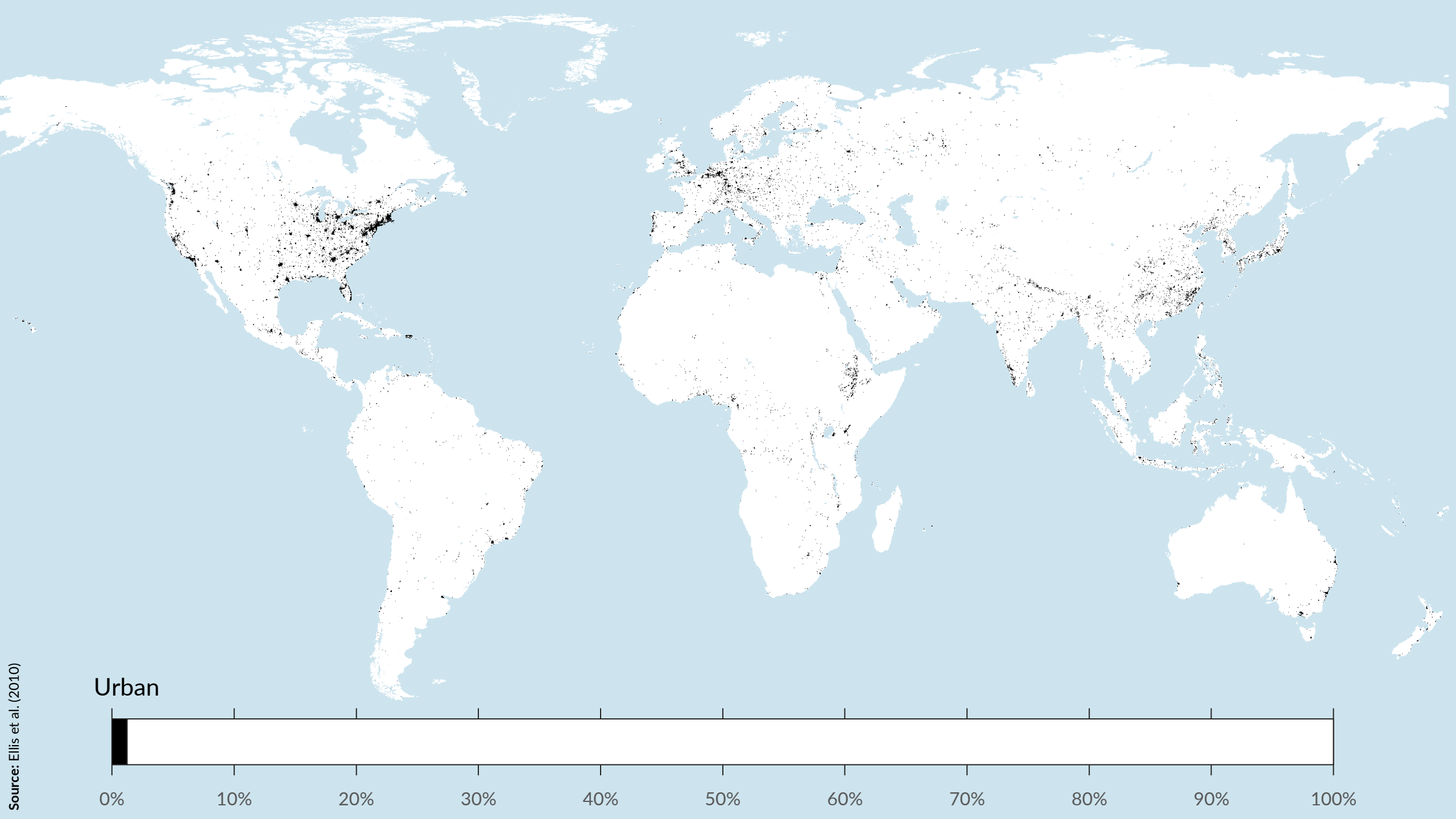
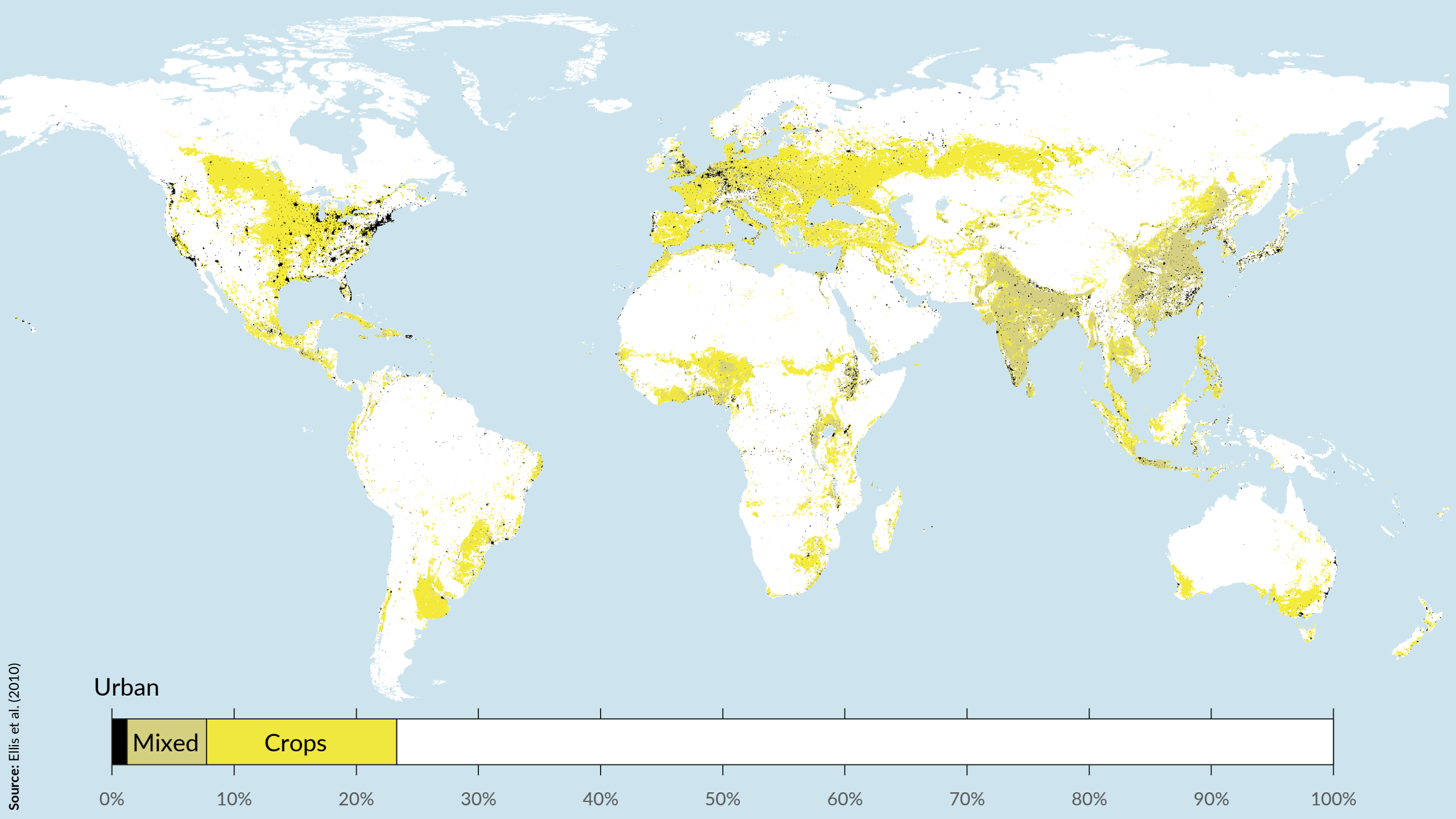
UNIVERSITY OF OXFORD

Reducing the environmental impacts of food: The critical role of plant-based diets

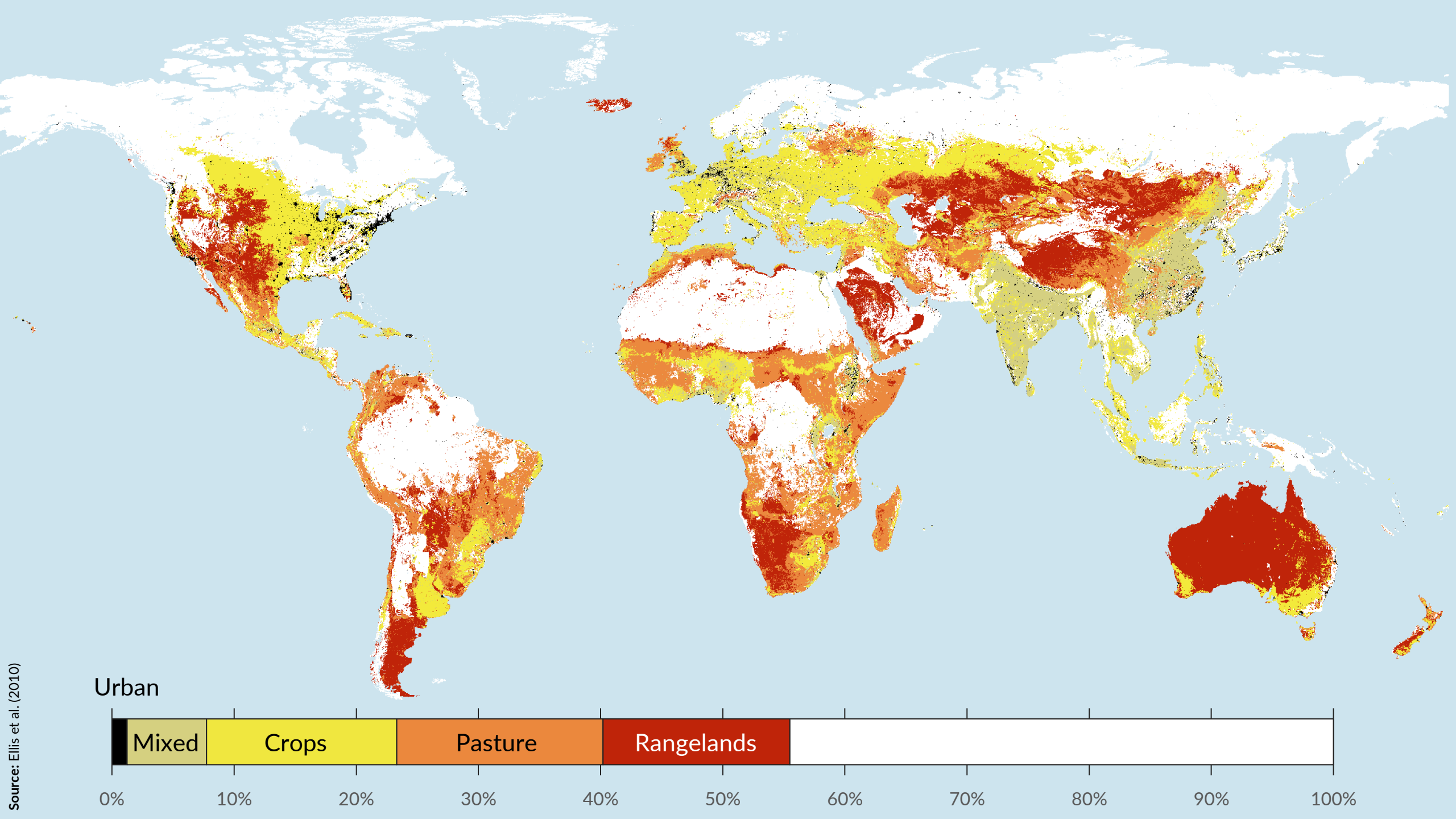
Joseph Poore, Vegforum presentation, 12th April 2023



Source: Ellis et al. (2010)



Source: Ellis et al. (2010)



Source: Ellis et al. (2010)

