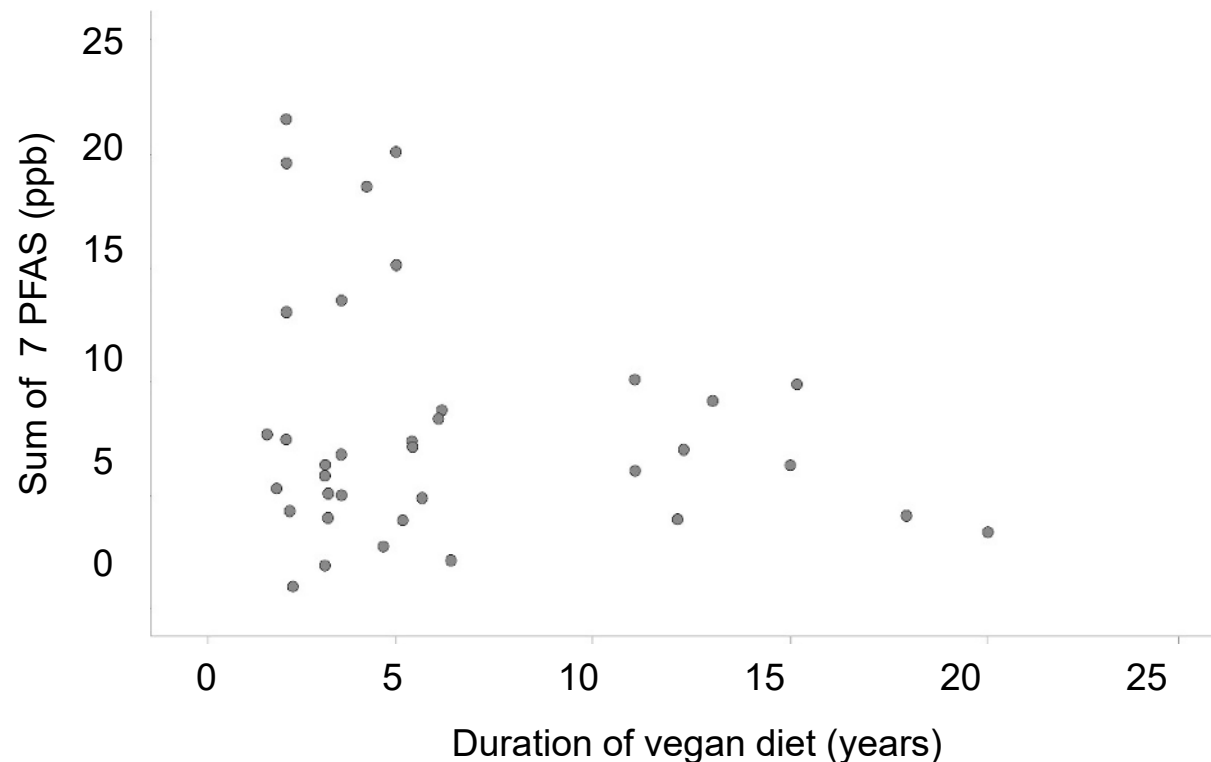
PFOA PFHpS
PFOS PFUdA
PFNA PFDeA
PFHxS



PFOA PFHxS
PFOS PFUdA
PFNA PFDeA
PFDA

Study of German Vegans vs Omnivores

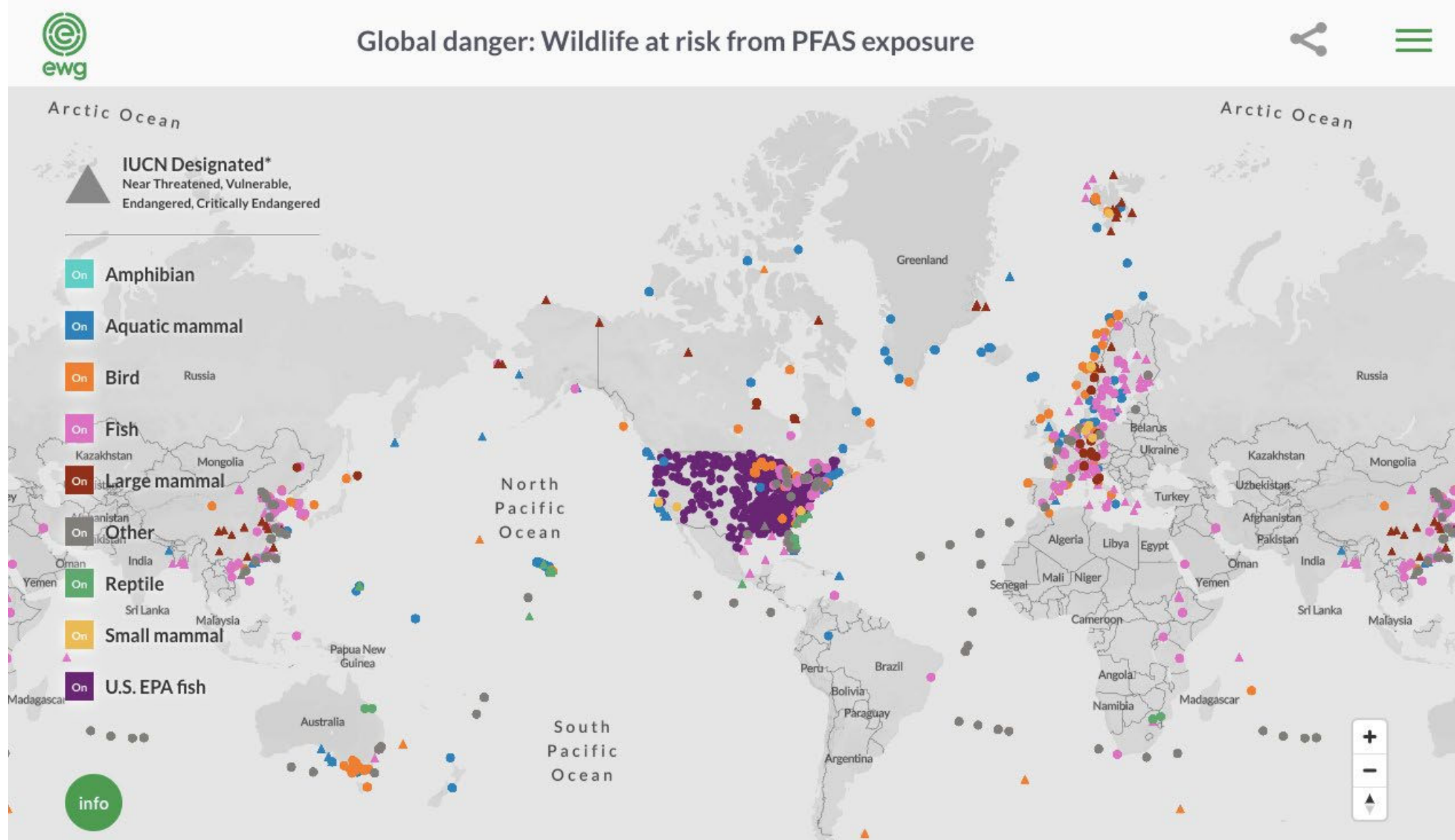
- PFOS (54%) & PFNA (240%) higher in omnivores
- No participants who were vegan > 7 years had elevated levels



