

WWF Report Summary: Bending the curve: the restorative power of plant-based diets

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**BENDING THE CURVE:
THE RESTORATIVE
POWER OF
PLANET-BASED DIETS**

Key Points of the Report

Numerous recent studies have shown that a global shift toward healthier, more sustainable diets will combat climate change, improve human health and food security, reduce biodiversity loss, save lives, decrease the risks of future pandemics, and unlock economic benefits. This research has helped establish the global impacts of the current food system; now these global recommendations must be translated into local reality. We begin this work by offering a detailed analysis of the impacts of various dietary patterns (including national dietary guidelines) on several health and environmental variables in 147 countries around the world, highlighting impacts using a handful of examples.

We frame the analysis around five strategic actions that can be strongly influenced by dietary shifts and are needed to bend the curve on the negative impacts of the food system, moving from one that exploits the planet to one that restores it for nature and people. These actions are 1) reversing biodiversity loss; 2) living within the global carbon budget for food; 3) feeding humanity on existing cropland; 4) achieving negative emissions; and 5) optimizing crop yields. National-level success on these strategic actions through dietary changes is critical to building a nature-positive food system that helps to reverse the loss of nature to restore both people and planet.

Dietary shifts toward planet-based diets can contribute to climate, biodiversity and sustainable development goals. As the Living Planet Report 2020 highlights, achieving these international goals and commitments is more urgent than ever: *“humanity’s increasing destruction of nature is having catastrophic impacts not only on wildlife populations but also on human health and all aspects of our lives.”*

Currently, we are producing enough food to feed the planet, but global food production does not respect planetary boundaries. We are now beginning to see the consequences of our actions and the warning signs of a planet in crisis. Dietary shifts are key in reversing course so that food is produced in a way that restores the planet, not destroys it. In the end, dietary changes will play out at local levels and differently in countries around the world. Understanding the impacts of country-level dietary shifts and how the strategic actions outlined in this report synergistically interact is a critical first step toward taking action.

WHAT ARE PLANET-BASED DIETS?

Planet-based diets are “win-win” consumption patterns that are high on human health benefits and low on environmental impacts. They comprise healthy and sustainable ingredients produced within planetary boundaries and adaptable to local contexts. These diets discourage over-consumption of any food, to the extent that over-consumption negatively impacts biodiversity, the environment and human health. In particular, a large body of evidence has shown that reducing over-consumption of animal-source foods, by increasing the relative consumption of plant-based foods, confers both environmental and health benefits (win-win).

BENDING THE CURVE: THE RESTORATIVE POWER OF PLANET-BASED DIETS

KEY POINTS

- 1 Shifting diets can unlock a multitude of environmental and health benefits including combating the climate and biodiversity crises, relieving water stress and eutrophication of lakes and oceans, and saving lives. But these impacts play out differently in countries around the world and must to be assessed separately for each country.
- 2 Dietary shifts toward more planet friendly diets is a powerful lever for achieving more ambitious Nationally Determined Contributions (NDCs), a more holistic Post-2020 Global Biodiversity Framework, and a renewed commitment to the Sustainable Development Goals (SDGs).
- 3 National Dietary Guidelines (NDGs) are important tools for changing diets and act as a bridge between global dietary recommendations and local context and relevance. Current NDGs, however, are not ambitious enough to achieve global goals and commitments and should therefore be reviewed and updated to ensure they are in line with global health and environmental targets.
- 4 Five strategic actions need to be achieved to bend the curve on a food system that currently exploits nature to one that restores nature. These actions are 1) reversing biodiversity loss; 2) living within the global carbon budget for food; 3) feeding humanity on existing cropland; 4) achieving negative emissions and; 5) improving water and fertilizer use.
- 5 A full range of policy levers need to be implemented to leverage dietary changes as a tool for achieving the five strategic actions outlined in this report. Countries must commit to closing the evidence gaps that remain regarding specific implications of dietary shifts at the national level and which actions are most effective for their context.

6

FIVE STRATEGIC ACTIONS

Five strategic actions, which can be strongly influenced by dietary changes, need to be achieved to bend the curve on the negative impacts of the food system (Figure 1), moving from one which exploits the planet to one that restores it for nature and people. These are:



1 Reversing biodiversity loss – rapidly slow down and move toward zero loss of biodiversity from food production while also using agricultural systems to restore biodiversity across the planet.



2 Living within the global carbon budget for food – reduce total greenhouse gas emissions from food production to at most 5 Gt CO₂-eq, the maximum allowable total global emissions (or carbon budget) from producing our food.



3 Feeding humanity on existing cropland – stop expansion of new cropland, or any agricultural land, at the expense of natural habitats, supplying future food demand on the same area of land as today (or ideally less).



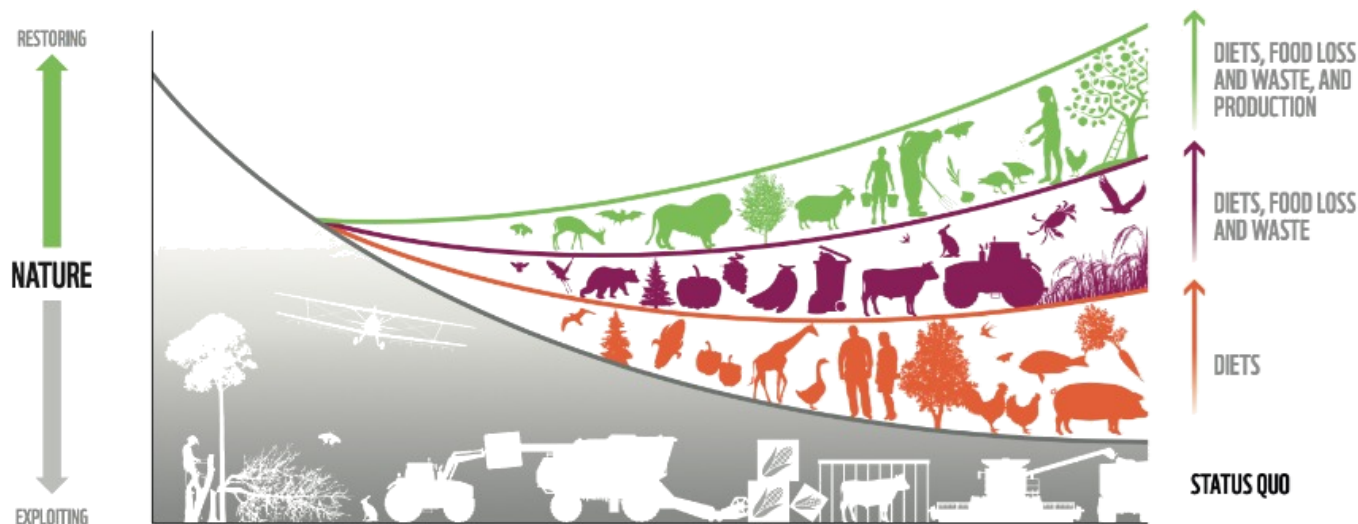
4 Achieving negative emissions – move agriculture from a carbon source to a carbon sink, including by freeing up existing agricultural lands that can be reforested or restored and rapidly implementing food production practices that increase carbon storage on existing cropland.



5 Optimizing crop yields – use all agricultural lands to their maximum potential including optimizing crop yields through better food production practices that more efficiently use water and fertilizers, preserve ecosystem functions and contribute to resilient landscapes.

FIGURE 1. National level success on five strategic actions is needed to bend the curve on the negative impacts of the food system, moving from one that exploits the planet to one that restores it for nature and people.

The relative position of the lines does not reflect the magnitude of potential impact of each action but instead that all three actions are important.



Nature restoration will depend on a combination of dietary shifts, reduction in food loss and waste and adoption of nature-positive production practices.

Dietary shifts are potentially the quickest action to achieve, and can help facilitate the other two actions.

Dietary Patterns, Environmental and Health Indicators Assessed

TABLE 1

Dietary patterns and environmental and health indicators assessed. To inform the analysis, we used UN Food and Agriculture Organization (FAO) food balance sheets to determine current food consumption in the countries and regions assessed. To evaluate the NDGs across all countries a graded coding method was used to extract quantitative values from each guideline.¹¹ For analyzing the environmental impacts, a life-cycle assessment (LCA) approach was used because it allows multiple environmental impact indicators to be estimated across the full supply chain. Here we use a regionalized version of the Poore & Nemecek¹² database to estimate environmental impacts of producing food in each country and use global average environmental impacts for imported food. For health impacts, we use the methods described in Springmann et al.¹¹

DIETARY PATTERNS ASSESSED	ENVIRONMENTAL AND HEALTH INDICATORS ASSESSED
Current diet – the average diet currently consumed by the citizens of a country.	GHG emissions – the greenhouse gas emissions related to food systems including all emissions along the food supply chain, from deforestation and land conversion, input production, fertilizer application, energy use on farm, animal production, aquaculture, processing, packaging, transport and retail.
National dietary guidelines – dietary guidelines put forward by the relevant government department of each country.	Carbon sequestration – the climate benefit of vegetation regrowth following reductions in agricultural land (only including reversion to native ecosystems – pre-agriculture).
Flexitarian – plant-based but allowing for moderate animal-source food consumption, including meat. ⁵	Eutrophication – the freshwater and marine eutrophication potential from nitrogen and phosphorus pollution related to food systems.
Pescatarian – replacing meat with two-thirds fish and seafood and one-third fruit and vegetables.	Water use – the freshwater withdrawals related to food production. Includes irrigation water, animal drinking water, and water used during food processing.
Vegetarian – replacing meat with two-thirds legumes and one-third fruit and vegetables.	Cropland use – the cropland used for food production (“cropland demand”), both domestically and abroad. Including land use for animal feed.
Vegan – replacing all animal-source foods with two-thirds legumes and one-third fruit and vegetables.	Grazing land use – rangelands and pastures related to food consumption, both domestically and abroad.
	Biodiversity loss – the number of species expected to go extinct as a result of food production for various diets.
	Premature mortality – the change in premature mortality from diet-related non-communicable diseases.