Source: Poore & Nemecek (2018) *Science*

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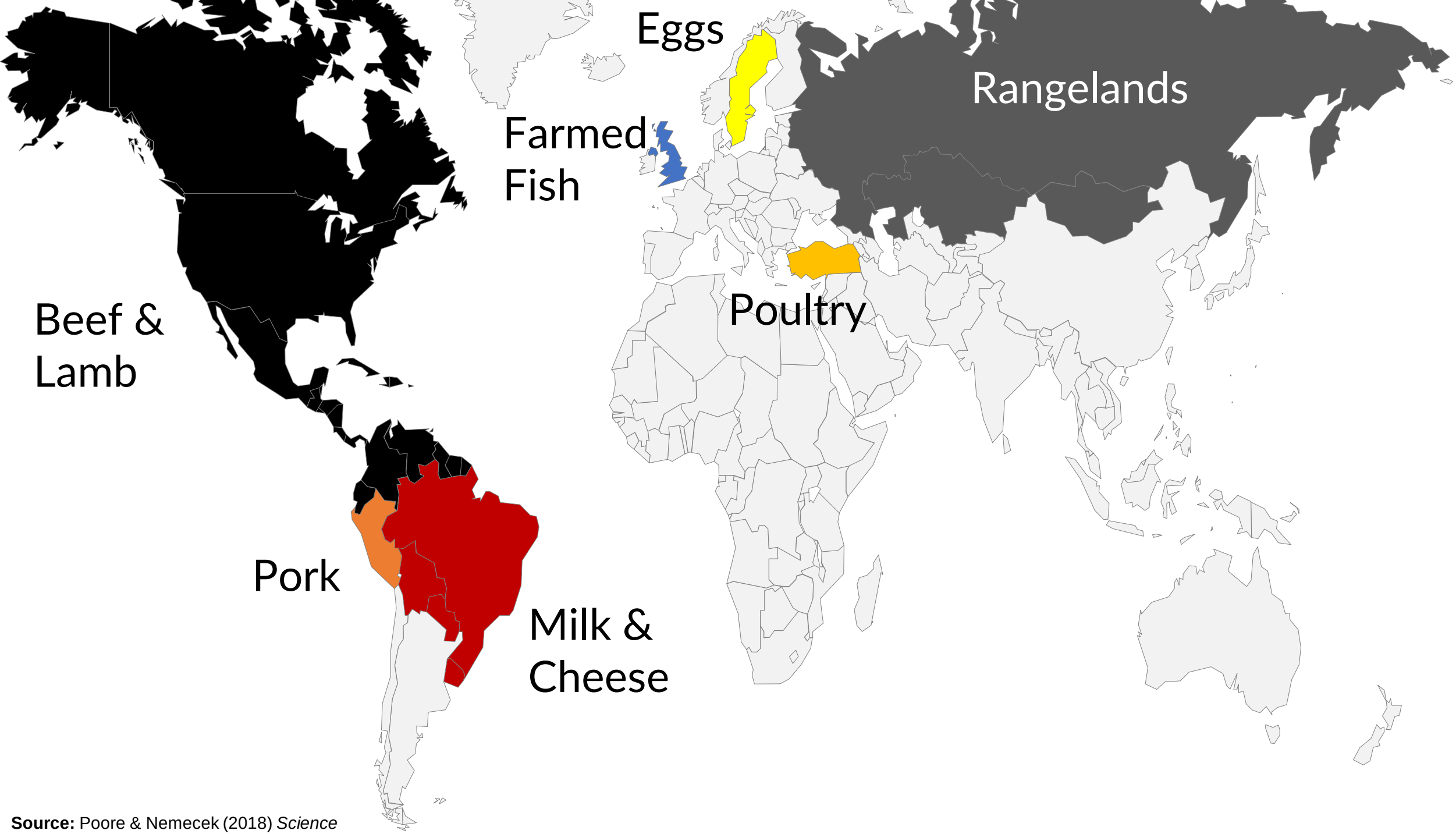
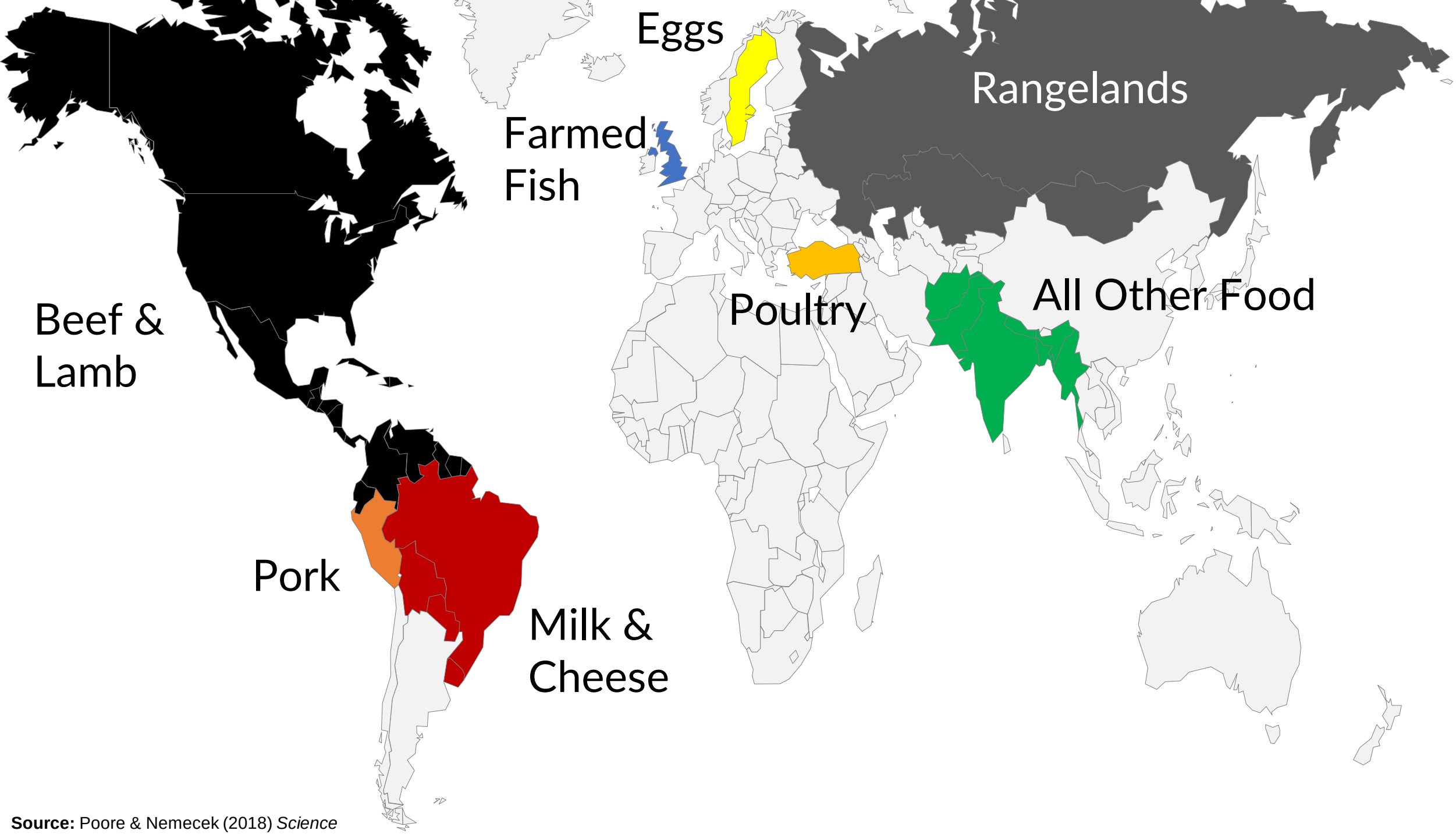
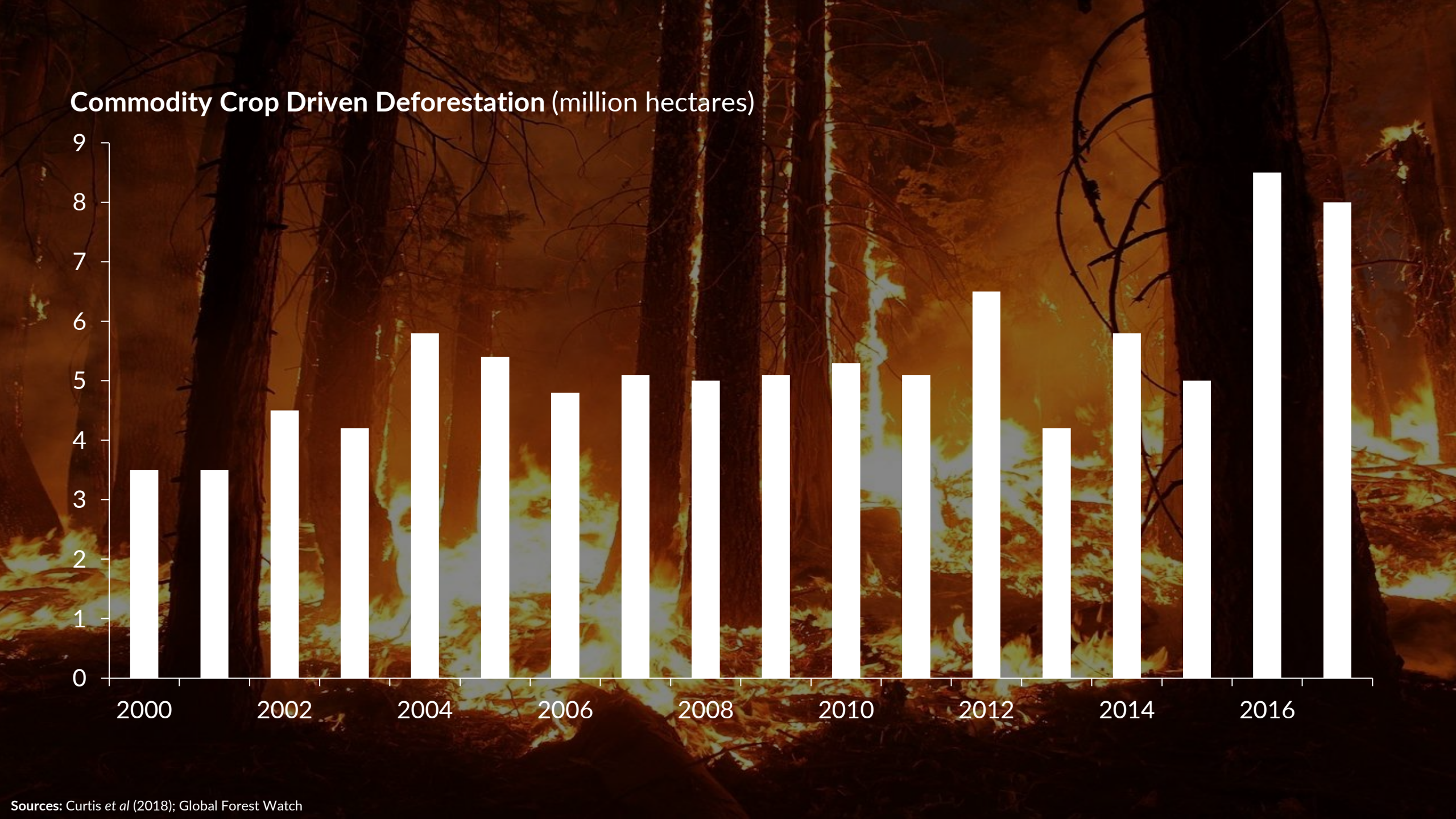


Source: Poore & Nemecek (2018) *Science*

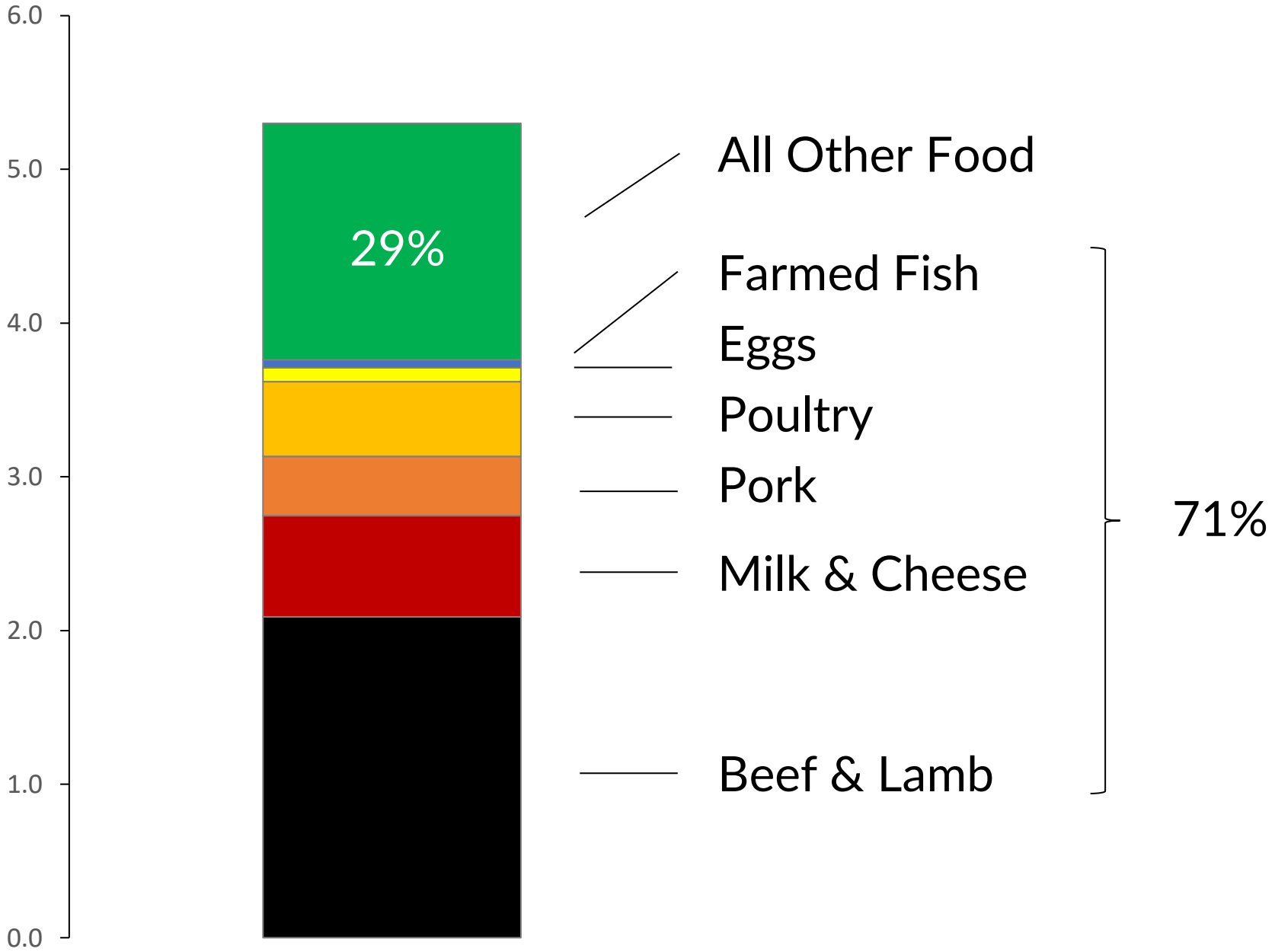


Source: Poore & Nemecek (2018) *Science*

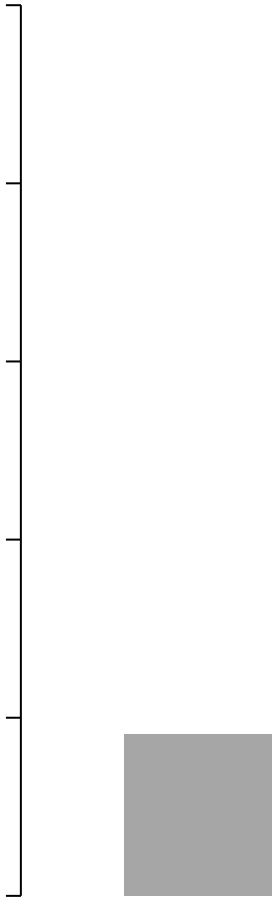


Sources: Curtis *et al* (2018); Global Forest Watch

Commodity Crop Driven Deforestation (million hectares per year, 1990-2010)