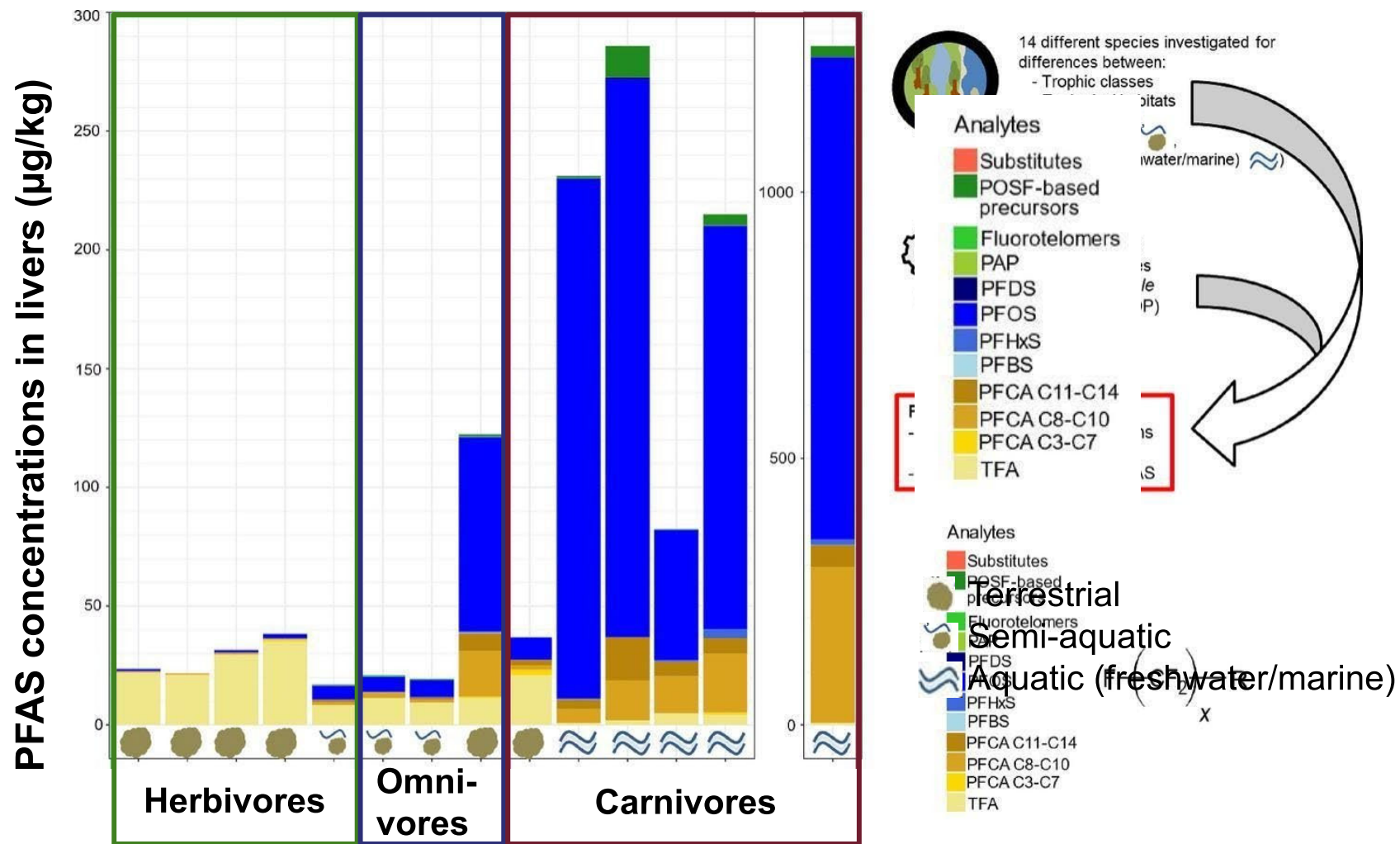
<https://www.sciencedirect.com/science/article/pii/S1438463921001231?via%3Dihub>

Lydia Jahl, PhD Lydia@greensciencepolicy.org

It's not just humans & livestock...



What About Herbivorous Animals?



Plant-Eating People & Animals Still Consume PFAS

New report finds most US kale samples contain 'disturbing' levels of 'forever chemicals'

PFAS was found in seven of eight samples bought at US stores, with organic kale containing higher levels of the toxic compounds



... But Fiber Seems to be Protective



Environment International

Volume 146, January 2021, 106292



The concentration of several perfluoroalkyl acids in serum appears to be reduced by dietary fiber