ENVIRONMENTAL AND HEALTH IMPACTS OF FOOD

Currently, our dietary choices are driving a system of food production that is destroying the planet (Figure 2).^{1,2,5} The agricultural revolutions of the past have allowed us to feed more people, but this has come at the expense of forests, grasslands, wildlife, water and a stable climate. This exploitation of the environment is behind multiple converging global crises including the climate and biodiversity crises, which alone have the ability to disrupt the stability of the planet. Luckily, we are waking up to the fact that what we eat really does matter and that our everyday food choices are among the most important individual actions we can take for the environment and our health.

FIGURE 2

The global food system is a leading contributor to our rapidly deteriorating environment and unraveling of nature.

Responsible for
27%
of GHG emissions



70%
of freshwater
withdrawals



Main driver of biodiversity
loss and tropical
deforestation



Increasing risk for future
pandemics



Our dietary choices are also damaging our health (Figure 3). These choices are characterized by either excess or insufficiency. People in some countries have an abundance of food and choice while people in other countries still lack both. This highly polarized reality has led to a situation where many countries face a growing obesity epidemic, in others hunger and undernutrition persist, and in far too many both realities exist at the same time.³ Unhealthy diets now pose a greater risk of morbidity and mortality than unsafe sex and alcohol, drug and tobacco use combined.¹⁶

FIGURE 3

The global food system is also a major contributor to much of the ill-health that we see around the world.

1 in 3
overweight or obese



1 in 12
hungry or undernourished



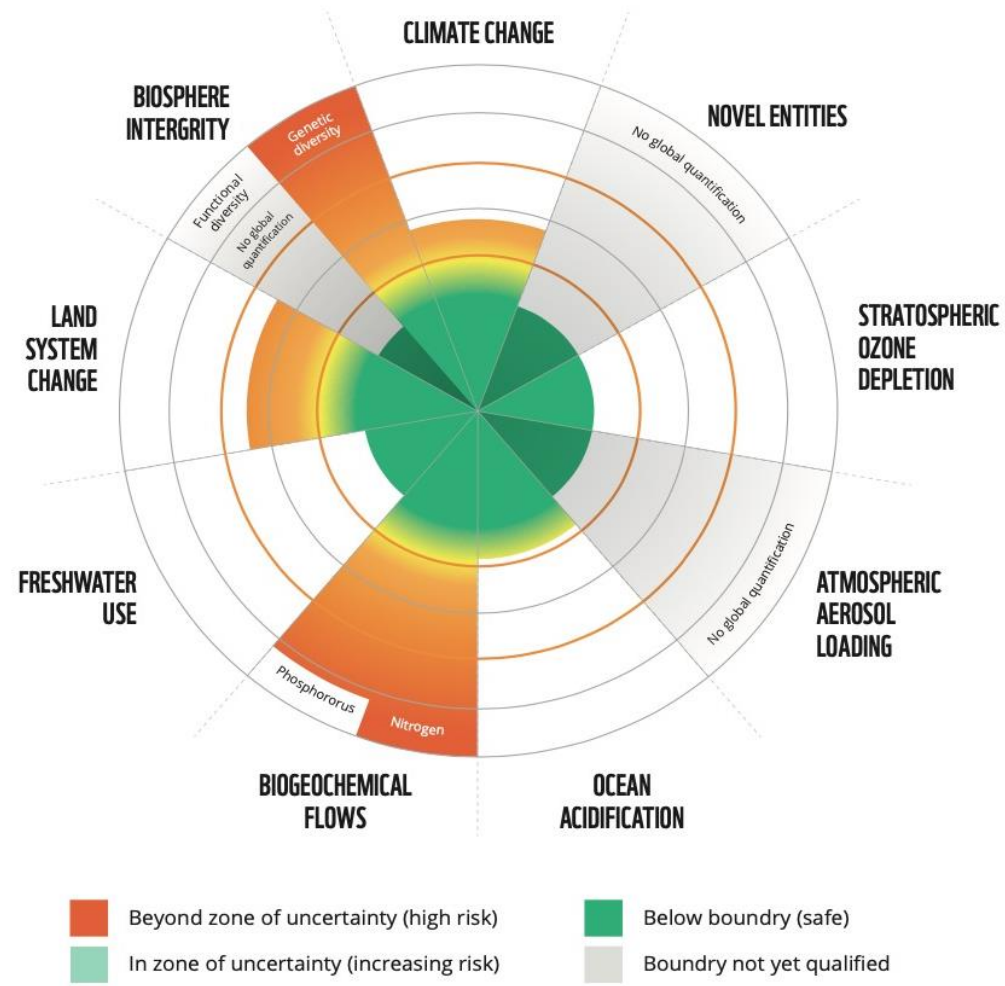
Leading cause of
death



No country on course to meet
2025 global
nutrition targets



The Planetary Boundaries Framework Describing the Upper Limits of Environmental Impact from all Human Activities at the Global Scale



Source: Whitmee et al. 2015







Available in: "Bending the curve: the restorative power of plant-based diet" - WWF 2020

The Planetary Boundaries Specific to Food Production

FIGURE 4B

The planetary boundaries specific to food production that define the upper limits of the environmental impact that food production can have at the global scale.

Source: Adapted from Willett et al. 2019⁵

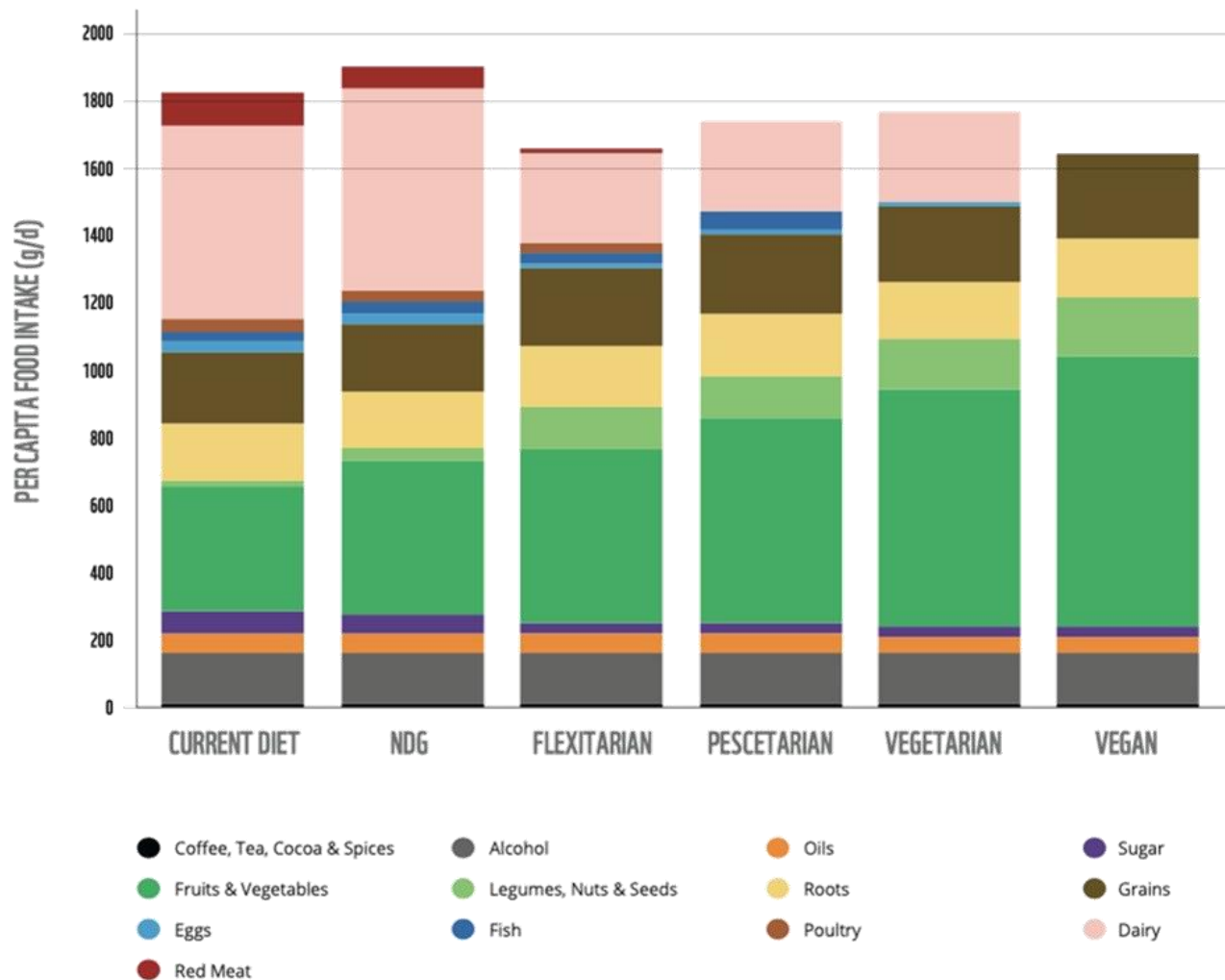
EARTH SYSTEM PROCESS	CONTROL VARIABLE	BOUNDARY (Uncertainty range)
Climate change	 GHG emissions	5 Gt CO₂ eq yr⁻¹ (4.7 - 5.4 Gt CO ₂ -eq yr ⁻¹)
Land-system change	 Cropland use	13 M km² (11 - 15 M km ²)
Freshwater use	 Water use	2,500 km³yr⁻¹ (1000 - 4000 km ³ yr ⁻¹)
Nitrogen re-cycling	 N application	90 Tg N yr⁻¹ (65 - 90 Tg N yr ⁻¹)* (90 - 130 Tg N yr ⁻¹)**
Phosphorous re-cycling	 P application	8 Tg P yr⁻¹ (6 - 12 Tg P yr ⁻¹)* (8 - 16 Tg P yr ⁻¹)**
Biodiversity loss	 Extinction rates	10 E/MSY (1 - 80 E/MSY)

* Lower boundary range if improved production practices and redistribution are not adopted.