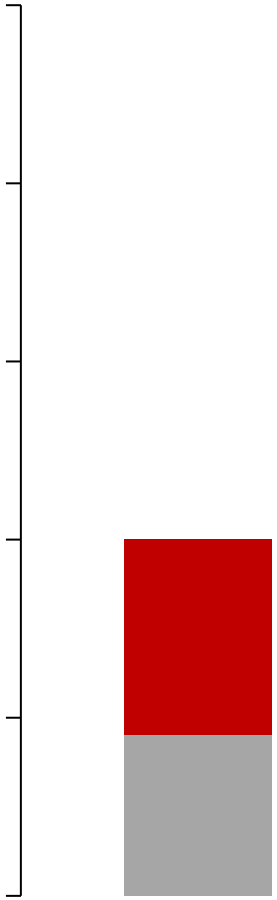


Source: Poore & Nemecek (2018) *Science*



Today: 0.9-1.2° warming

Source: IPCC (2018); Lenton *et al* (2019)



2° warming

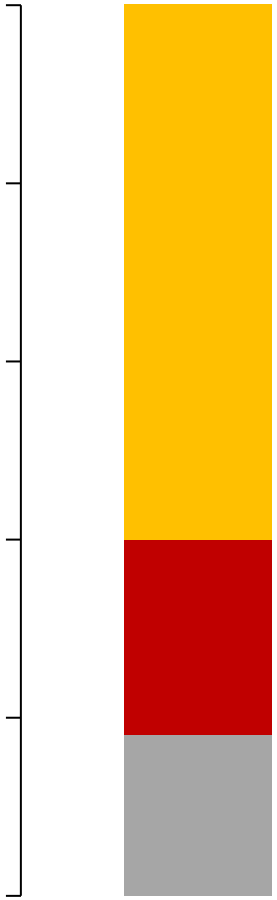
Today: 0.9-1.2° warming

- Coral reefs mostly disappear

- Ice-free summers at poles

- $20 trillion damages by 2100

Source: IPCC (2018); Lenton *et al* (2019)



4.3-5.1° warming
(SSP3/SSP5 by 2100)

- Forest dieback, releasing carbon
- Permafrost thawing, releasing methane

2° warming

- Coral reefs mostly disappear
- Ice-free summers at poles
- $20 trillion damages by 2100

Today: 0.9-1.2° warming

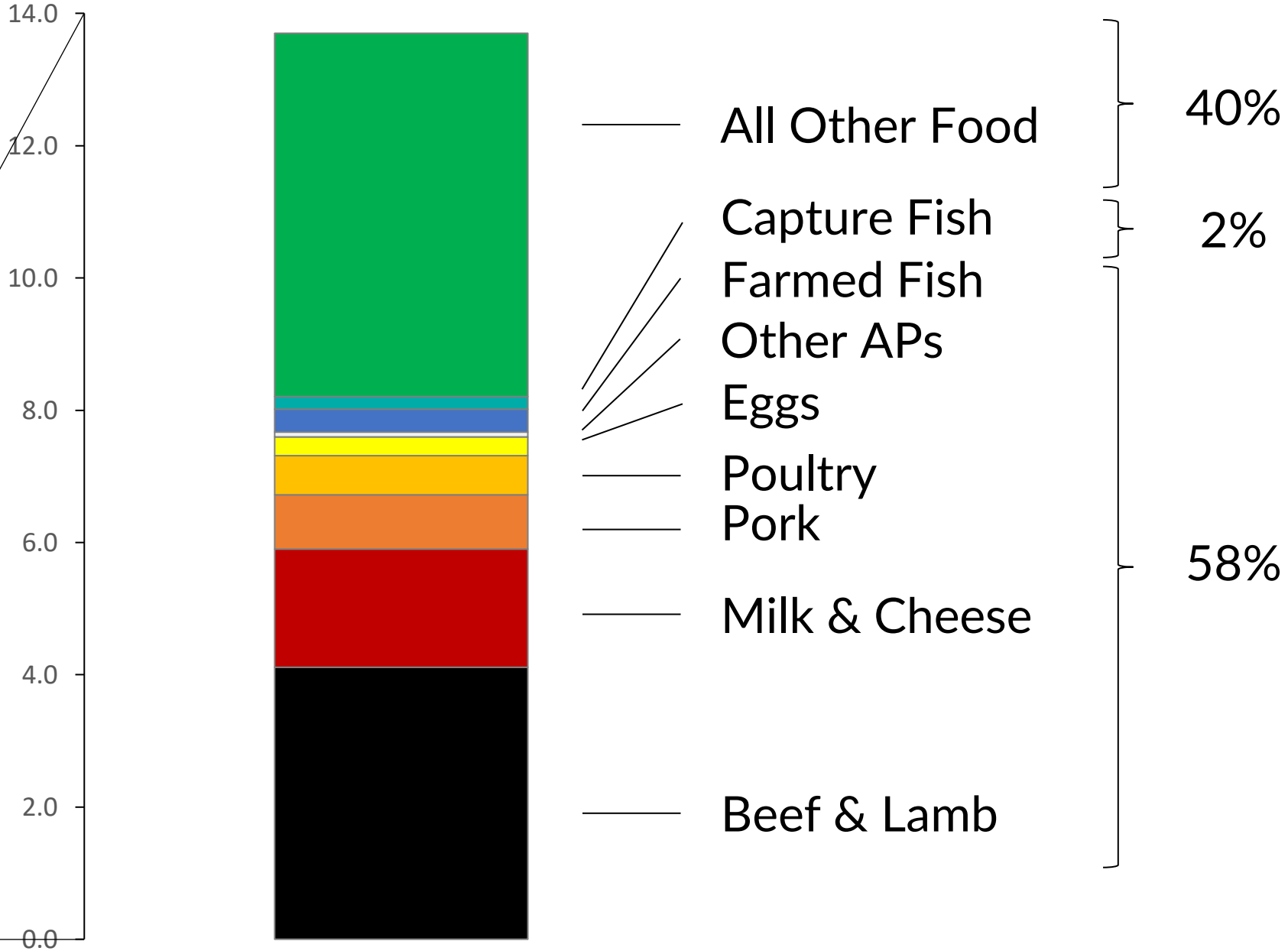
Source: IPCC (2018); Lenton *et al* (2019)

Greenhouse Gas Emissions

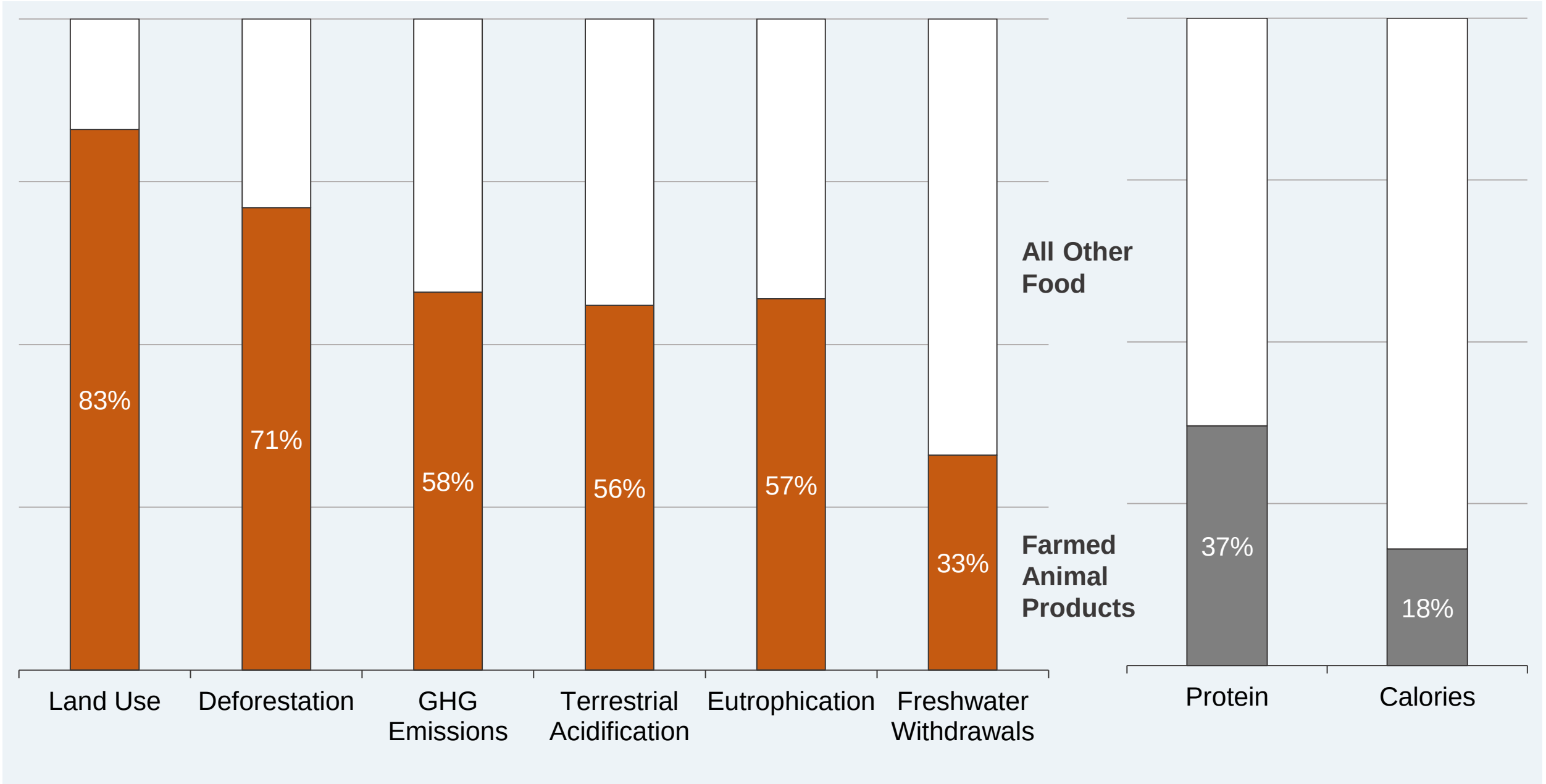
Source: Poore & Nemecek (2018)

Greenhouse Gas Emissions

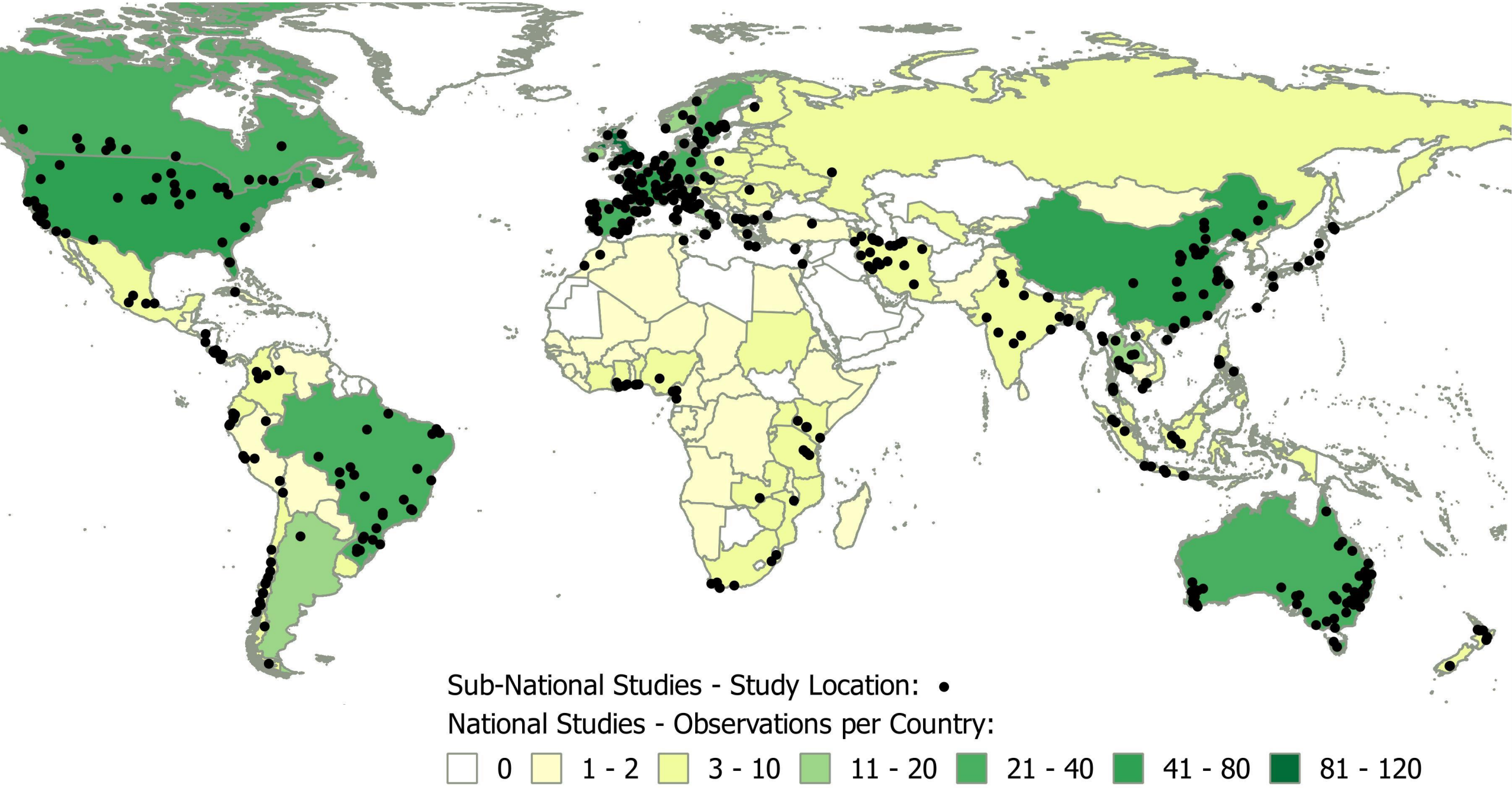
GHG Emissions (billion tonnes of CO_2eq per year)