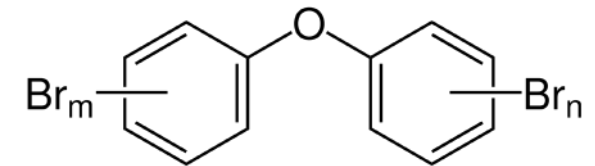
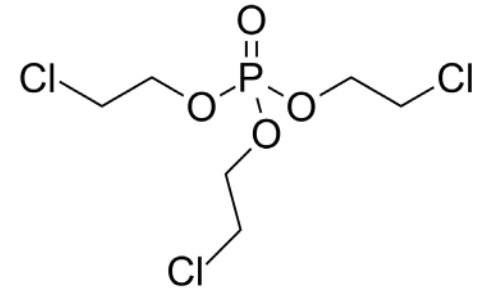
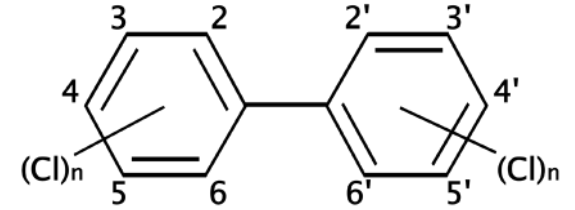
Michael W. Dzierlenga^a  , Debra R. Keast^b, Matthew P. Longnecker^a

- 8.4% decrease in PFNA, 3.6% decrease in PFOA with an interquartile increase in fiber
- Fiber known to help decrease absorption of harmful chemicals

What About Chemicals Besides PFAS?