** Upper boundary range if improved production practices and redistribution are adopted and 50% of applied phosphorous is recycled.

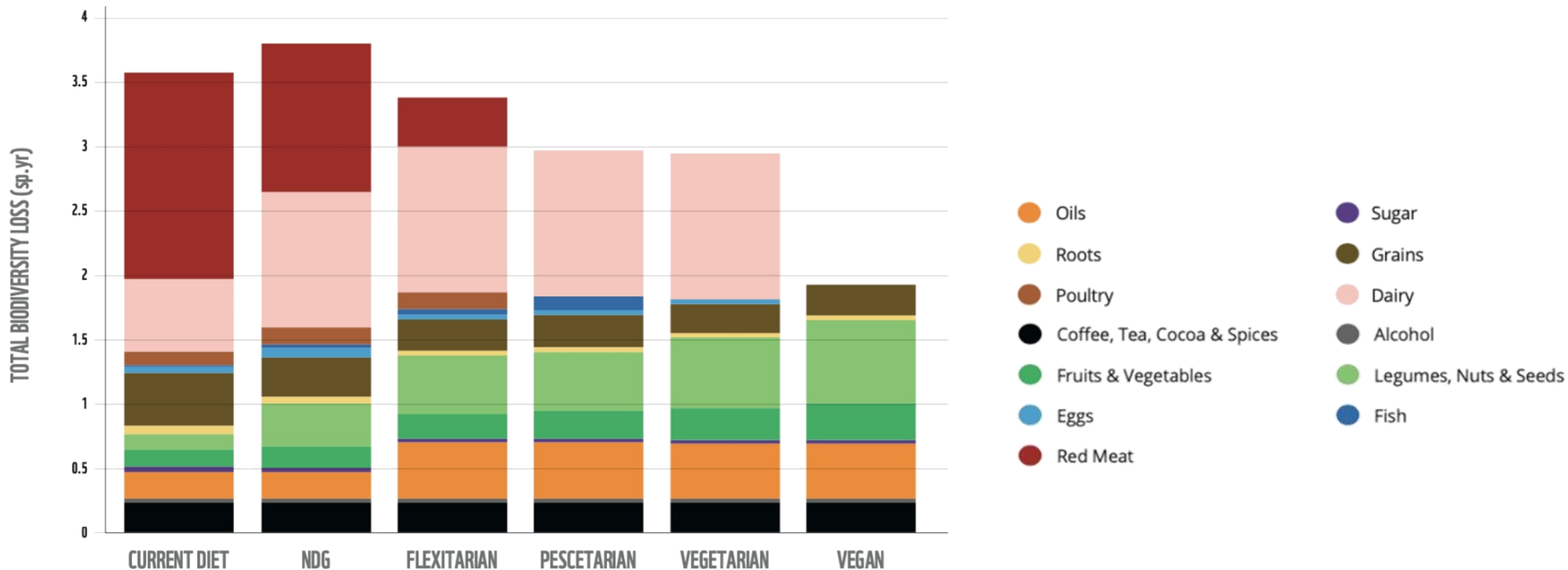
Source: "Bending the curve: the restorative power of plant-based diet"
WWF 2020

Current per Capita Food Consumption in European Countries and Food Intake (g/day) Required to Shift Towards NDGs and Other Dietary Patterns



Source: "Bending the curve: the restorative power of plant-based diet"
WWF 2020

Number of Total Species Expected go Extinct per Year Globally as a Result of Food Production for Current Diets, NDGs, and Other Dietary Patterns



Global Emissions Projection Until 2050

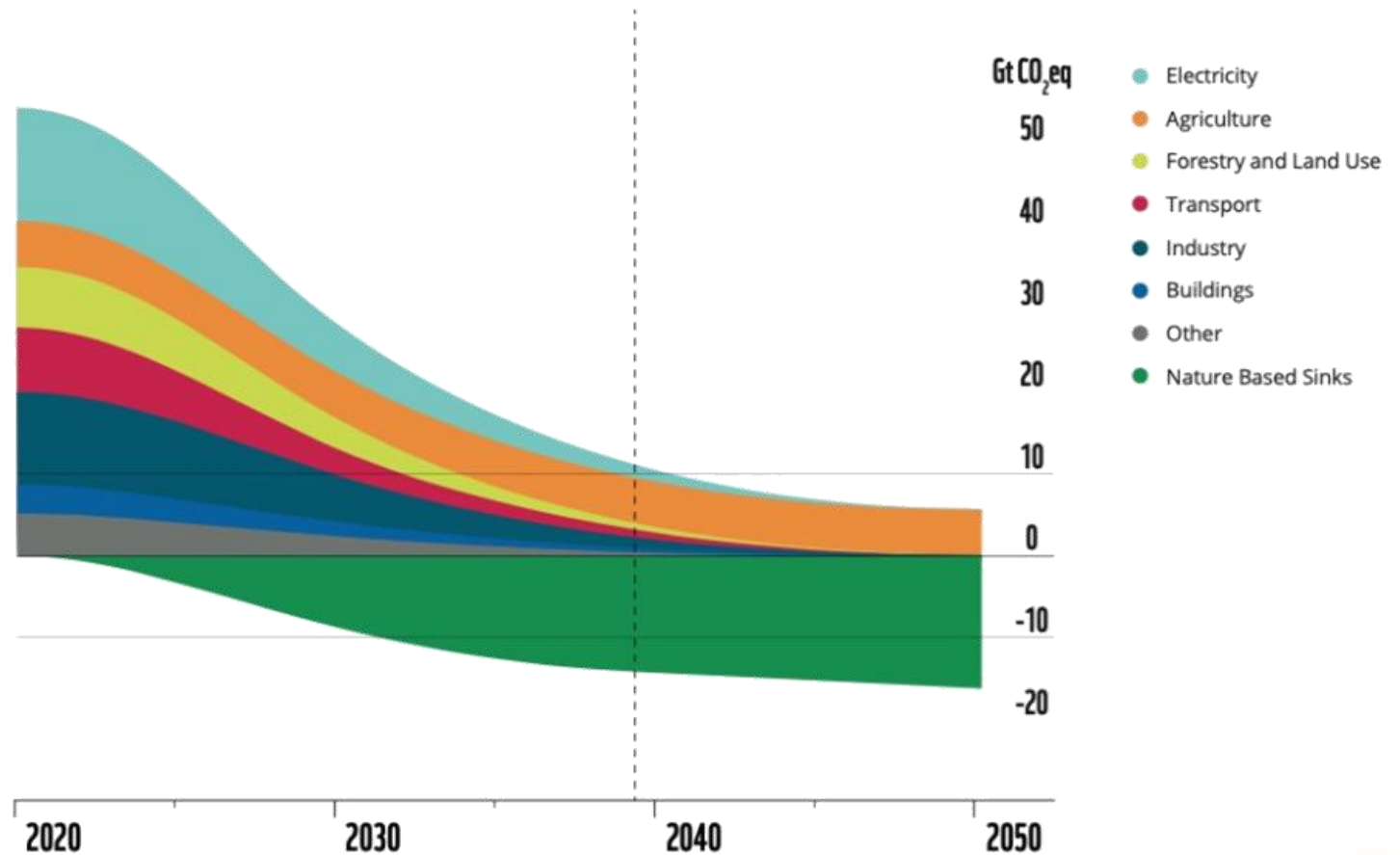
FIGURE 18

Total global emissions projections across major contributing sectors showing the exponential decreases necessary to keep global warming well below 2°C and aiming for 1.5°C. Emissions in all sectors, except for agriculture, must peak in 2020 and rapidly decrease, halving every decade until 2050. In addition to rapid decarbonization, massive amounts of carbon dioxide must be stored in nature-based sinks (dark green in figure).