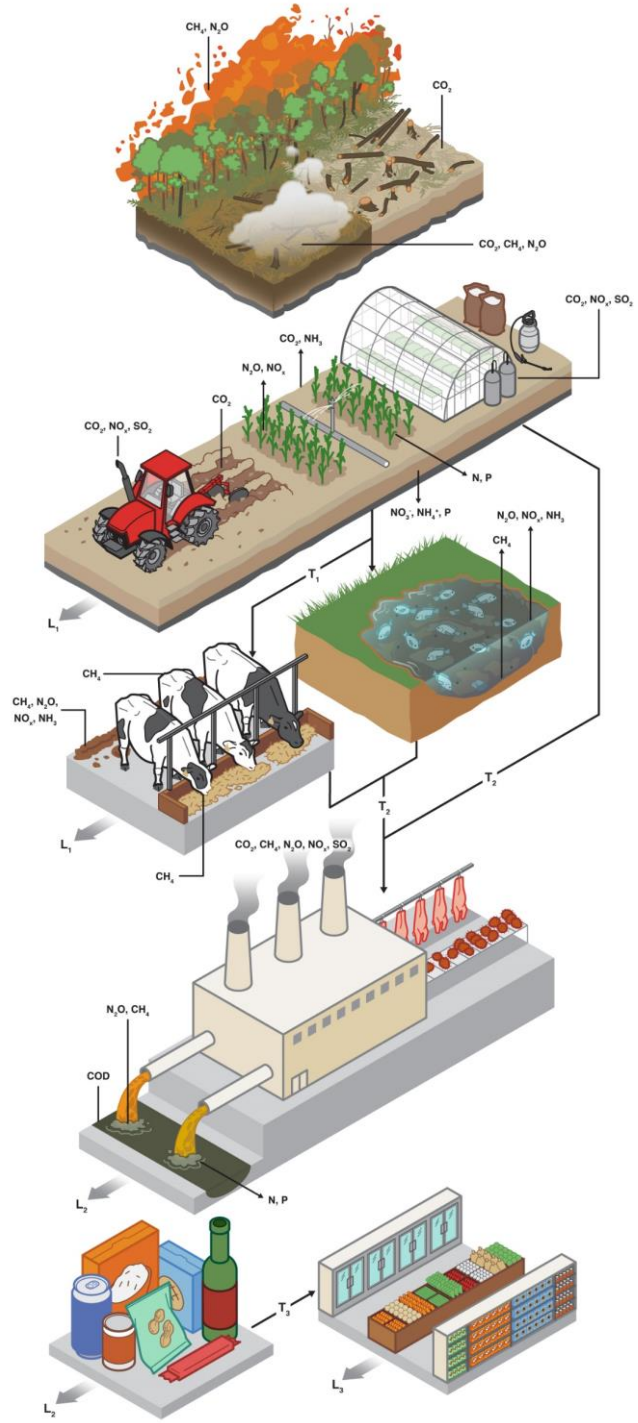
Source: Poore & Nemecek (2018)



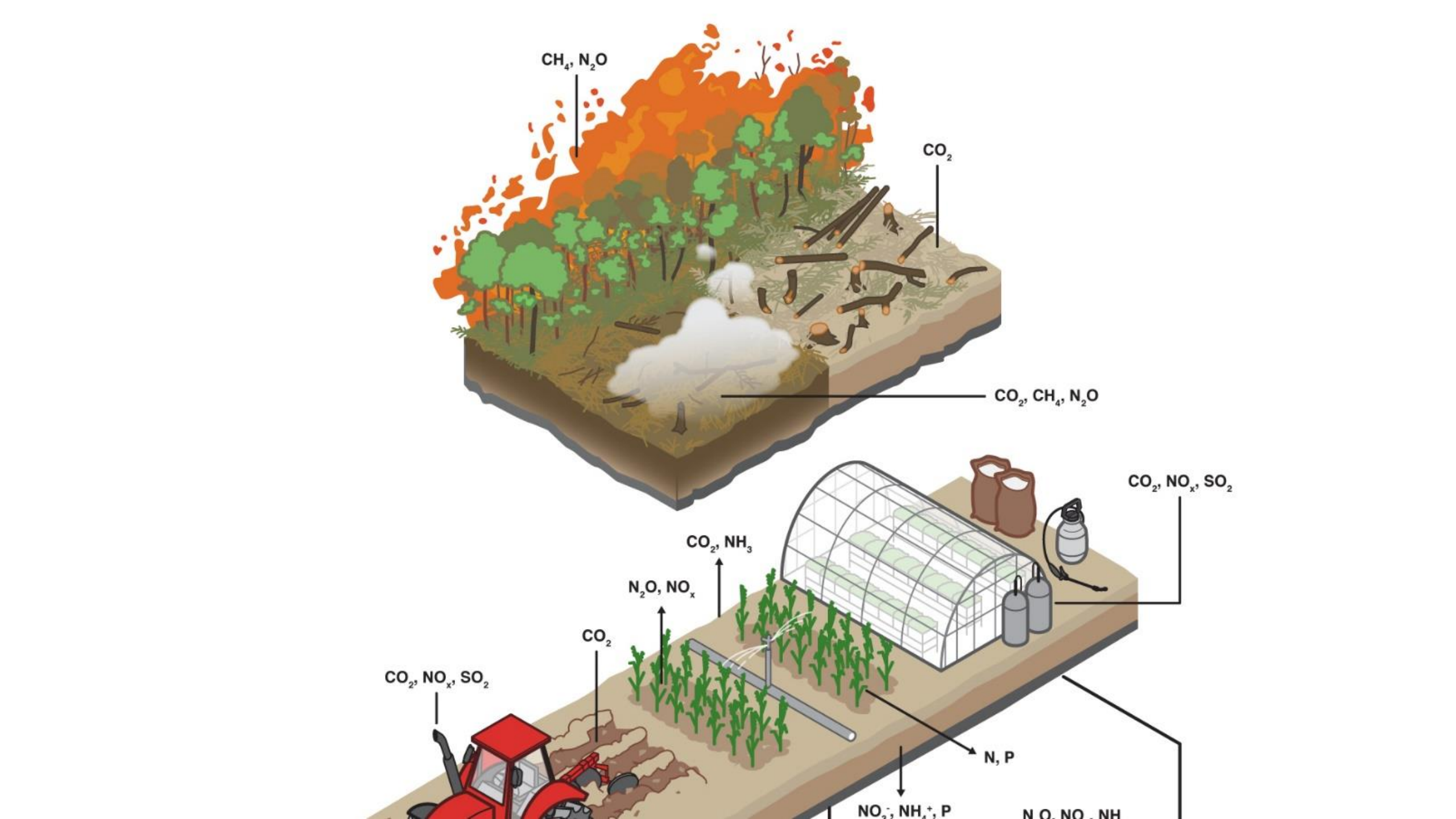
Source: Poore & Nemecek (2018)

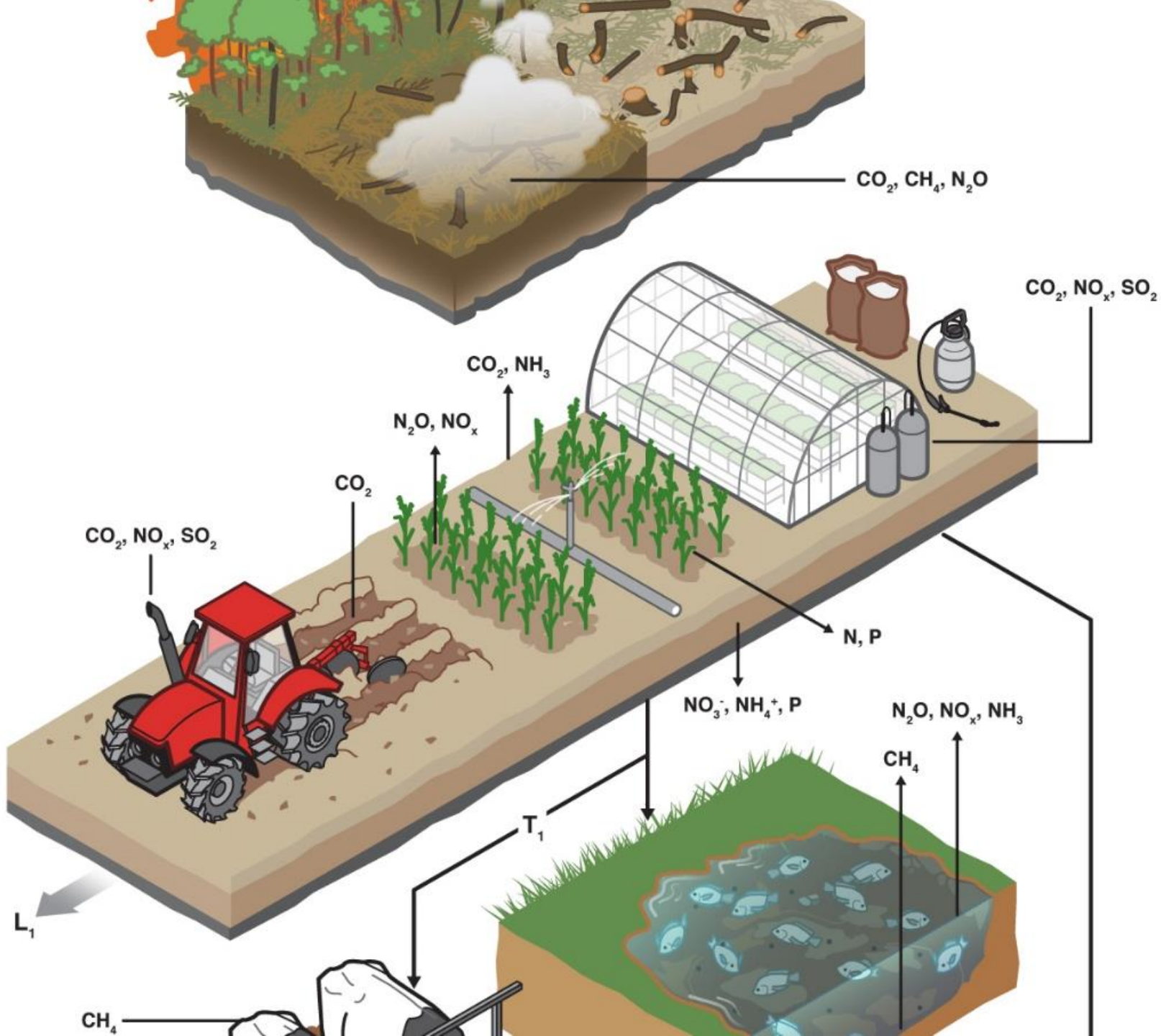


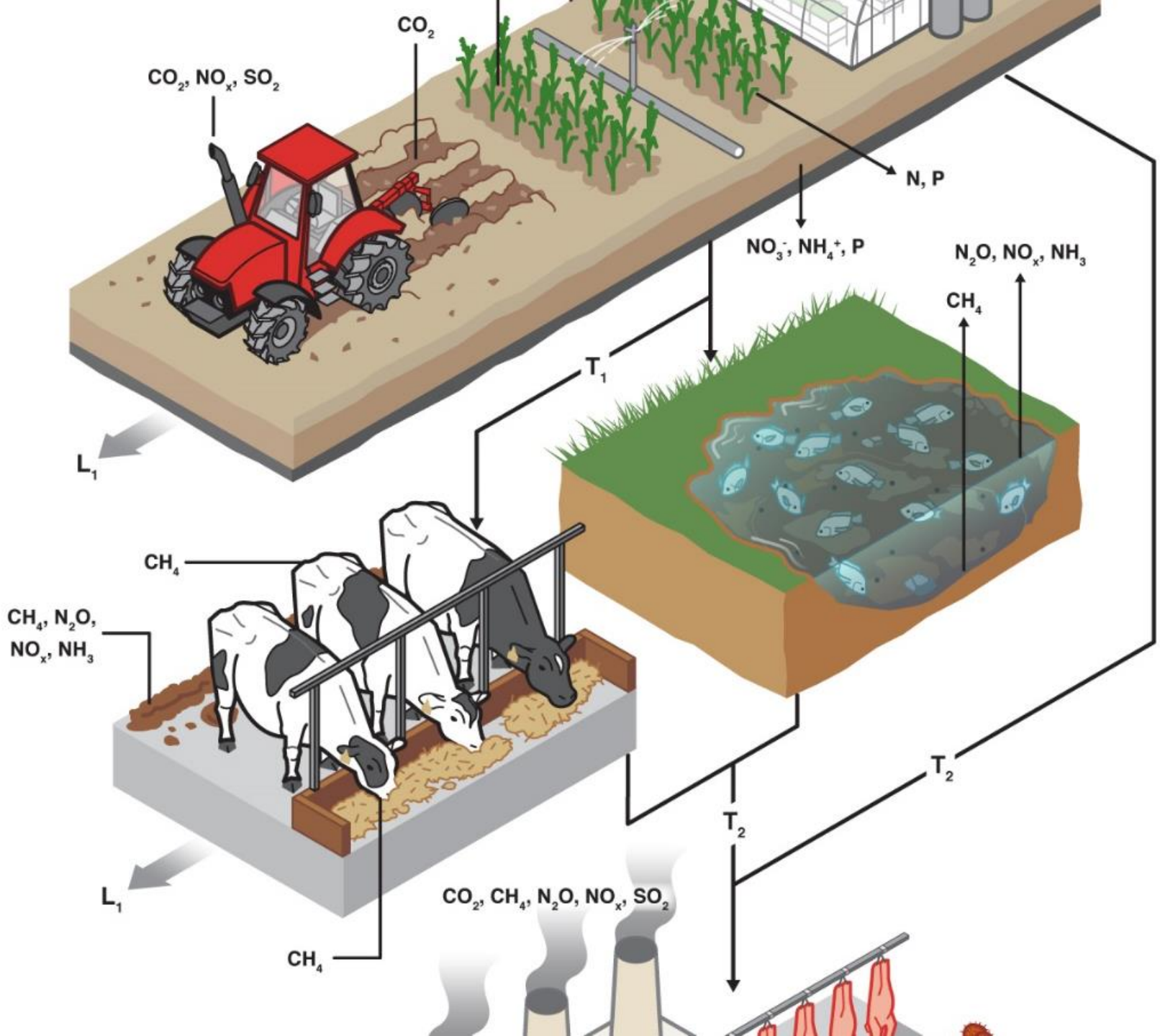
Source: Poore & Nemecek (2018) *Science*