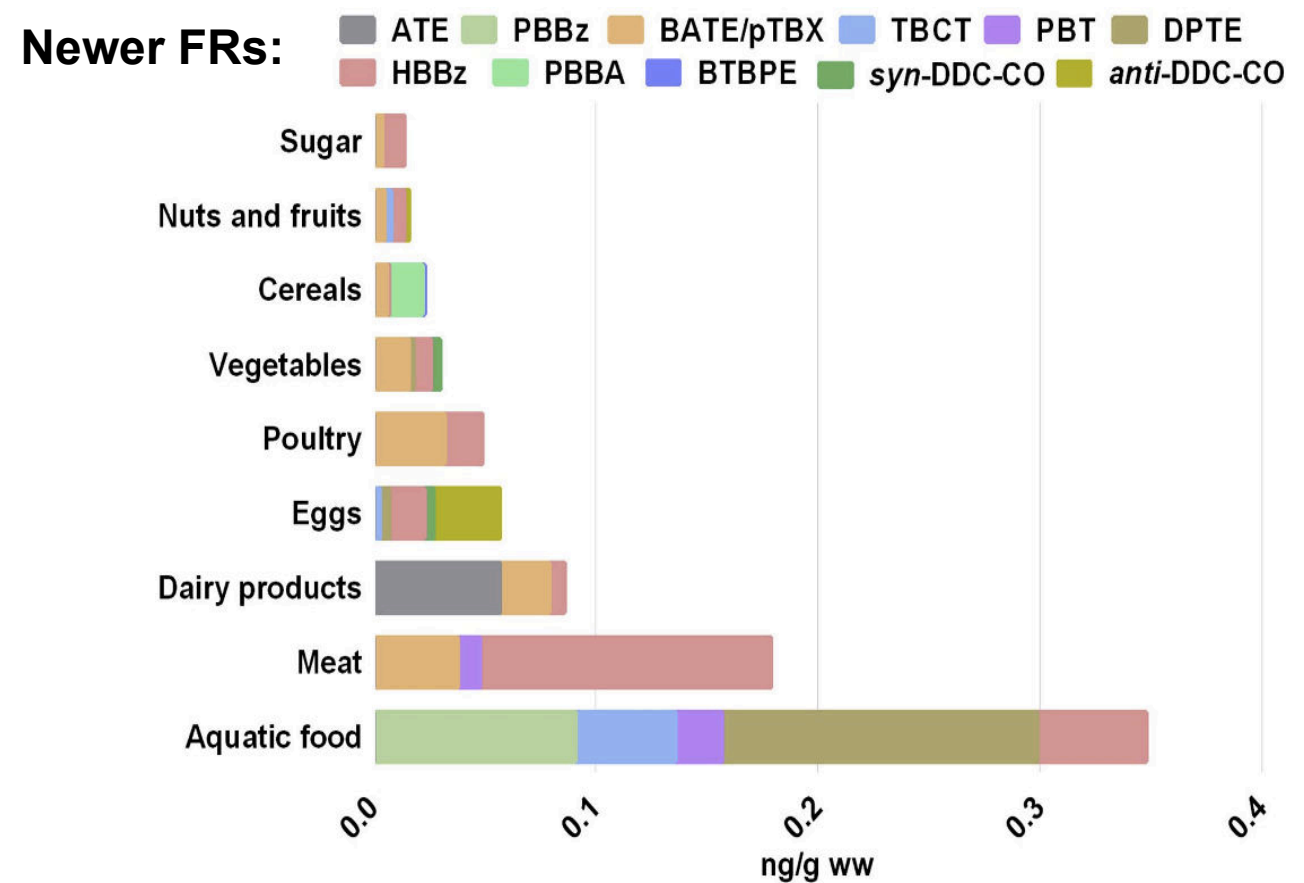
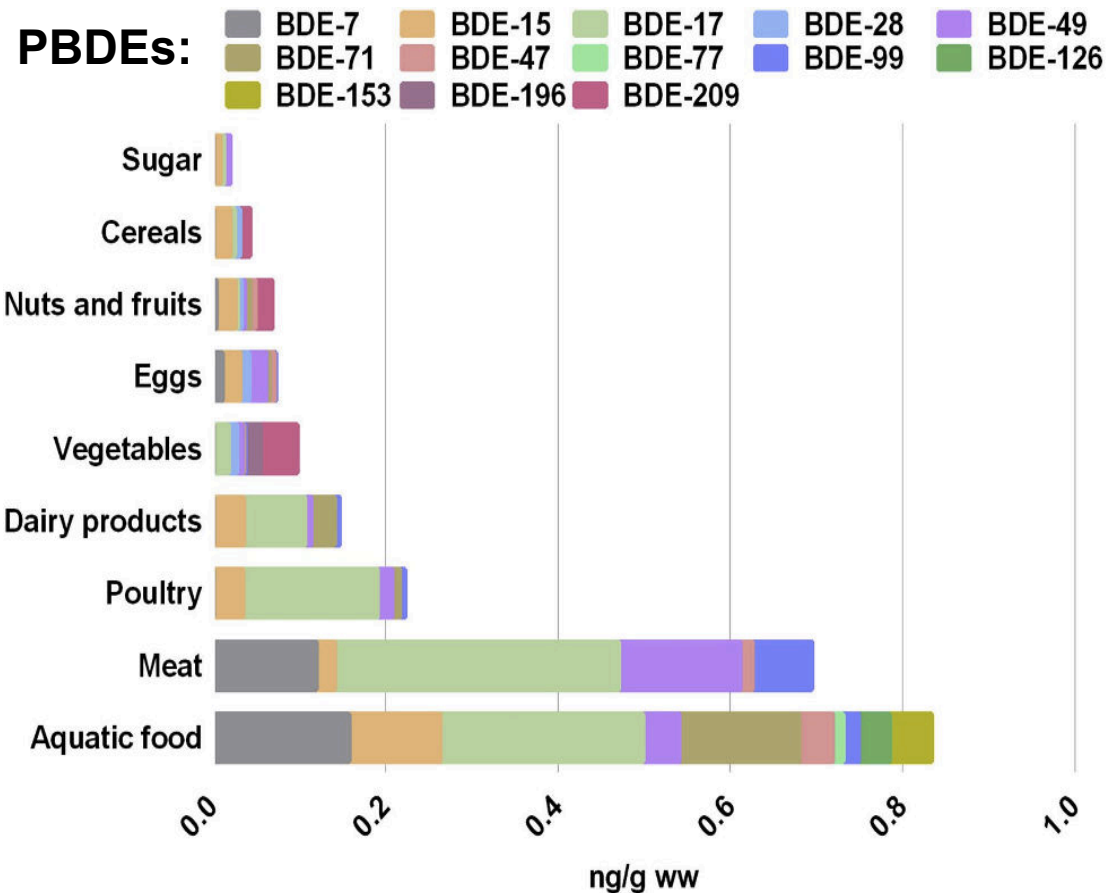
Flame Retardant Chemicals: Often Carcinogenic, Neurotoxic, and Endocrine-Disrupting

- Canadian study found significant levels of PCBs in omega-3 supplements, especially those derived from salmon and seal
- Norwegian cohort: Fish main source of PCBs & PBDEs, meat main source for organophosphate flame retardants
- Norwegian women: Two halogenated flame retardants correlated with consumption of lamb & margarine but not air or dust concentrations