Source: Loken (2020)¹⁴

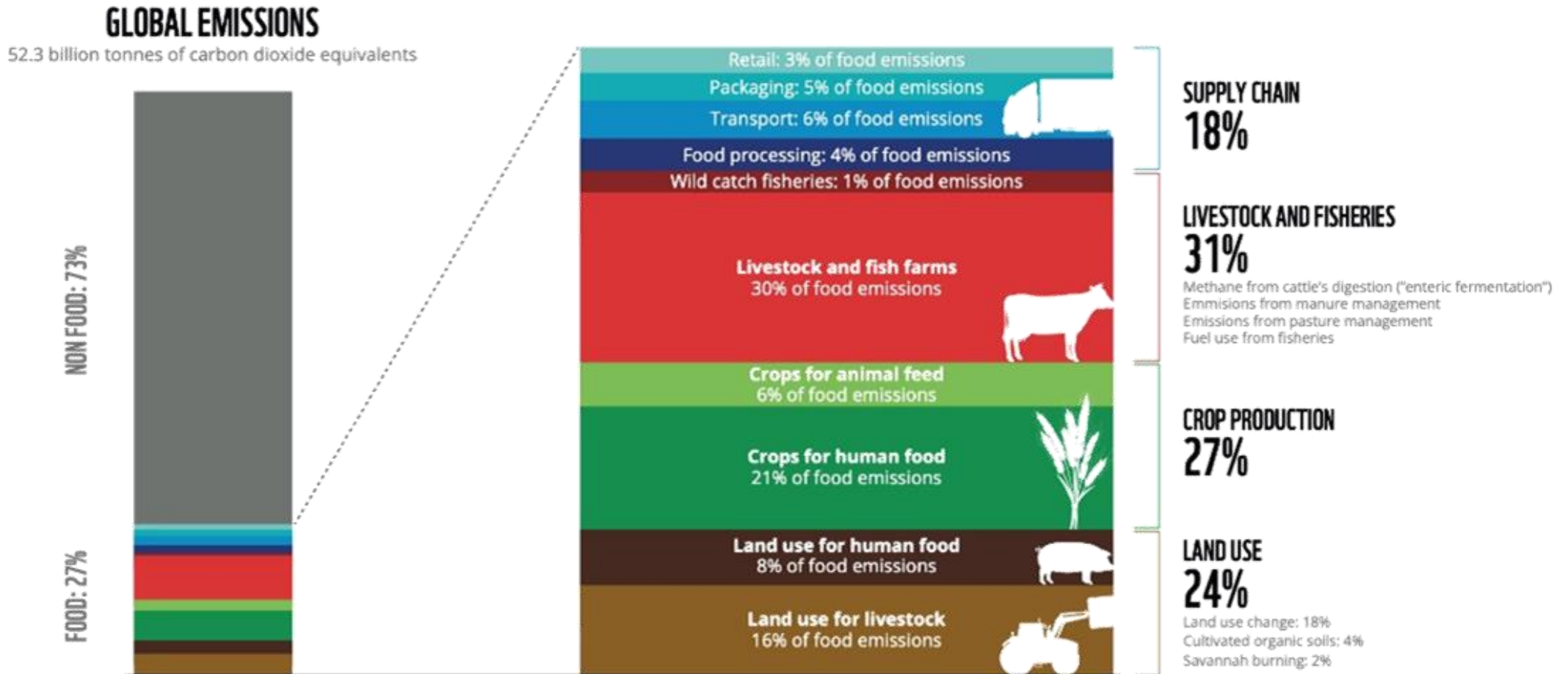
ROADMAP TO 1.5°C

REACHING NEGATIVE EMISSIONS IN 2039



Source: "Bending the curve: the restorative power of plant-based diet"
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Major Contributing Sources of Total Emissions from Food Production



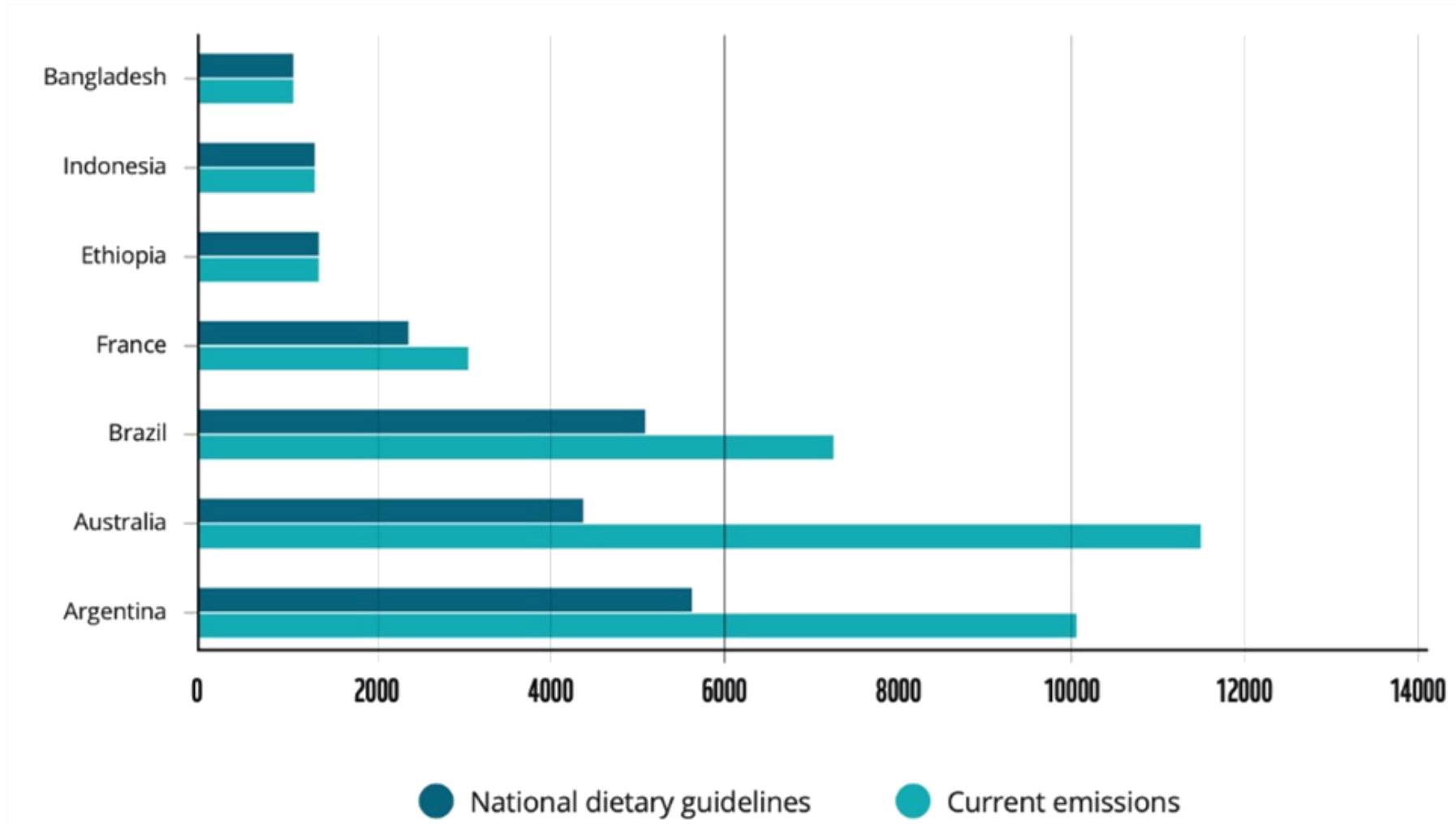
Source: Poore and Nemecek (2018)

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Total Global GHG Emissions for Current Diets, NDGs, and Other Dietary Patterns

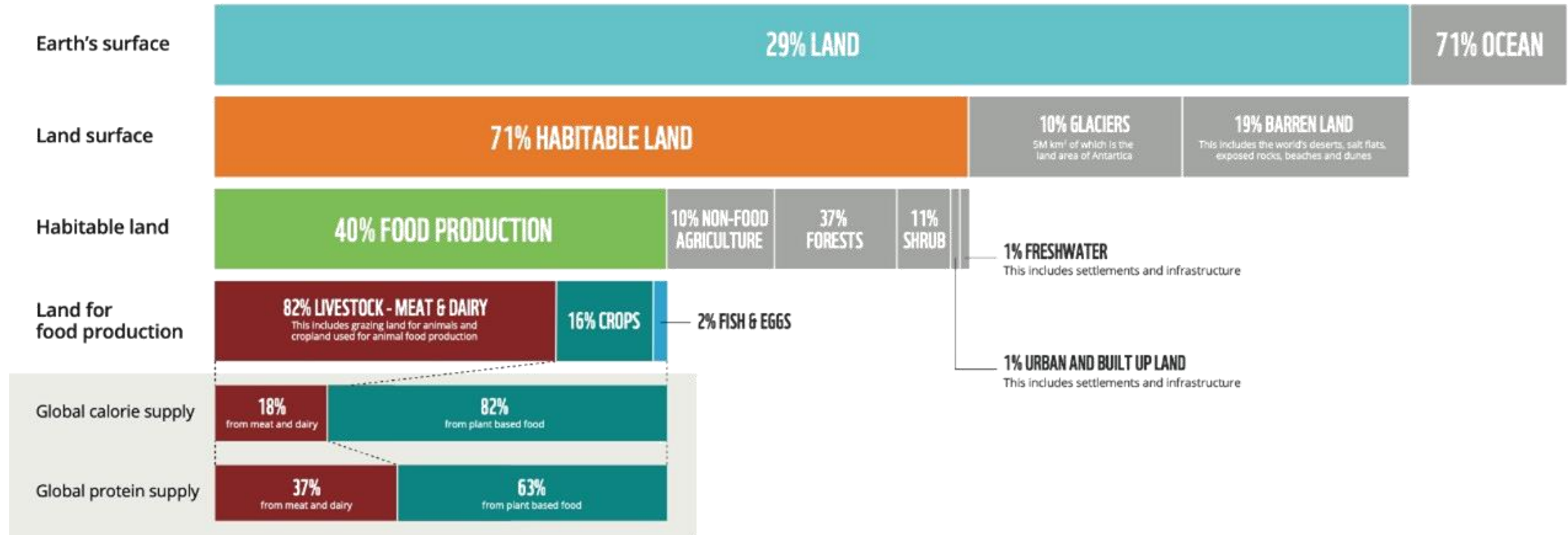


Per Capita Food Related Emissions in Various Countries for Current Consumption Patterns and if NDGs were Followed