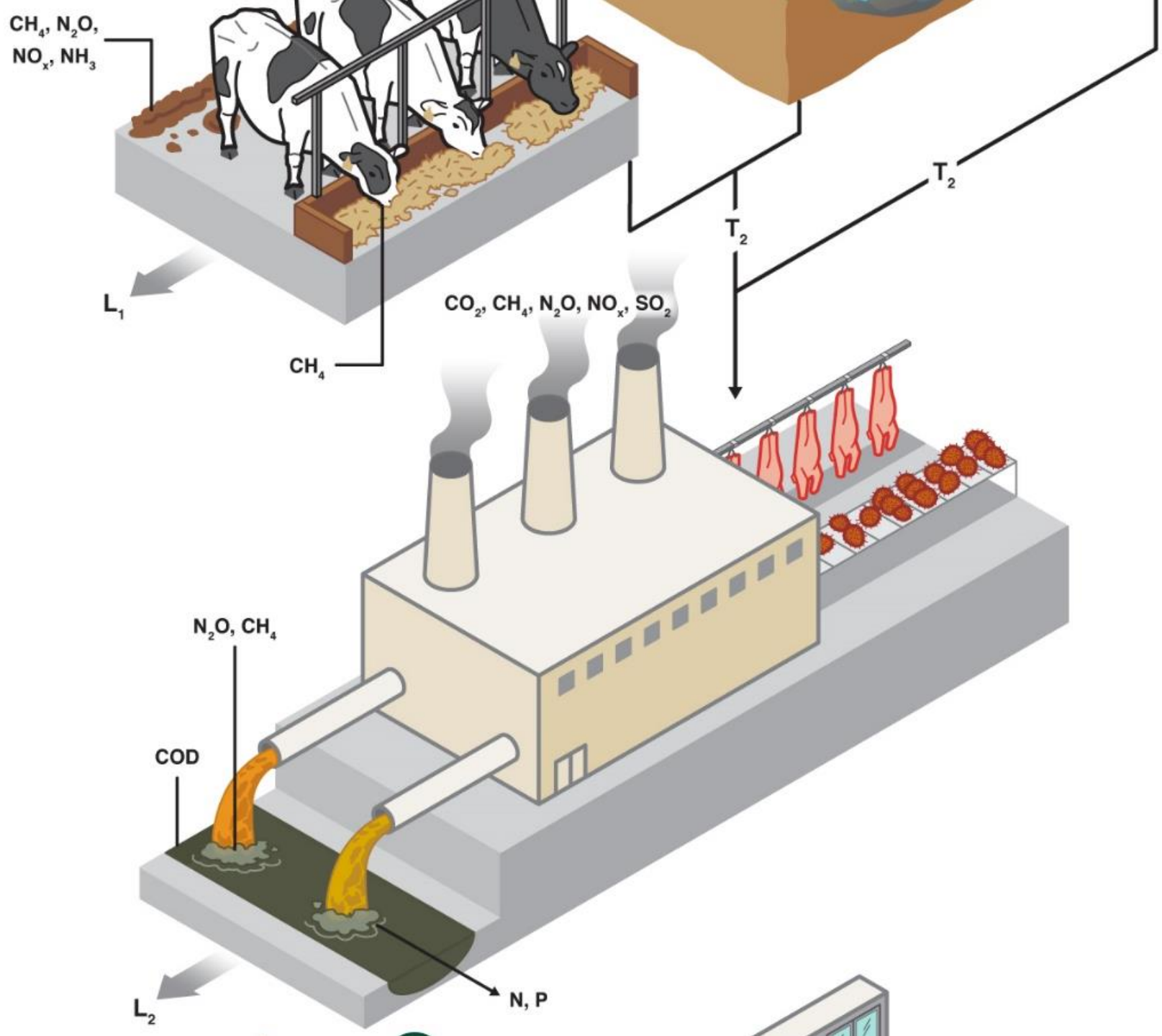


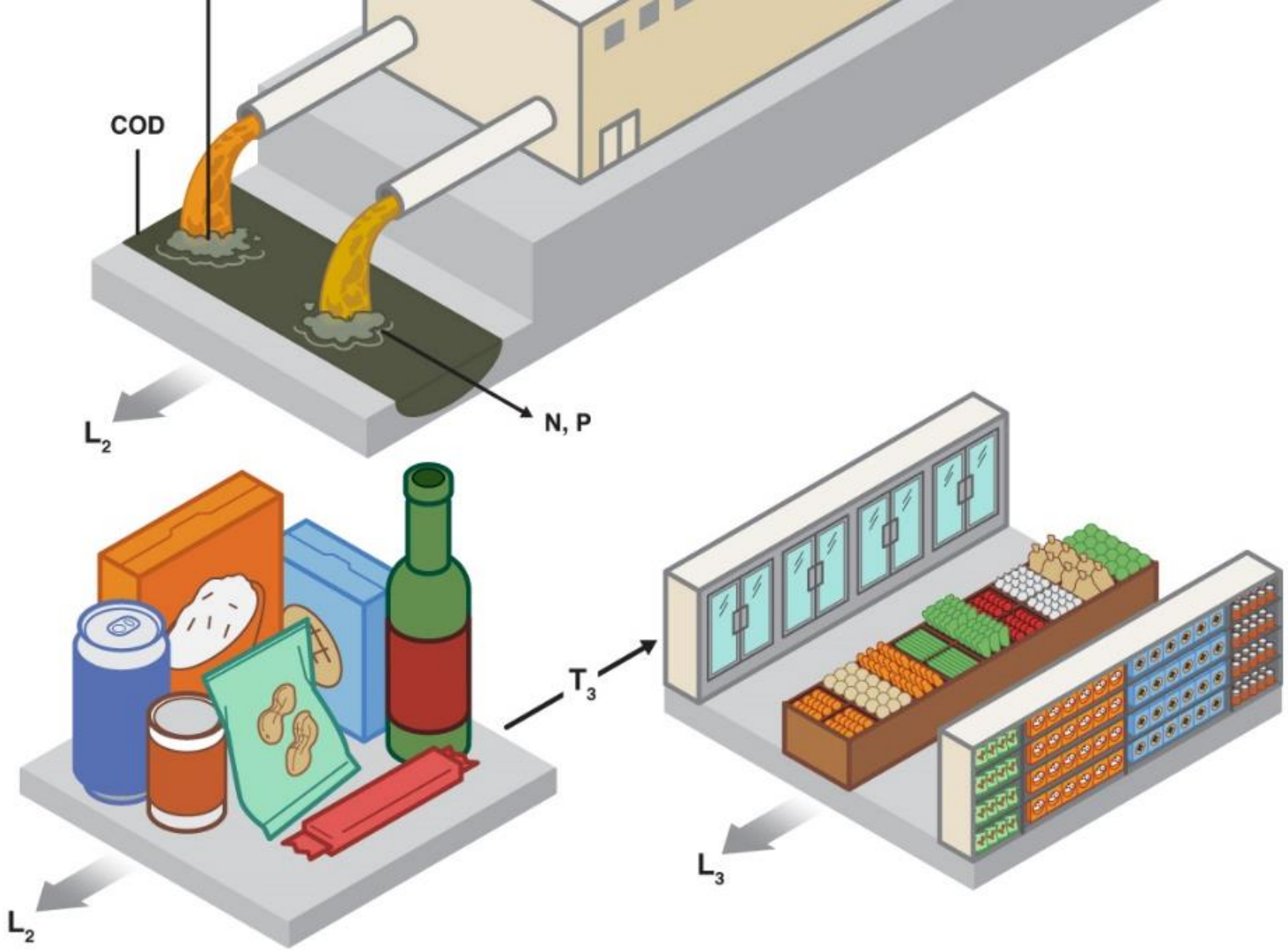
Source: Poore & Nemecek (2018) *Science*

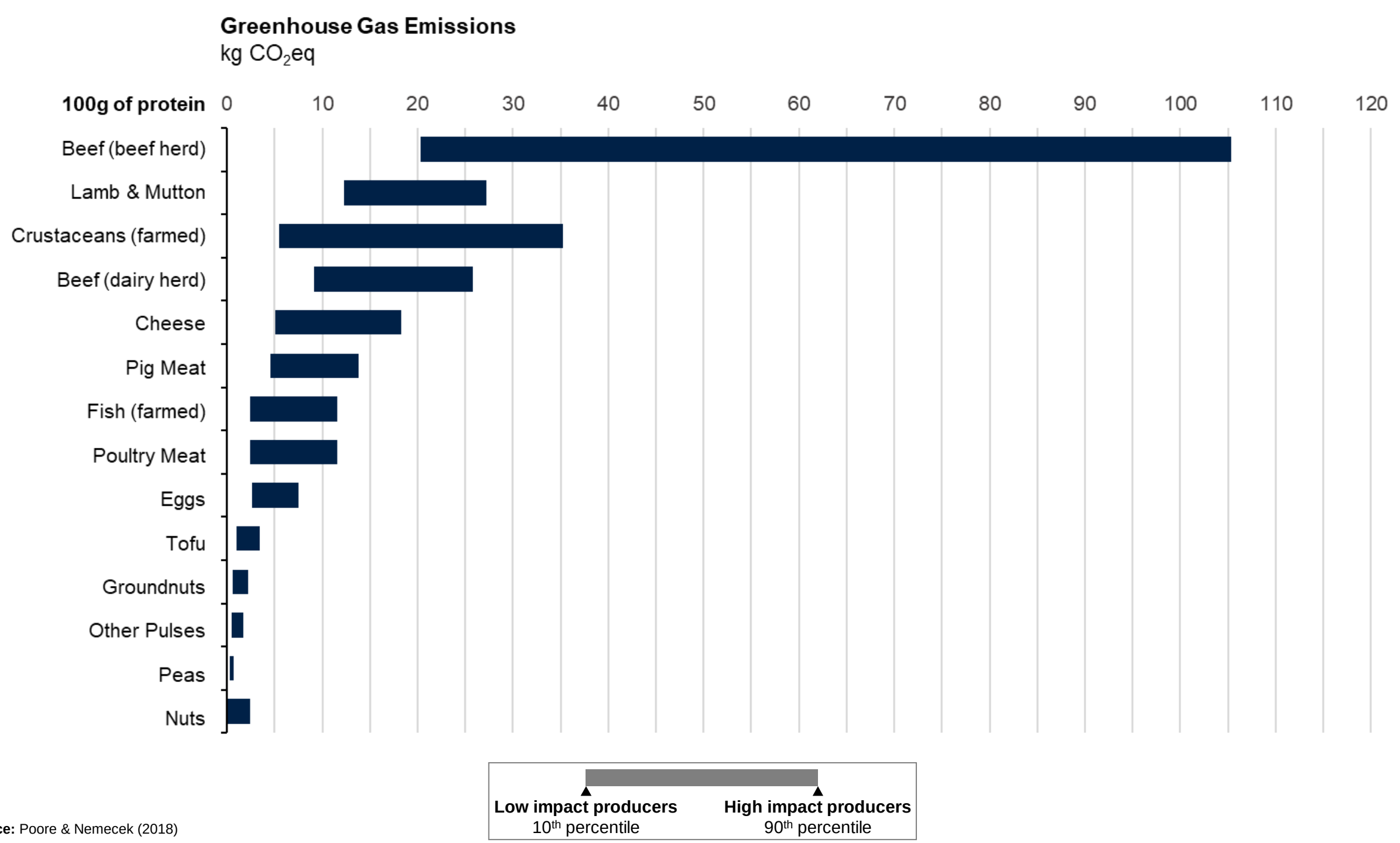

CH_4, N_2O
CO_2
CO_2, CH_4, N_2O
CO_2, NO_x, SO_2
CO_2, NH_3
N_2O, NO_x
CO_2
CO_2, NO_x, SO_2
N, P
NO_3^-, NH_4^+, P
N_2O, NO_x, NH_3


CO_2, CH_4, N_2O
CO_2, NO_x, SO_2
CO_2, NH_3
N_2O, NO_x
CO_2
CO_2, NO_x, SO_2
N, P
NO_3^-, NH_4^+, P
N_2O, NO_x, NH_3
CH_4
T_1
L_1
CH_4

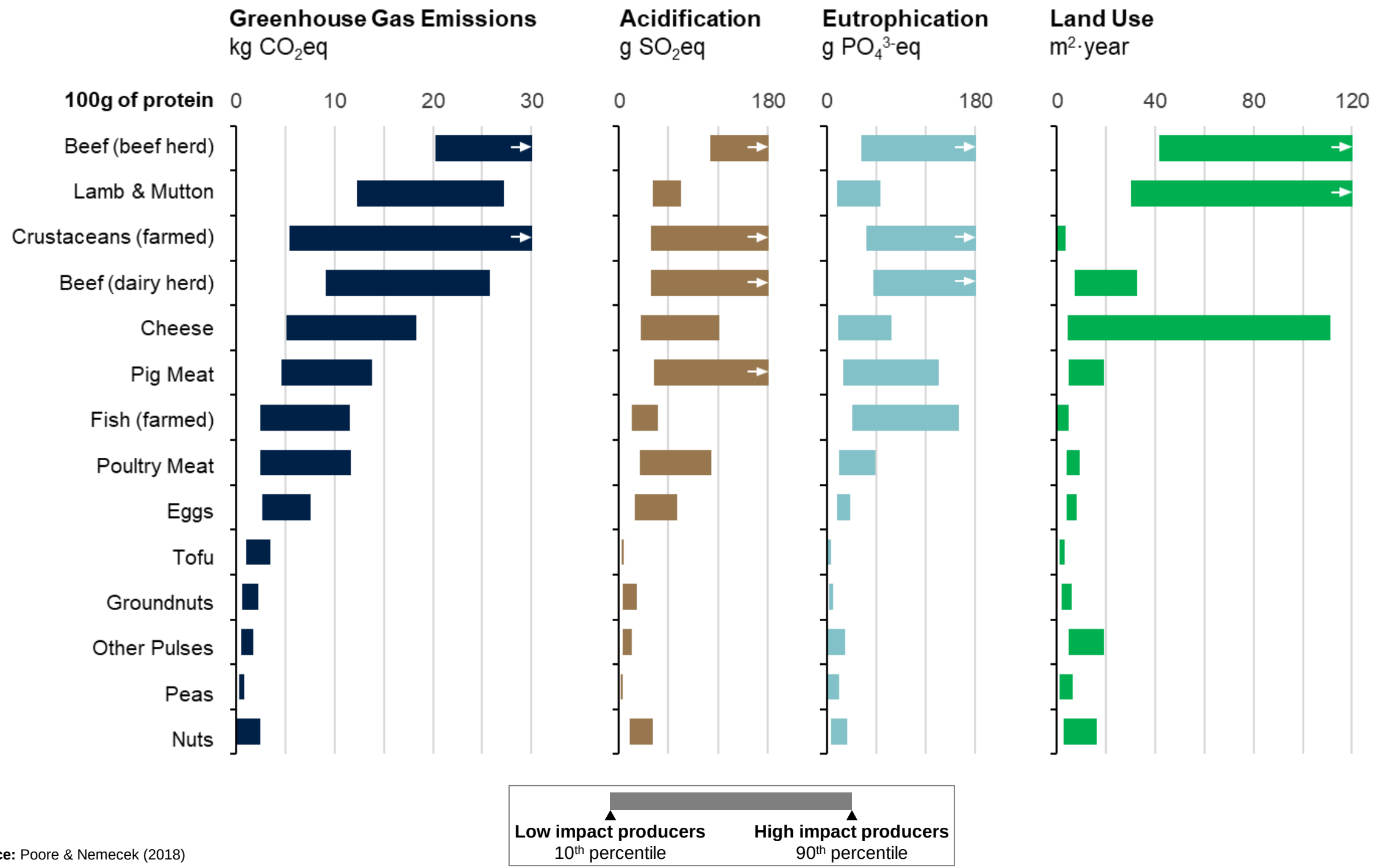

CO_2
CO_2, NO_x, SO_2
N, P
NO_3^-, NH_4^+, P
N_2O, NO_x, NH_3
CH_4
T_1
L_1
CH_4
CH_4, N_2O,
NO_x, NH_3
L_1
T_2
T_2
CO_2, CH_4, N_2O, NO_x, SO_2
CH_4