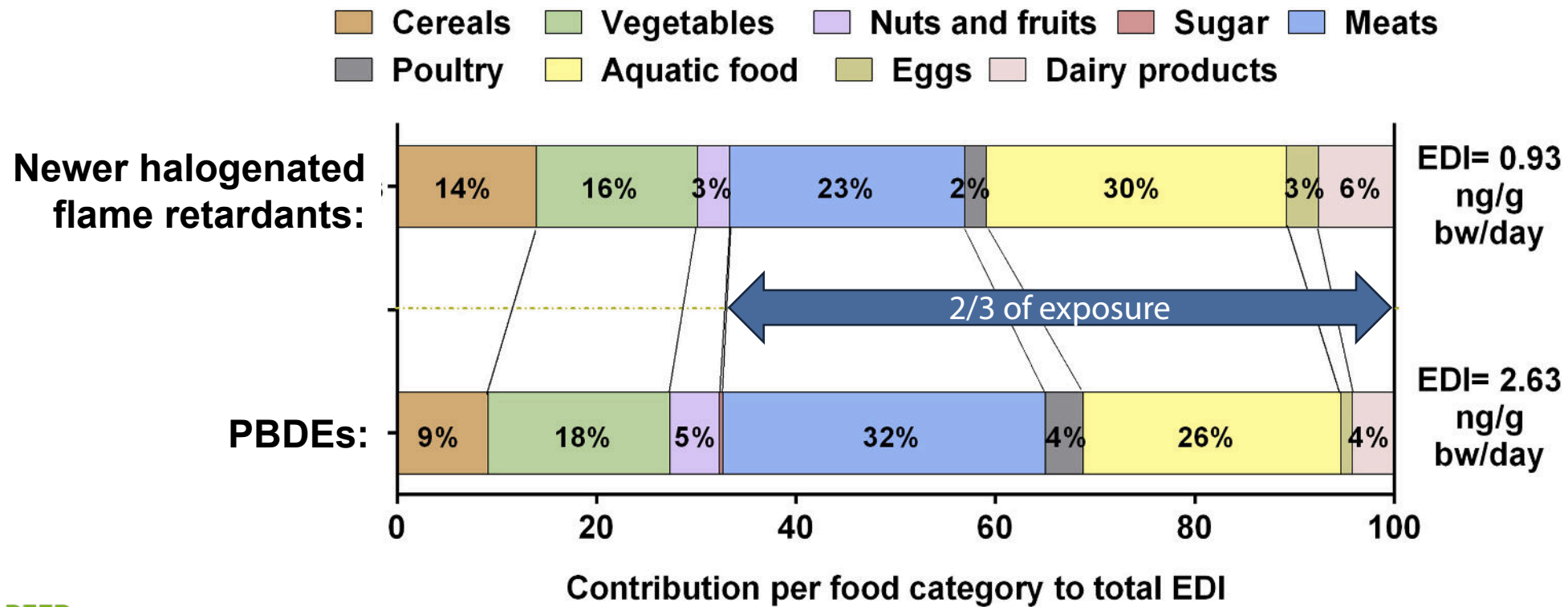
Flame Retardant Chemicals: Often Carcinogenic, Neurotoxic, and Endocrine-Disrupting

- “Market Basket” study of 105 foods in China:

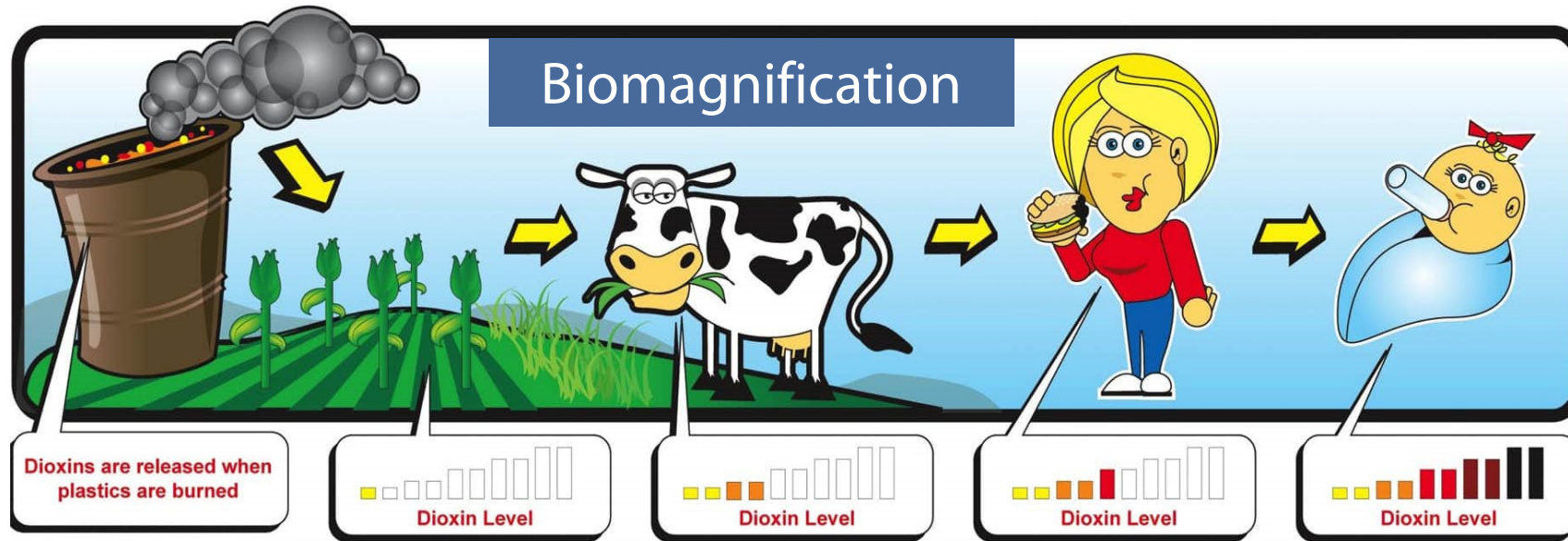


Flame Retardant Chemicals: Often Carcinogenic, Neurotoxic, and Endocrine-Disrupting

- “Market Basket” study of 105 foods in China:



Dioxins: Carcinogenic, Endocrine-Disrupting Chemicals that Concentrate in High-Fat Products



- 1994 estimate: vegetarian dioxin intake 2% of intake of general population
- USDA study: Omnivore children in US may exceed the safe reference dose

Plastic Can't Always be Avoided

- Phthalates: endocrine disrupting chemicals that concentrate in high-fat products
- Found in all dairy products due to tubing used to milk cows



The Chemicals in Your Mac and Cheese



By Roni Caryn Rabin

July 12, 2017

Potentially harmful chemicals that were banned from children's teething rings and rubber duck toys a decade ago may still be present in high concentrations in your child's favorite meal: macaroni and cheese mixes made with powdered cheese.

The chemicals, called phthalates, can disrupt male hormones like testosterone and have been linked to genital birth defects in infant boys and learning and behavior problems in older children. The chemicals migrate into food from packaging and equipment used in manufacturing and may pose special risks to pregnant women and young children.

What Can You Do?

- Prioritize plant-based foods as much as possible
 - At minimum, choose low-fat dairy products & trim excess fat off meat
- Avoid eating liver & fish, especially freshwater fish in US
- Increase fiber intake
- Prioritize minimally-processed foods
- Choose no packaging or glass packaging
- Never reheat foods in plastic
- Store leftovers in glass



Credit: Jessica Kielman

Questions

Top Three Things You Can Do...

Sara's top 3

1. Reduce your consumption of beef (& lamb) as much as possible
2. When you want to eat meat, choose poultry or pork over beef
3. Get your family involved in learning new ways to enjoy food

Kyla's top 3

1. Read food labels and avoid palm oil
2. Buy from small family farms/backyard farms if possible
3. Engage with NGOs who are promoting tighter regulation of CAFOs

Lydia's top 3

1. Prioritize plant-based foods & fiber consumption
2. Eat low on the food chain
3. Limit processed food consumption

Questions from the Audience:

Please type your question in
the zoom Q&A function at the
bottom of your screen