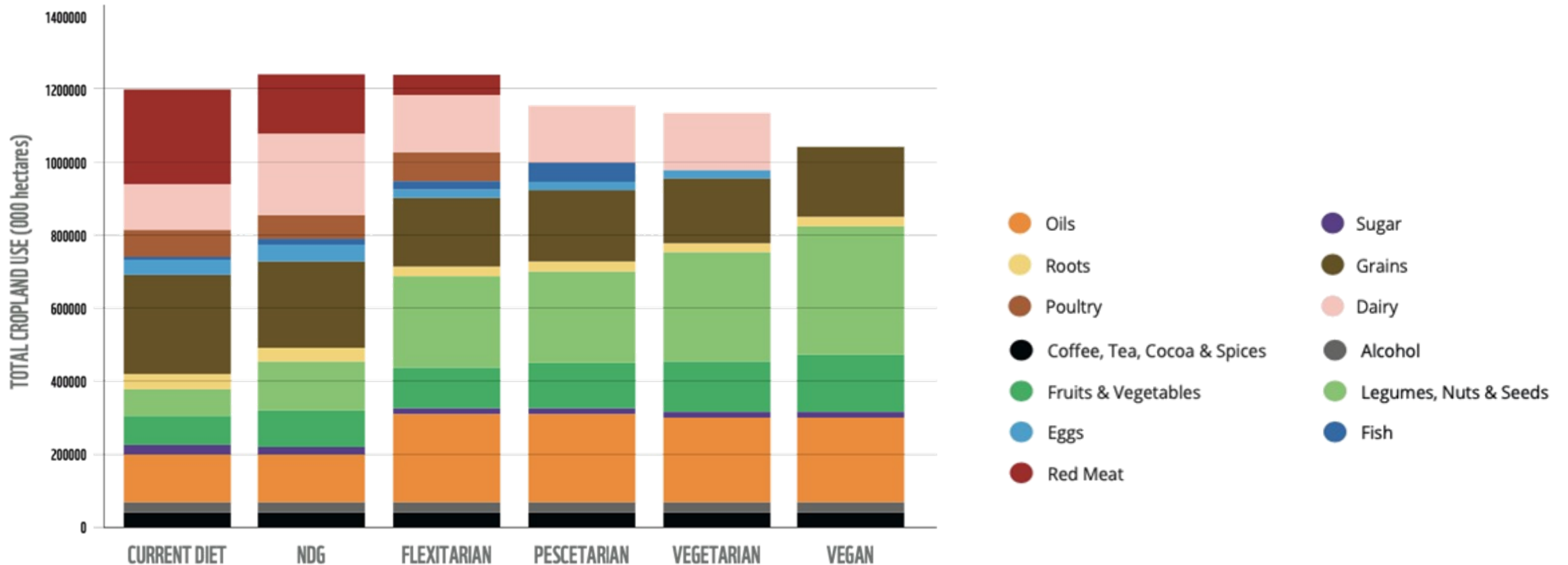
Source: "Bending the curve: the restorative power of plant-based diet"
WWF 2020

Total Global Land Use for Food Production

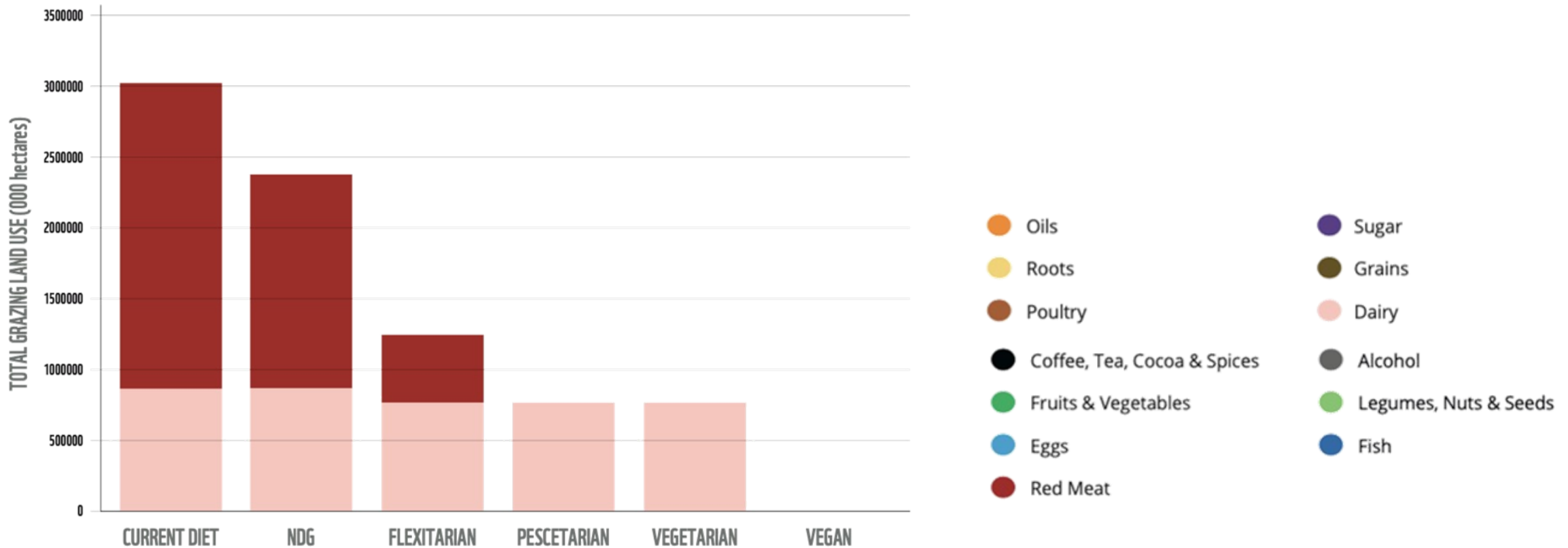


Data source: Analysis used for this report and complimented with data from the UN Food and Agriculture Organization (FAO)
Figure adapted from: OurWorldinData.org

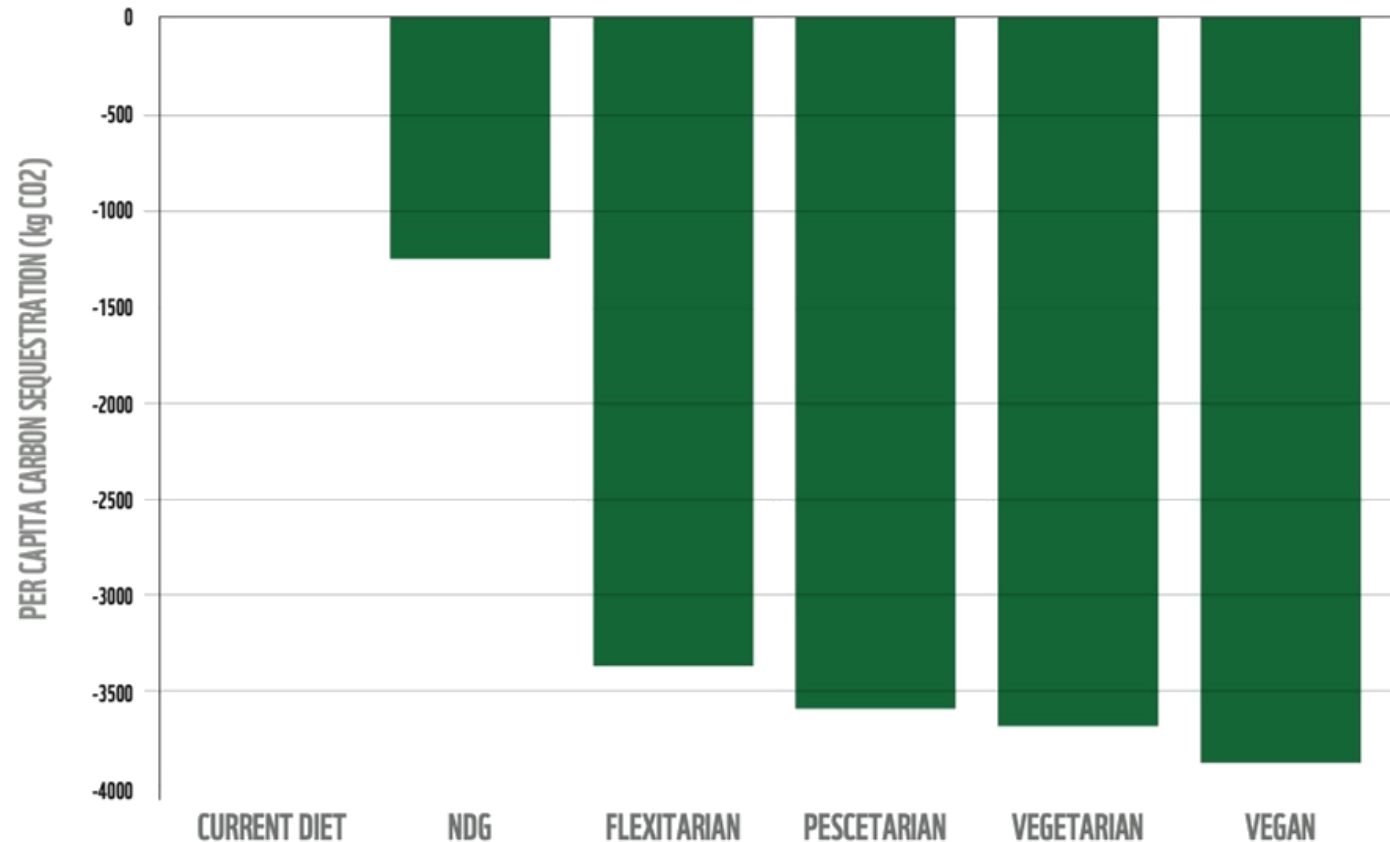
Total Global Cropland Use for Current Diets, NDGs, and Other Dietary Patterns



The Global Area of Grazing Lands (Pasture and Rangelands) to Support Current Diets, NDGs, and Other Dietary Patterns