CH_4, N_2O,
NO_x, NH_3
T_2
T_2
L_1
CH_4
CO_2, CH_4, N_2O, NO_x, SO_2
N_2O, CH_4
COD
L_2
N, P

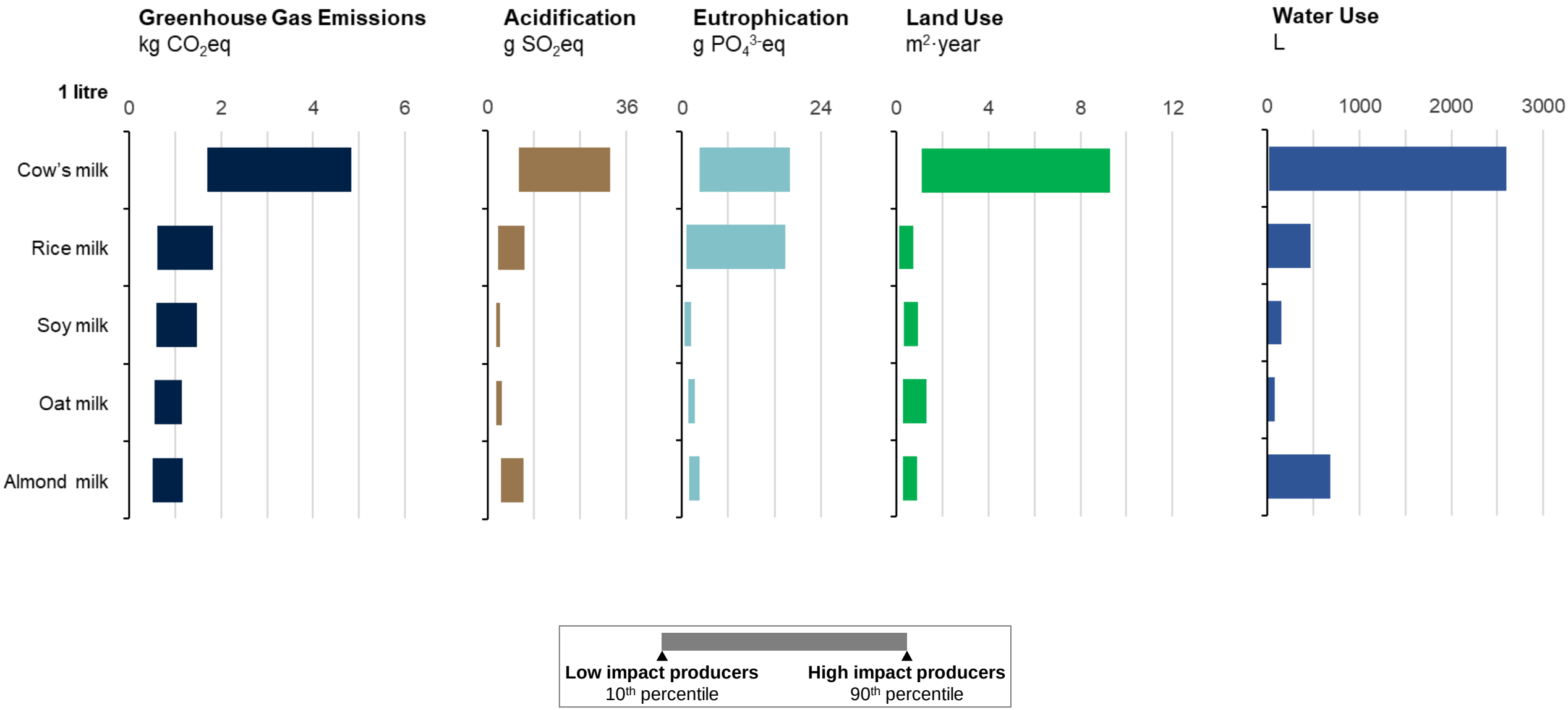

COD
N, P
L_2
T_3
L_3
L_2



Source: Poore & Nemecek (2018)

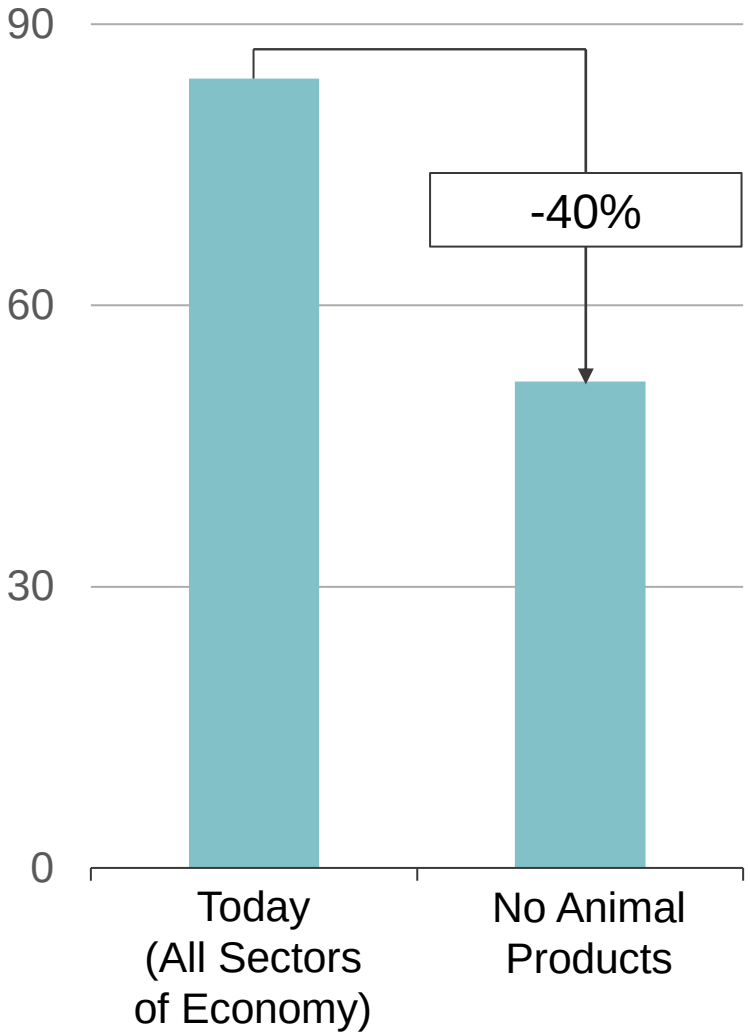


Source: Poore & Nemecek (2018)



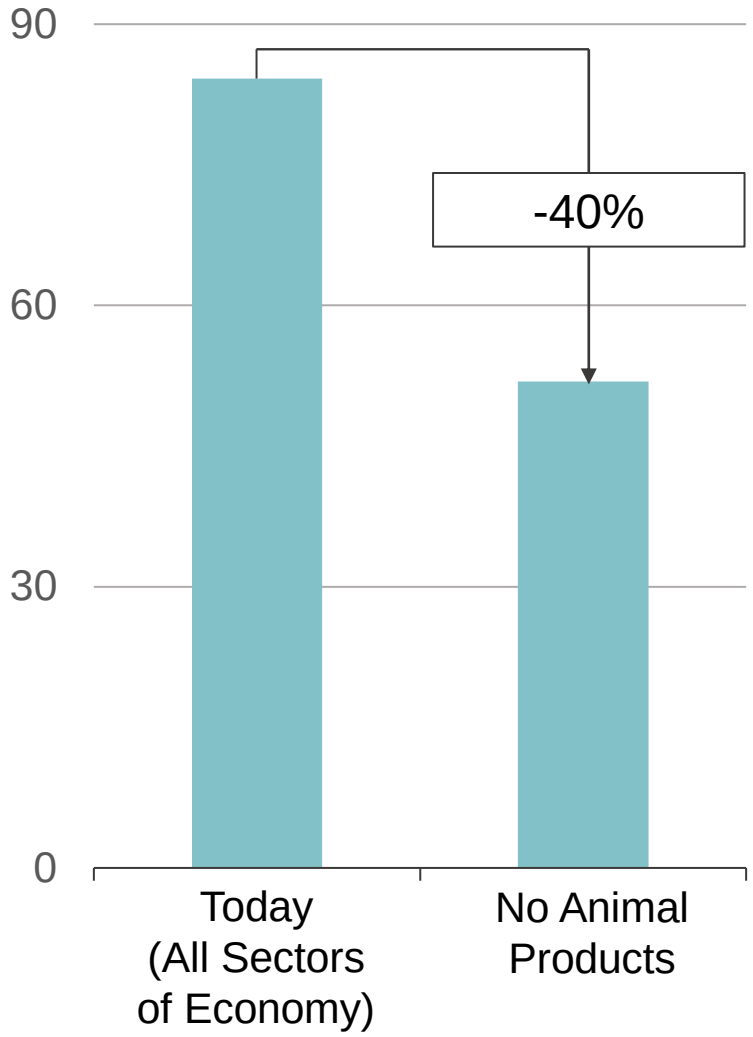
Source: Poore & Nemecek (2018); additional calculations for the BBC and Science Vs for oat milk, rice milk, and almond milk.

Eutrophication (Mt PO_4^{3-})

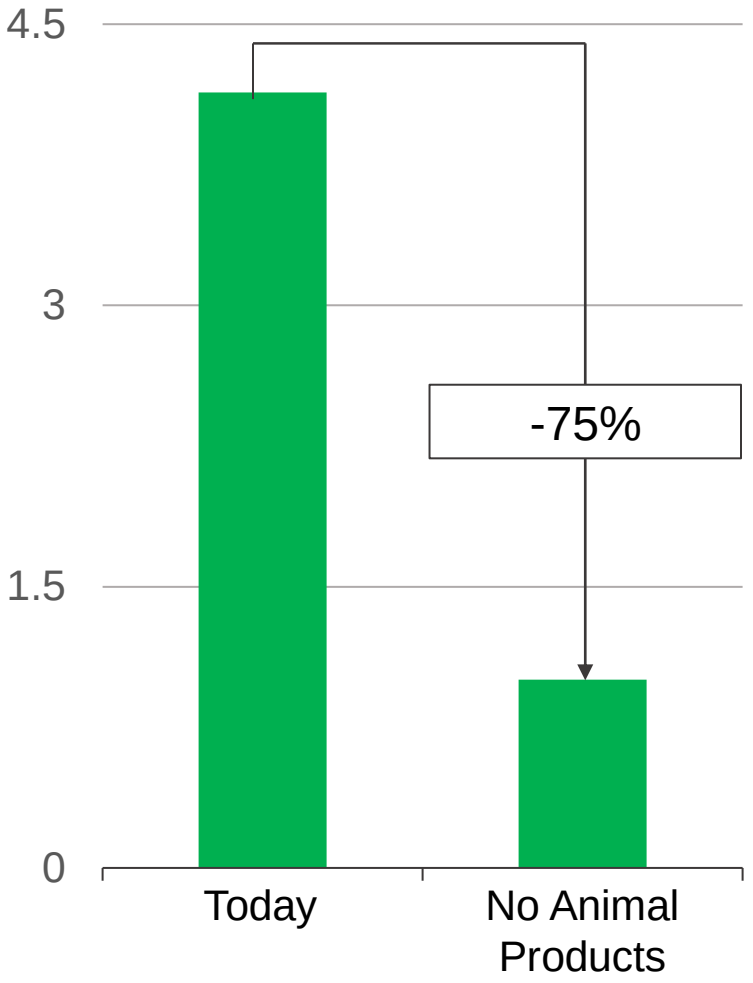


Source: Poore & Nemecek (2018)

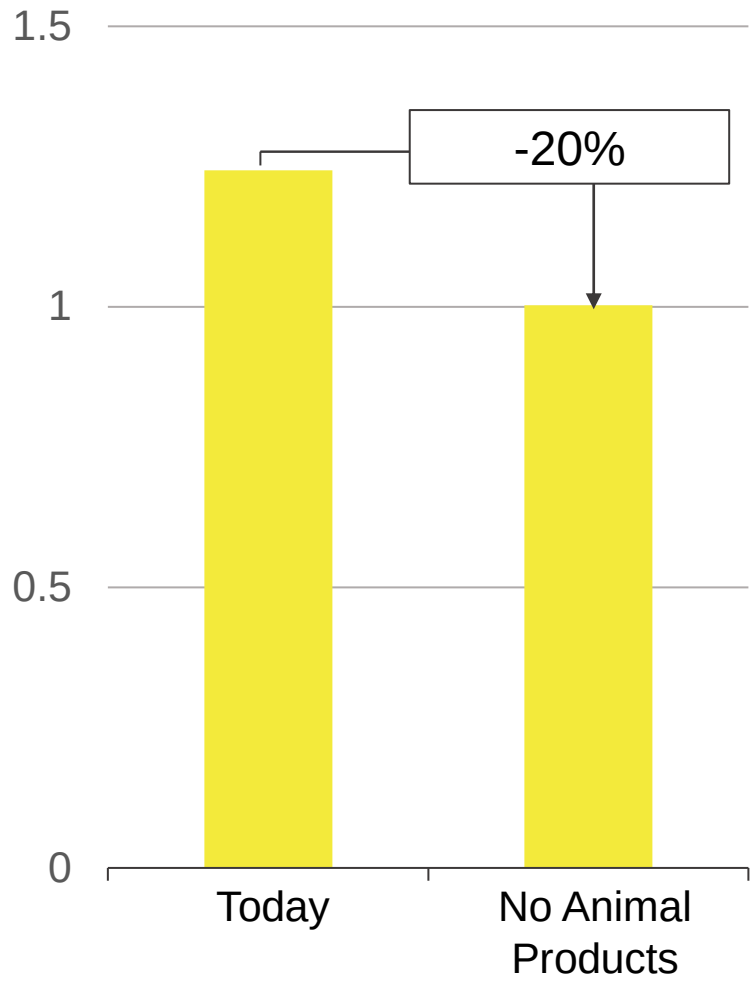
Eutrophication (Mt PO_4^{3-})



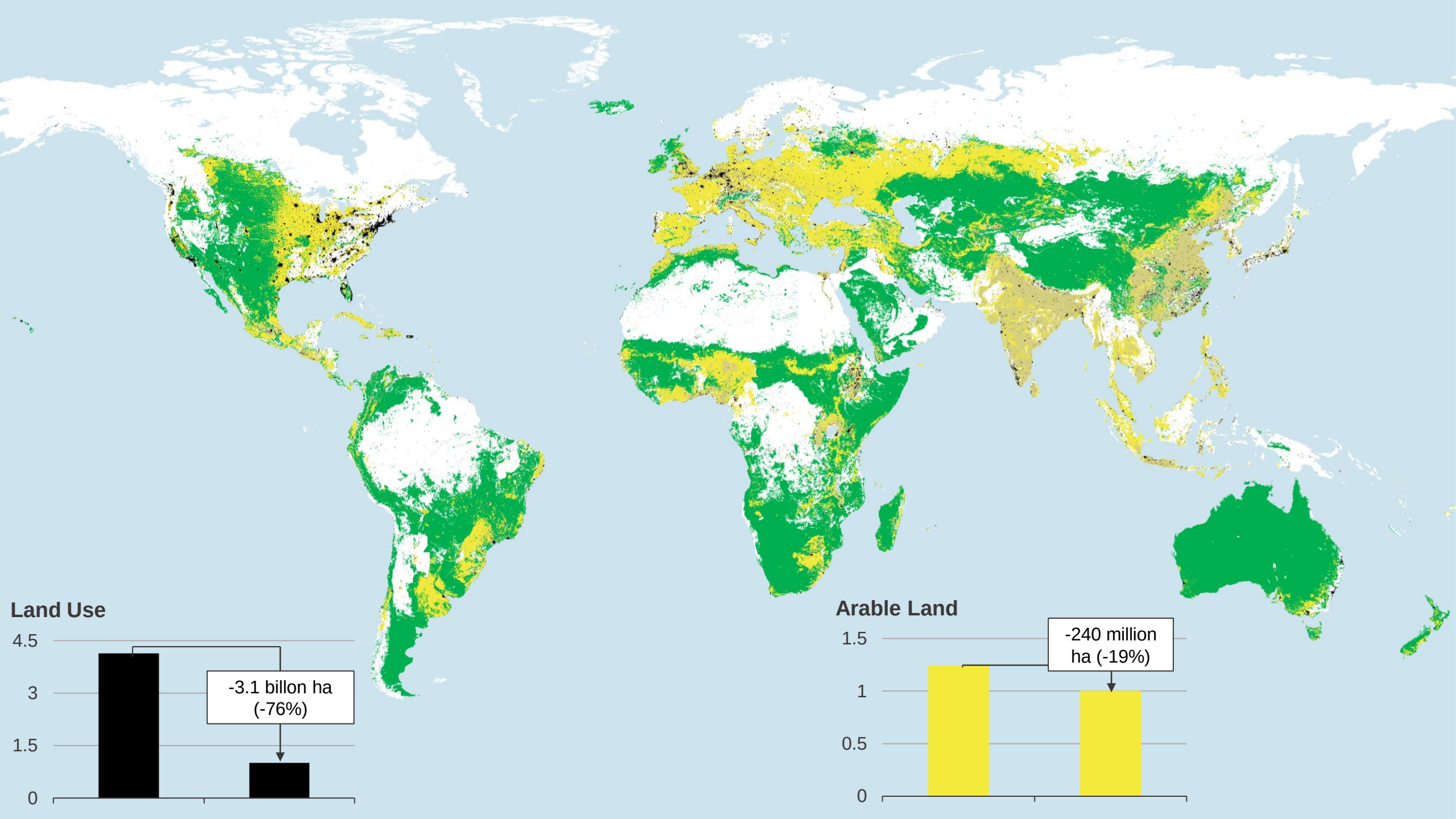
Land Use (billion ha)



Arable Land Use (billion ha)

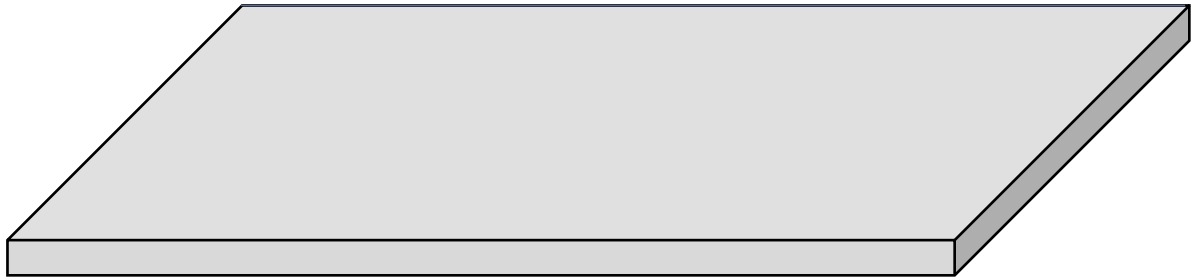


Source: Poore & Nemecek (2018)

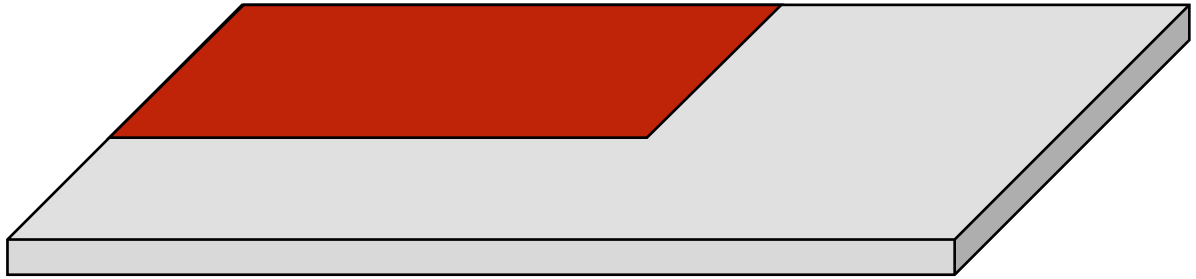

Land Use
4.5
3
1.5
0
-3.1 billon ha
(-76%)
Arable Land
1.5
1
0.5
0
-240 million
ha (-19%)

Land Per Person on Earth
17,000m^2

Source: Poore & Nemecek (2018)



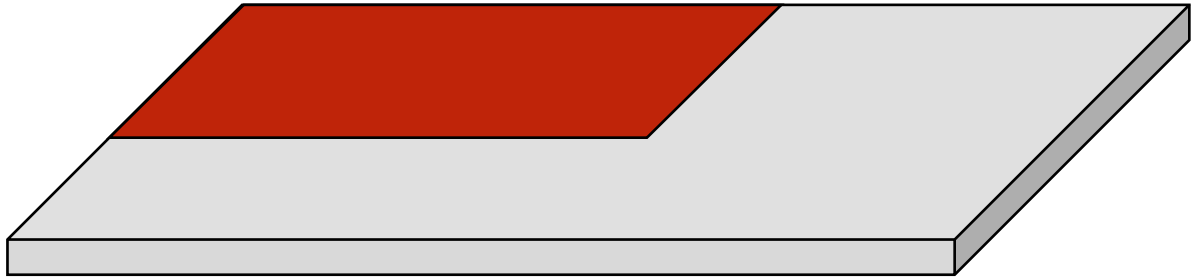
Land Per Person on Earth
17,000m^2



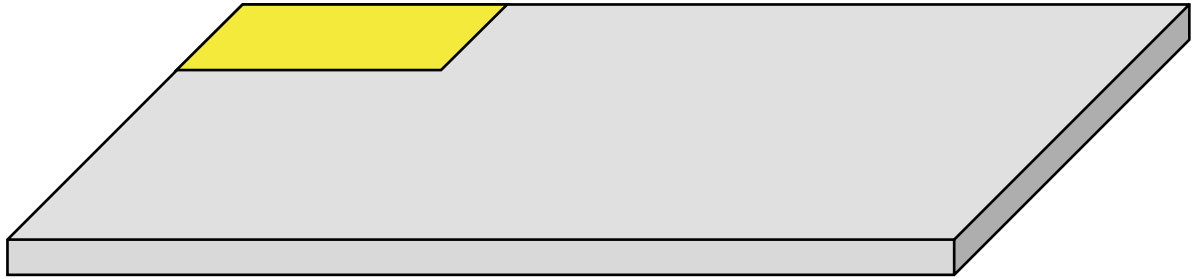
Current Diet
Global 6,200m^2

Source: Poore & Nemecek (2018)

Land Per Person on Earth
17,000m^2

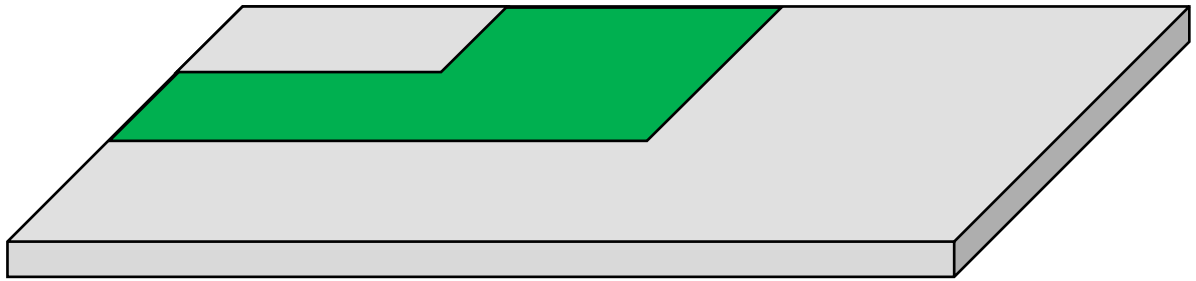


Current Diet
Global 6,200m^2



No Animal Products Diet
1,500m^2

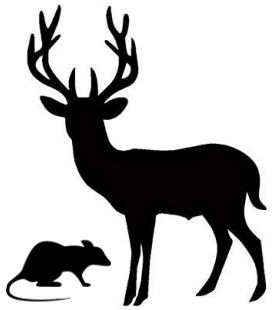
Source: Poore & Nemecek (2018)



Spared Land
4,700m^2

Source: Poore & Nemecek (2018)

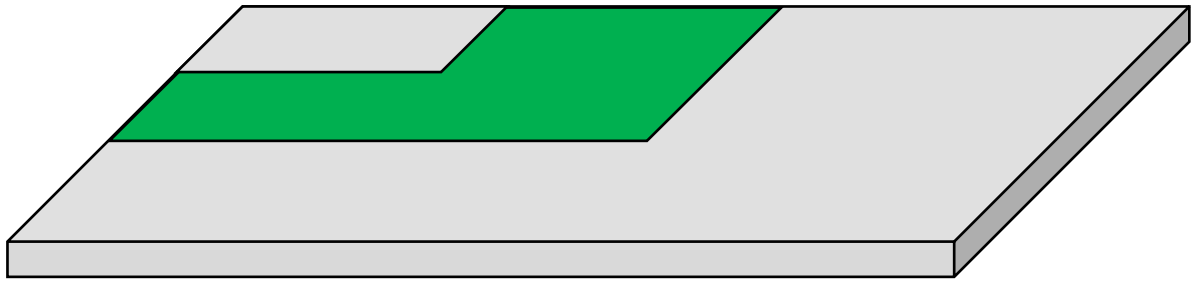
5
birds



15
mammals

20
reptiles

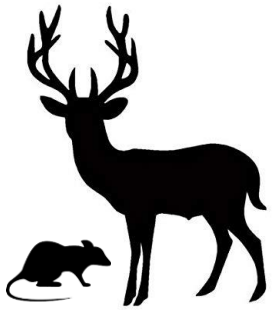
100
amphibians



Spared Land
4,700m^2

Sources: Poore & Nemecek (2018); Ellis *et al* (2010) Gaston *et al* (2003); Bar-On *et al* (2018)