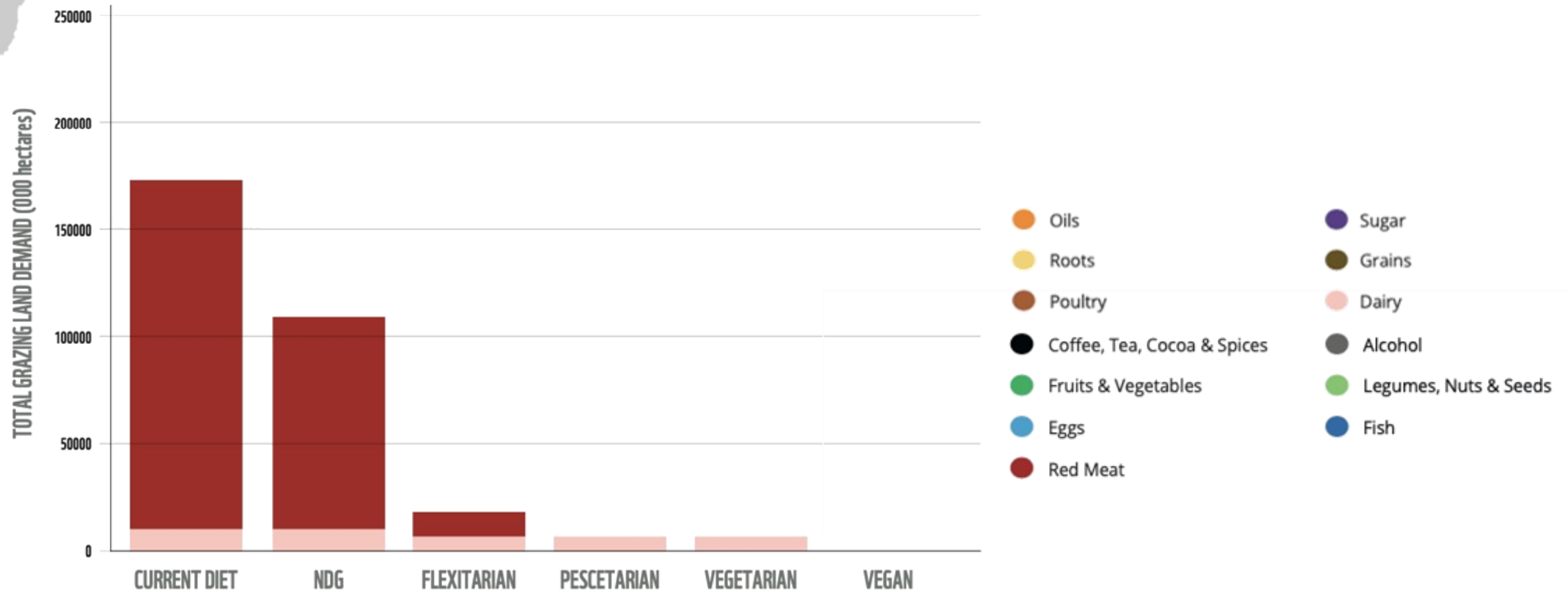


Per Capita Carbon Sequestration per Year for Current Diets, NDGs, and Other Dietary Patterns in Brazil



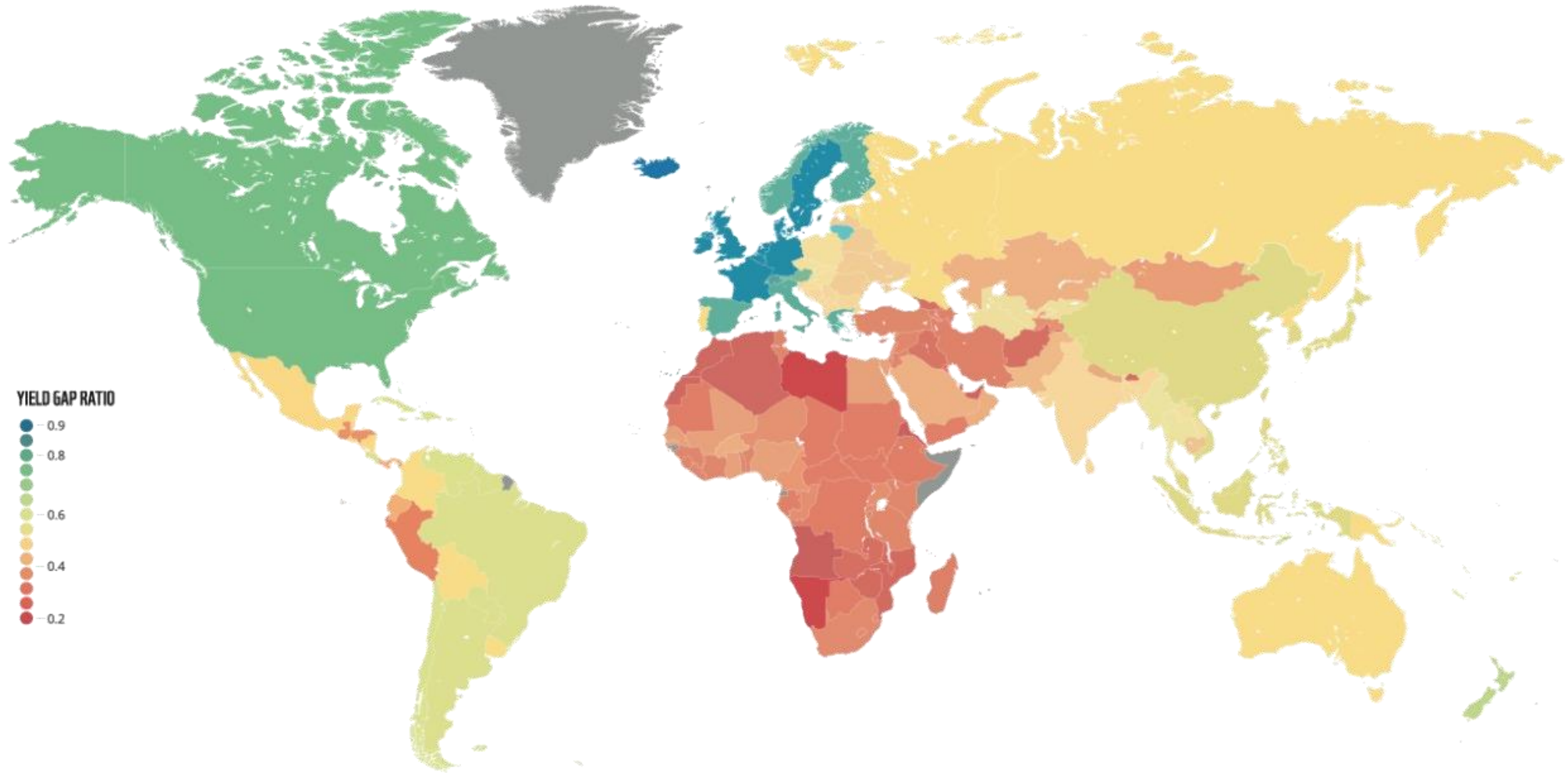
Source: "Bending the curve: the restorative power of plant-based diet"
WWF 2020

Total Area of Grazing Lands (Pasture and Rangelands) Needed to Support Current Diets, NDGs, and Other Dietary Patterns in Brazil



Source: "Bending the curve: the restorative power of plant-based diet"
WWF 2020

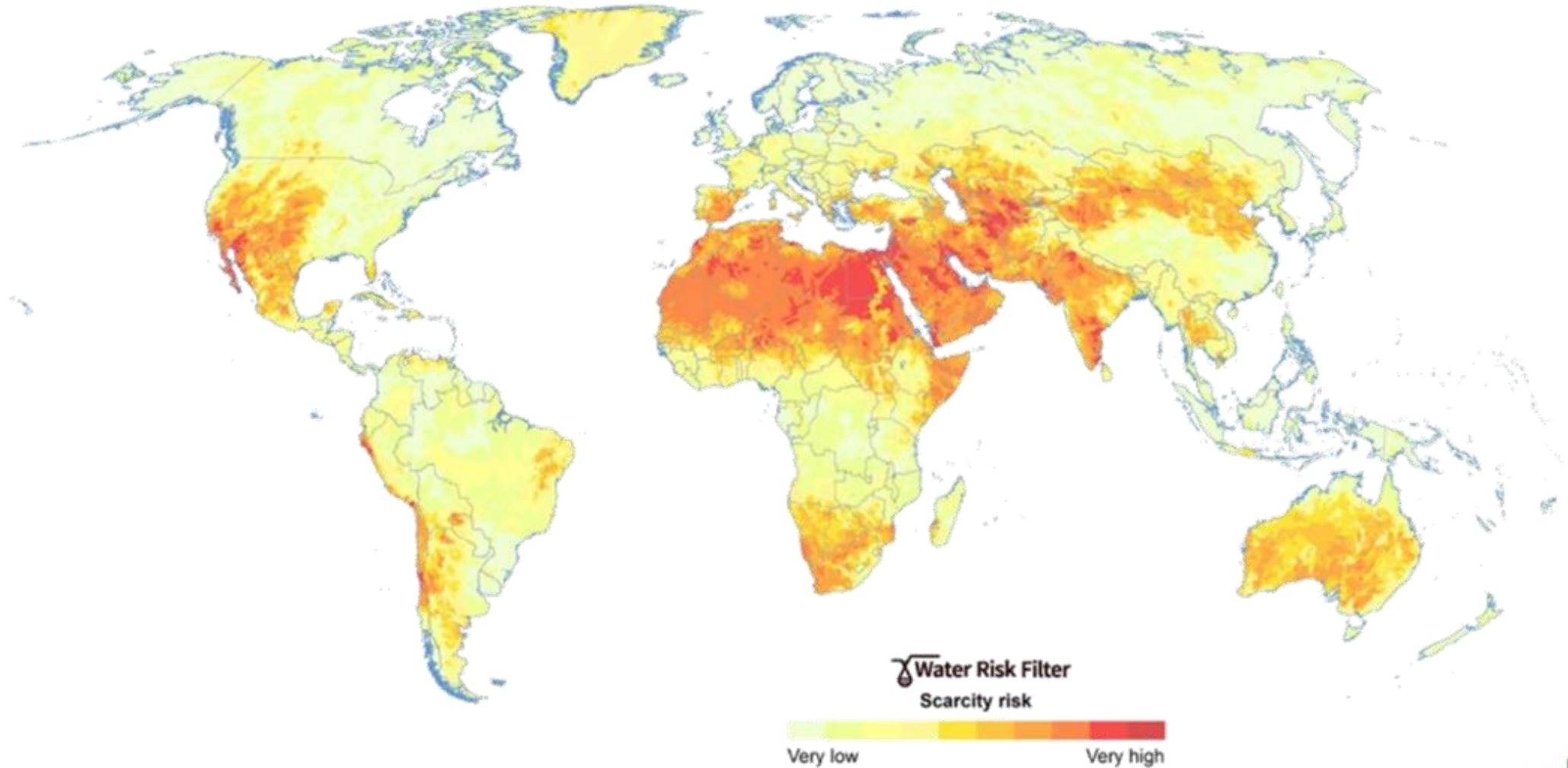
Yield Gap Ratios for Various Countries



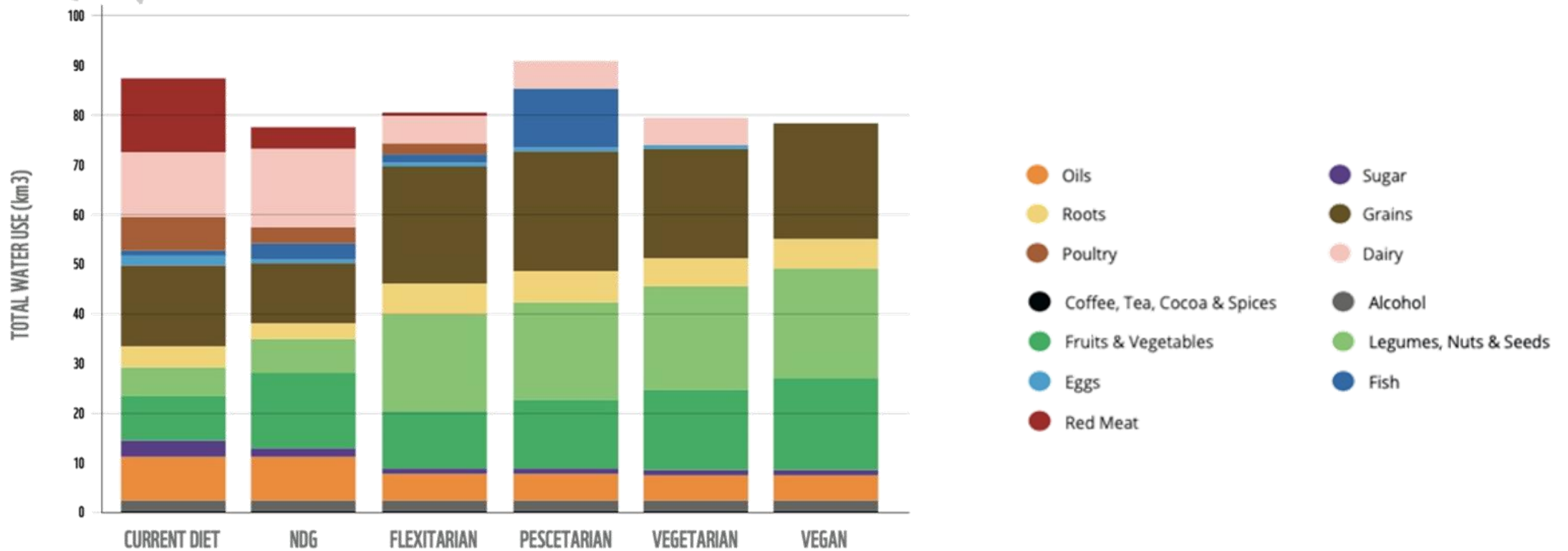
Source: Clark et al. (2018)

Available in: "Bending the curve: the restorative power of plant-based diet" - WWF 2020

Water Risk Filter Map Showing the Variation in Water Scarcity



Total Water Use of Current Diets, NDGs, and Other Dietary Patterns in USA



Source: "Bending the curve: the restorative power of plant-based diet"
WWF 2020

WE URGE ALL COUNTRIES TO:

1 Immediately review and update existing NDGs or develop new NDGs that integrate human health and environmental sustainability goals.

2 Assign shared responsibility for updating existing NDGs to the Ministries of Health and Ministries of Environment or Agriculture, or their associated agencies.

3 Ensure updated NDGs are developed by an independent scientific body and are free from industry influence.

4 Integrate NDGs into environmental policy frameworks including the Paris Agreement, post-2020 global biodiversity framework and Sustainable Development Goals.

Levels of Policy Options Available to Policy Makers

POLICY RUNG	POLICY OPTION	LEVEL OF INTERVENTION	DESCRIPTION
8	Eliminate choice		Channel actions only to the desired end and isolate inappropriate actions
7	Restrict choice		Remove inappropriate choice options
6	Guide choices through disincentives		Apply taxes or charges
5	Guide choices through incentives		Use regulations or financial incentives
4	Guide choice by changing		Provide 'better' options
3	Enable choice		Enable individuals to change behaviour
2	Provide Information		Inform or educate the public
1	Do nothing		No action or only monitor situation

WE ARE PRODUCING ENOUGH FOOD TO FEED EVERYONE ON THE PLANET BUT IN THE PROCESS WE ARE NOT RESPECTING PLANETARY BOUNDARIES

MULTILATERAL ACTIONS



Facilitate international coordination of efforts

Global transformations of the past have taught us that no single actor or breakthrough will be enough to catalyse systems change.⁵ The results presented in this report have highlighted that transformational changes in the way we produce and consume food will require an unprecedented level of global partnerships and coordination of efforts. Although the specific actions that are implemented will be context-specific, the only way that we can bend the curve on the negative impacts of the global food system to achieve healthy and sustainable diets for all people is through coordinated global action.

The UN Food Systems Summit in 2021 is a critical opportunity to facilitate such international coordination. The UN Summit is intended to “raise global awareness and land global commitments and actions that transform food systems to resolve not only hunger, but to reduce diet-related disease and heal the planet. The Secretary-General is calling for collective action of all citizens to radically change the way we produce, process, and consume food.”⁵ The findings of this report can serve as a scientifically robust evidence base for the Summit to guide individual countries as they develop commitments to bend the curve on negative impacts of their own food systems.



Incorporate diets into the post-2020 global biodiversity framework

As the UN Decade on Biodiversity (2011–2020) and the Strategic Plan for Biodiversity 2011–2020 and its Aichi Targets draw to a close, there is a need for a more robust and binding commitment from all countries to slow down and reverse biodiversity loss. The post-2020 global biodiversity framework is currently being negotiated and will be agreed upon in 2021. The results of this study and many others have highlighted the critical role that shifting diets can play in reducing pressure on land conversion for agriculture and reversing biodiversity loss (see Figures 26, 30).^{4-5,27} With current food production accounting for nearly 80% of biodiversity loss globally (see Figure 12), the world will not be able to achieve progress on bending the curve on biodiversity loss unless dietary shifts are considered and incorporated into new treaties and agreements moving forward. Given this, we are calling for healthy and sustainable

diets and their associated impacts to be integrated into the post-2020 global biodiversity framework. This could be similar to how the IPCC’s Special Report on Climate Change and Land¹ described plant-based diets as a major opportunity for mitigating and adapting to climate change – and included a policy recommendation to reduce meat consumption.⁷⁶



Establish global research coordination bodies for food systems

Underlying any international coordination of efforts must be a champion or group of champions that highlights the narrowing gap between scientific evidence and policymaking. Such a group of champions for food systems and dietary shifts could be similar to existing bodies such as the IPCC, the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) or the International Panel of Experts on Sustainable Food Systems (IPES-Food). Currently, an integrated health and sustainable diets agenda tends to get lost or seen as too big to tackle and therefore a new oversight body or bodies might be needed that would be able to deliver robust scientific synthesis research while being subject to intergovernmental agreements, conventions and Conferences of the Parties (COP). An international body specifically focusing on healthy and sustainable diets, akin to how the IPCC focuses on climate change, could play a key role in curating the global evidence base necessary to build a global agenda on diets.



Develop a framework convention on food systems

As shown in this report, dietary changes can help to meet existing international agreements such as the Paris Agreement, global biodiversity framework and SDGs. However, a new framework convention or agreement/treaty for food systems is almost certainly needed to spur commitments and hold countries legally accountable to these commitments. A “UN Framework Convention on Healthy and Sustainable Food Systems”, similar to the Framework Convention on Climate Change or the Convention on Biological Diversity, could help organize commitments but leave national-level strategies for transforming food systems up to individual countries. The agreements negotiated by such a framework convention on food would need to be informed by a scientific body of experts on healthy and sustainable diets, akin to the IPCC for climate change.



**SCOPE, LIMITATIONS,
UNCERTAINTY**

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Green Peace Report Summary: How JBS is Still Slaughtering the Amazon

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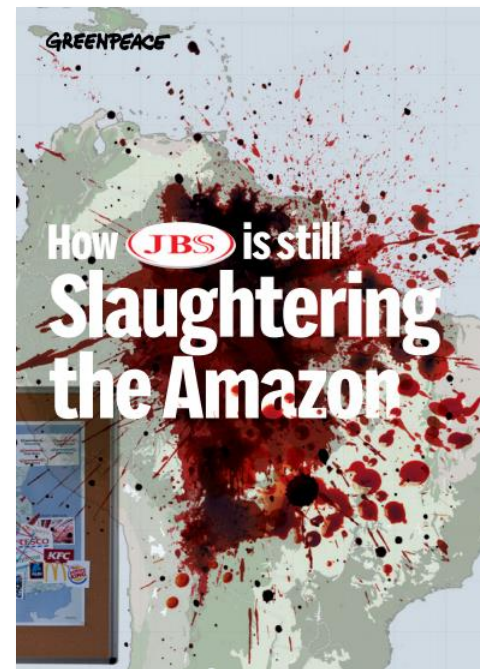
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Greenpeace Attacks Against JBS and Brazilian Meat Industry

GREENPEACE

Taking stock – JBS, the world's largest meat producer, is still slaughtering the Amazon



Greenpeace Attacks Against JBS and Brazilian Meat Industry



Above from top left:

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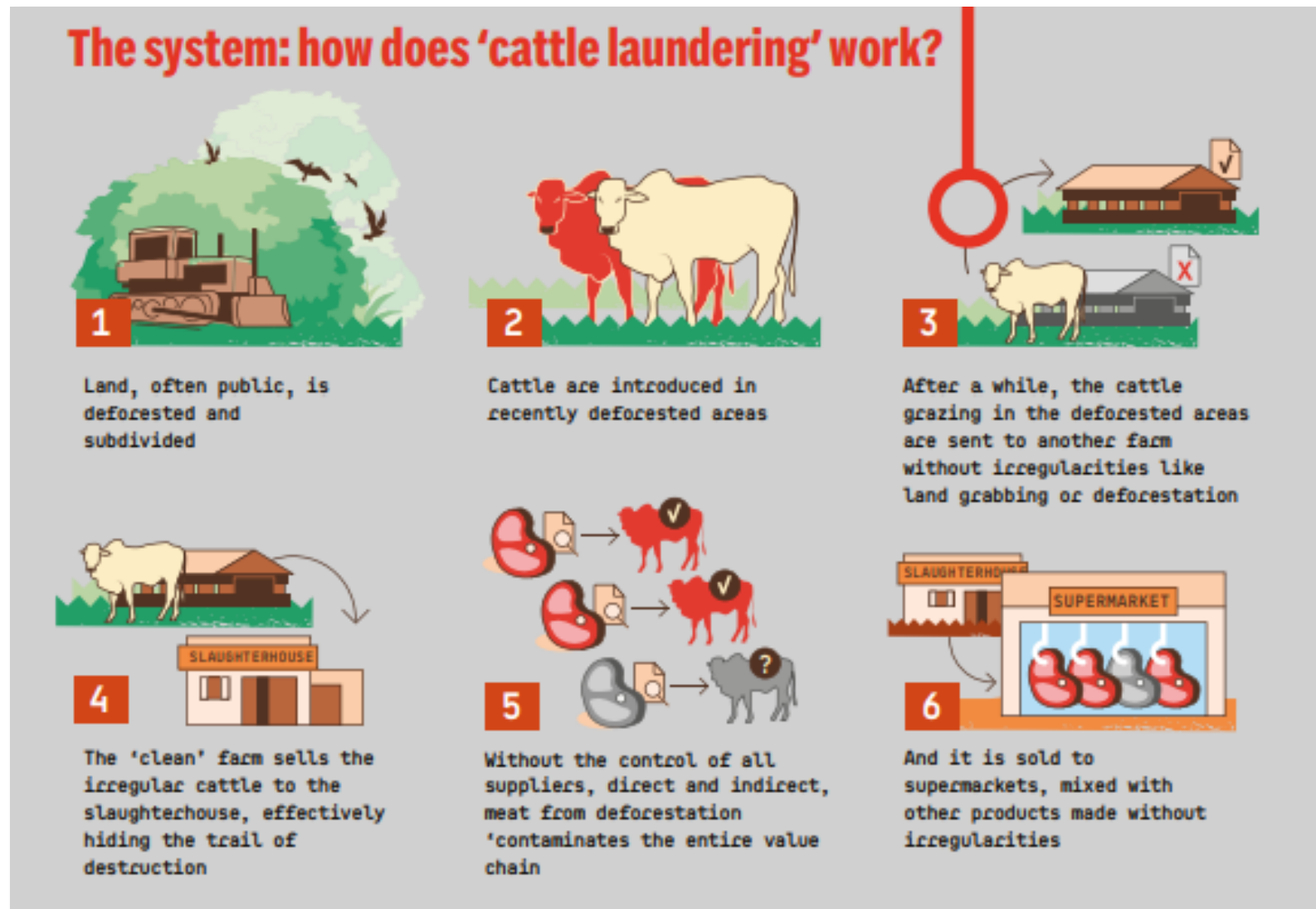
Screenshot from <https://www.youtube.com/watch?v=MF9oac5Yv4ARt&list=PL25g>

8 August 2008, Fazenda Estancia Bahia, Mato Grosso, Brazil: Cattle farm. ©Greenpeace/Daniel Beltrá

23 May 2019, Formosa do Rio Preto, Brazil: Cargill soya silo in the Cerrado region. ©Marizilda Cruppe/Greenpeace

9 July 2020, Alta Floresta, Mato Grosso, Brazil, 11°50'18.5259" S 57°16'33.3421" W: Deforestation and fire monitoring in the Amazon. ©Christian Braga/Greenpeace

Greenpeace Attacks Against JBS and Brazilian Meat Industry



Greenpeace Attacks Against JBS and Brazilian Meat Industry

**Supporting
destruction –
supermarkets and
fast food companies
are bankrolling
environmental
collapse**

***'All economic partners
of Brazil should share the
blame for indirectly promoting
deforestation and GHG emissions
by not barring imports and
consuming agricultural products
contaminated with deforestation,
illegal or not.'***⁴³

Raoni Rajão et al., Science, July 2020



Source: "How JBS is Still Slaughtering the Amazon"
Green Peace 2020

Greenpeace Attacks Against JBS and Brazilian Meat Industry



Source: "How JBS is Still Slaughtering the Amazon"
Green Peace 2020

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- ❖ Marcos Fava Neves, nascido em Lins (SP), é professor em tempo parcial das Faculdades de Administração da Universidade de São Paulo em Ribeirão Preto e da EAESP/FGV em São Paulo. Engenheiro Agrônomo formado pela Escola Superior de Agricultura Luiz de Queiroz (Esalq/USP) em 1991 e fez toda a carreira de pós graduação (mestrado, doutorado e livre-docência) em estratégias empresariais na FEA/USP e chegou a professor titular da USP aos 40 anos, tendo sido Chefe do Departamento de Administração da USP em duas gestões e Vice-Chefe em outras duas gestões.
- ❖ Complementou sua pós graduação em temas de planejamento e gestão aplicados ao agronegócio na França (1995 – no IGIA) e na Holanda (1998/99 – na Universidade de Wageningen). Fez também cursos de curta duração em Harvard (2008/2009/2010), Purdue (2013/2017), Sevilla (2017) e Florida (2018);
- ❖ Desde 2006 é Professor Visitante da Universidade de Buenos Aires e desde 2013 da Purdue University, Indiana, EUA, onde lecionou no ano de 2013;
- ❖ É especializado em planejamento e gestão estratégica, tendo realizado mais de 200 projetos no agronegócio brasileiro e mundial. Trabalhou ou foi membro de Conselhos das seguintes organizações: Botucatu Citrus, Vallée, Lagoa da Serra (CRV); Renk Zanini, Inova, Embrapa, Serviço de Informação da Carne, Associação Mundial de Agronegócios, Cooperativa Coplana, Cooperativa Holambra, Ouro Fino, Canaeste e Orplana (Organização dos Plantadores de Cana). Ajudou a montar e é acionista de 3 empresas, sendo 2 startups;
- ❖ É autor e organizador de 67 livros publicados no Brasil, Argentina, Estados Unidos, África do Sul, Uruguai, Inglaterra, Cingapura, Holanda e China, por 10 editoras diferentes. Escreveu também dois casos para a Universidade de Harvard (2009/2010) e para a Purdue University (2013);
- ❖ Publicou mais de 200 artigos em periódicos científicos internacionais e nacionais indexados, tendo recebido 4.000 citações de acordo com o Google Acadêmico, um dos cientistas brasileiros mais citados em sua área; Foi articulista do jornal China Daily de Pequim e da Folha de S. Paulo, além de escrever artigos para O Estado de S. Paulo e Valor Econômico, entre outros, tendo mais de 600 artigos de análises de conjunta publicados em revistas e jornais;
- ❖ Participou de 335 Congressos no Brasil e no Exterior, tendo organizado também mais de 30 Congressos nacionais e internacionais;
- ❖ Na *formação de discípulos e de talentos humanos* orientou 29 Teses, sendo 4 de Doutorado e 25 de Mestrado e 133 Monografias. Ajudou, como professor, a formar mais de 1.200 administradores de empresas, tendo oferecido 127 disciplinas de graduação e 22 cursos de Mestrado e Doutorado na USP;
- ❖ Na *avaliação de cientistas*, participou de 176 Bancas, sendo 52 de Doutorado e 124 de Mestrado no Brasil e exterior;
- ❖ **Realizou 1.092 palestras em 22 países, sendo um dos brasileiros mais conhecidos no exterior na área de agronegócios.**