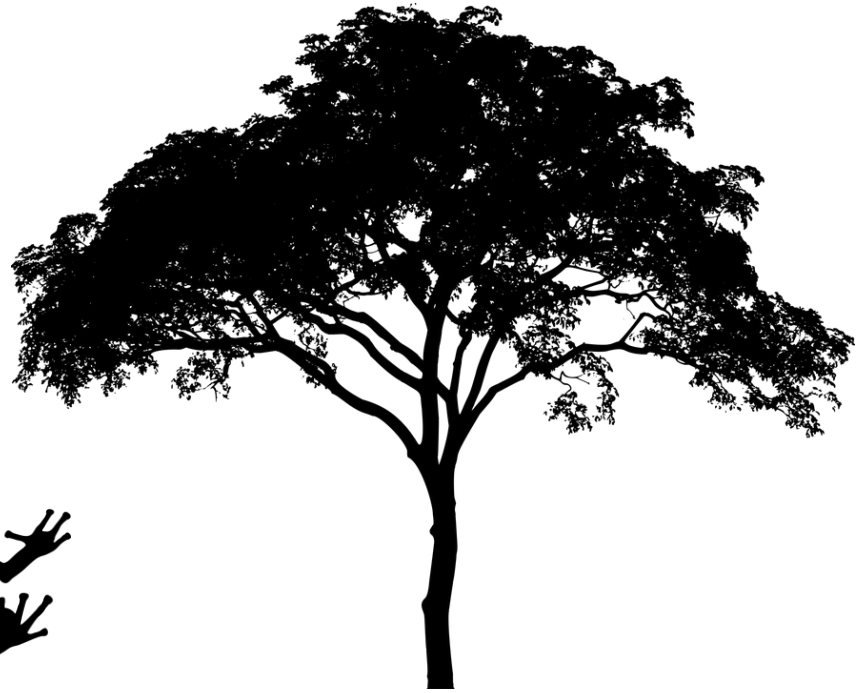
5
birds



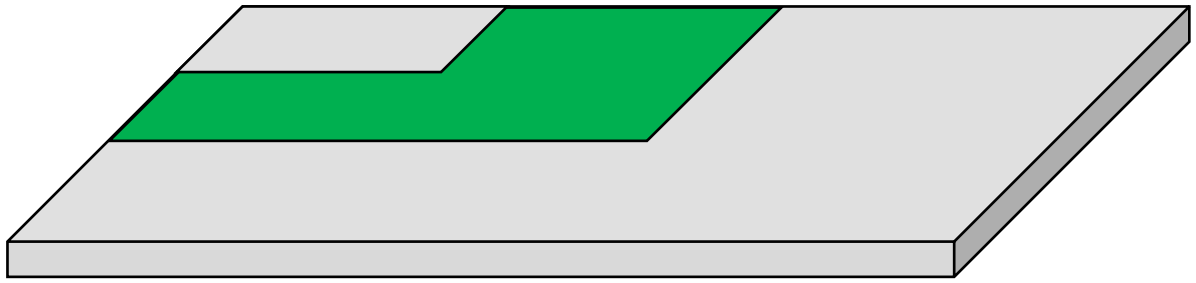
15
mammals

20
reptiles

100
amphibians



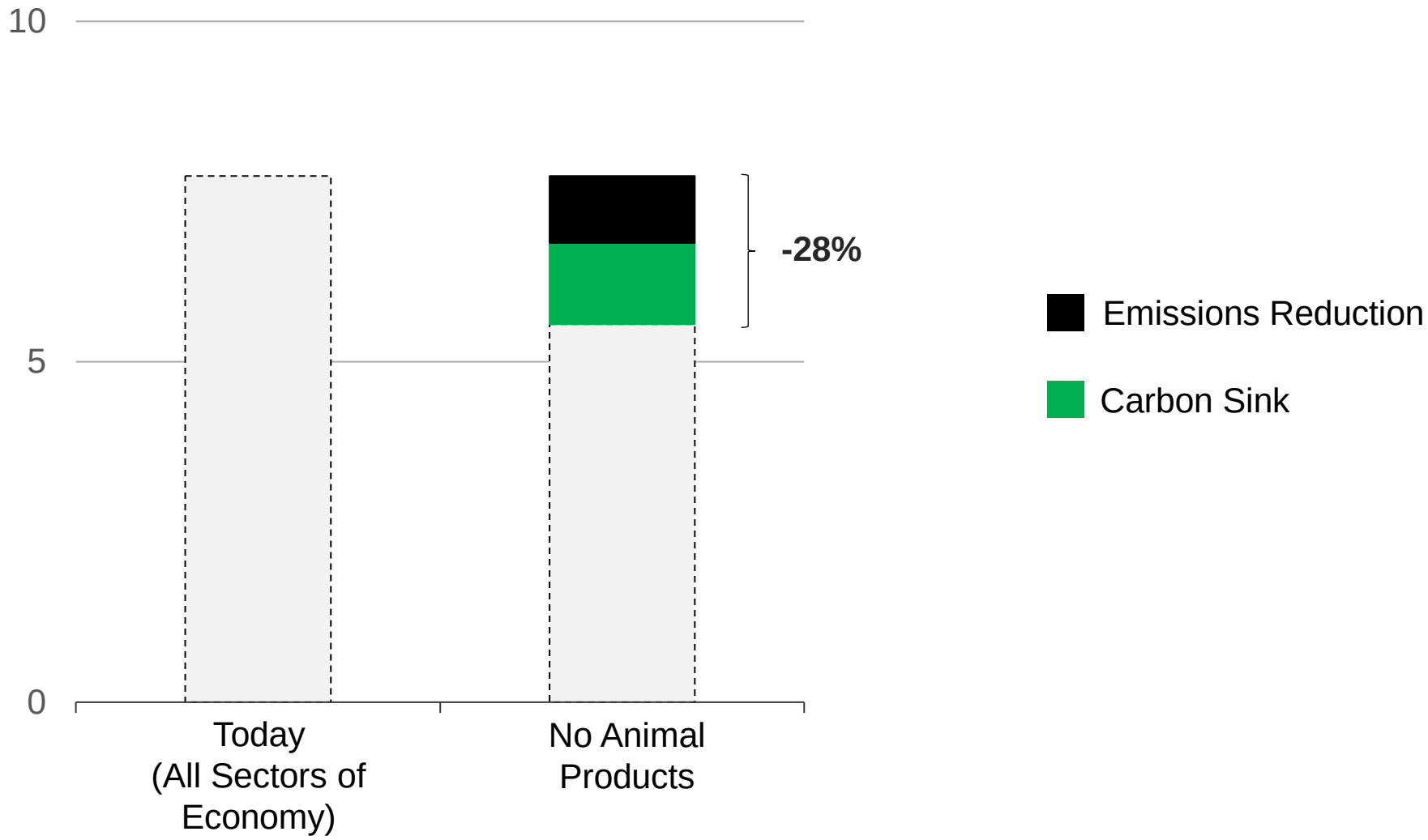
150 tonnes CO_2
plants and soil



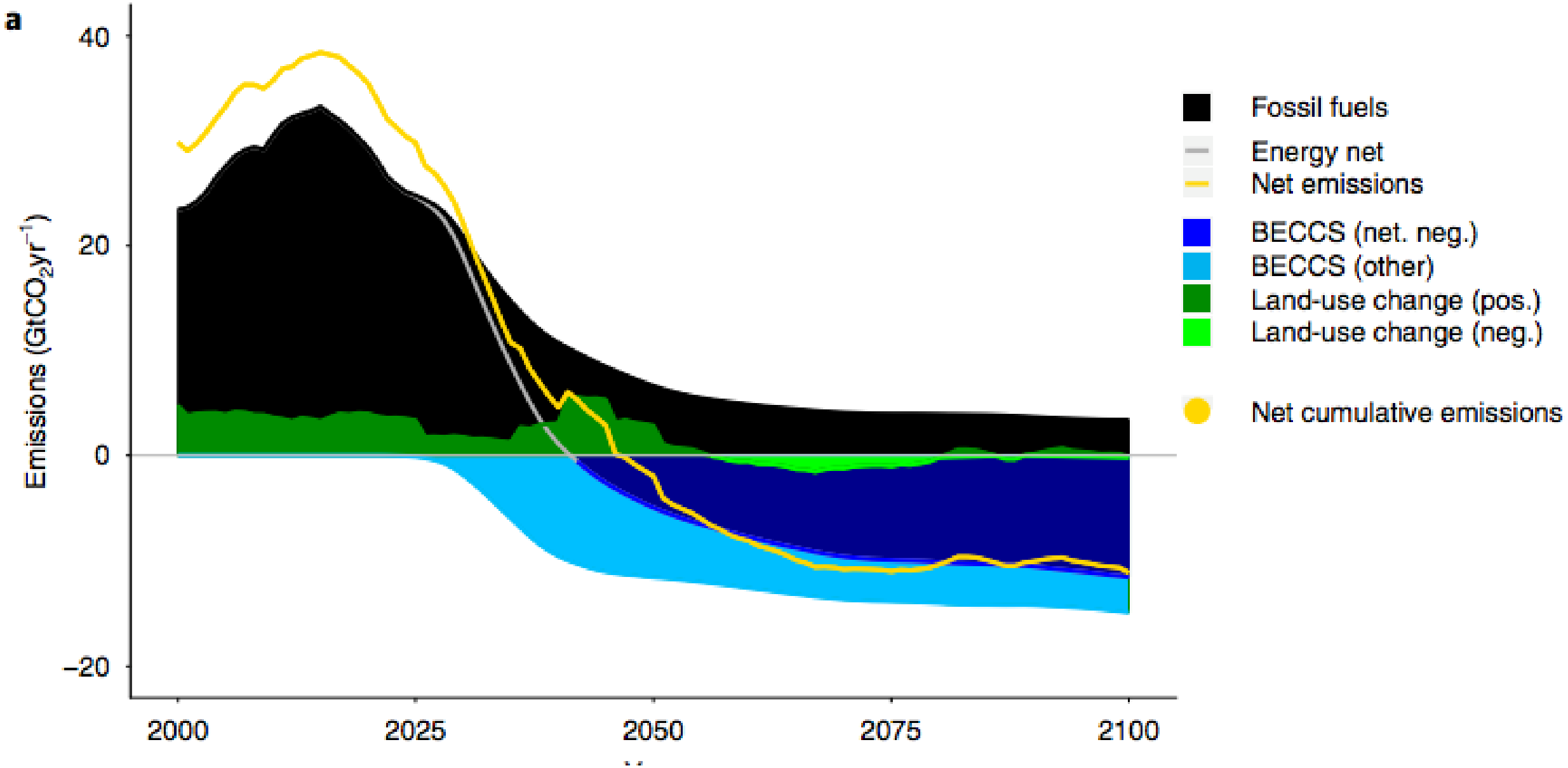
Spared Land
4,700m^2

Sources: Poore & Nemecek (2018); Ellis *et al* (2010) Gaston *et al* (2003); Bar-On *et al* (2018); Schmidinger & Stehfest (2012)

Greenhouse Gas Emissions Per Person (tonnes CO_2eq, year = ~2015)

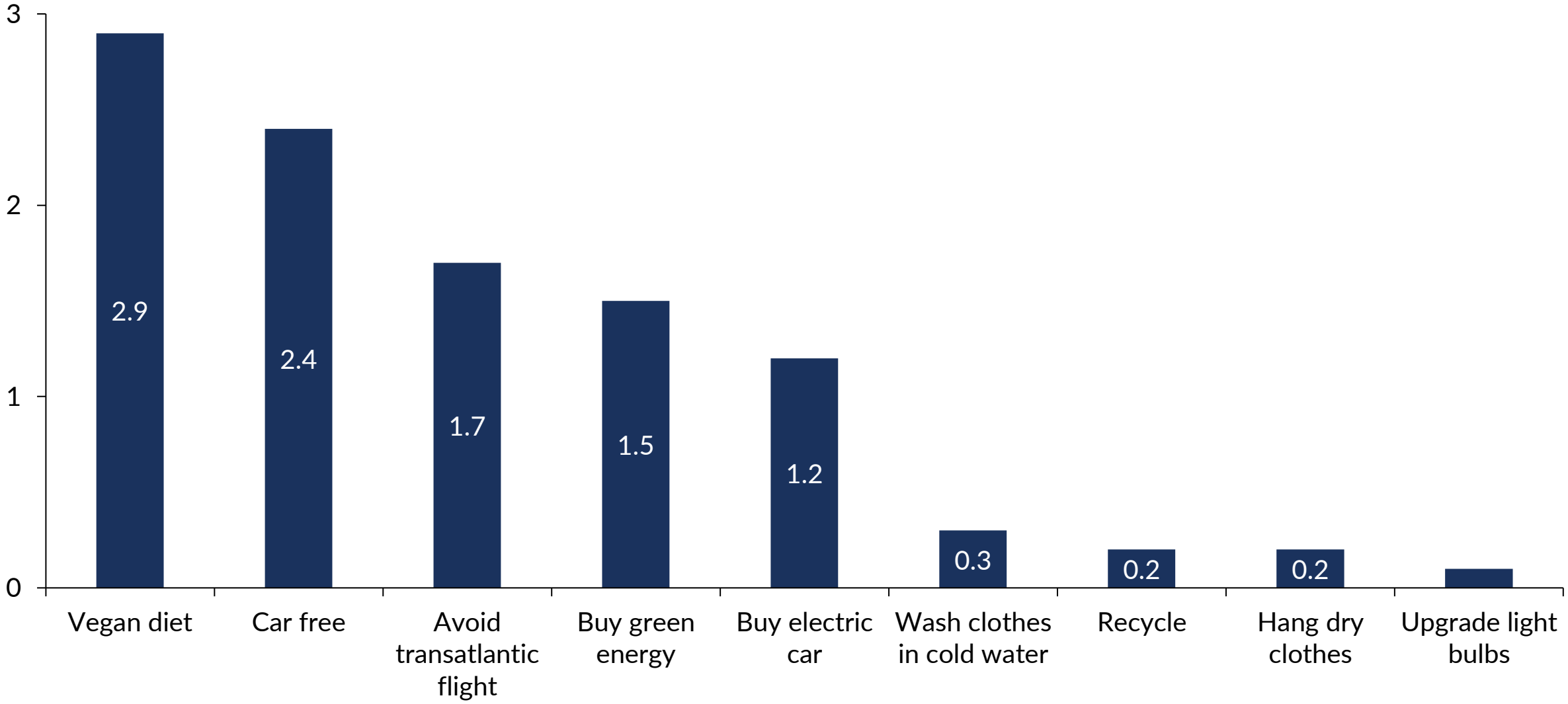


Sources: JRC (2016); Poore & Nemecek (2019); Schmidinger & Stehfest (2012)



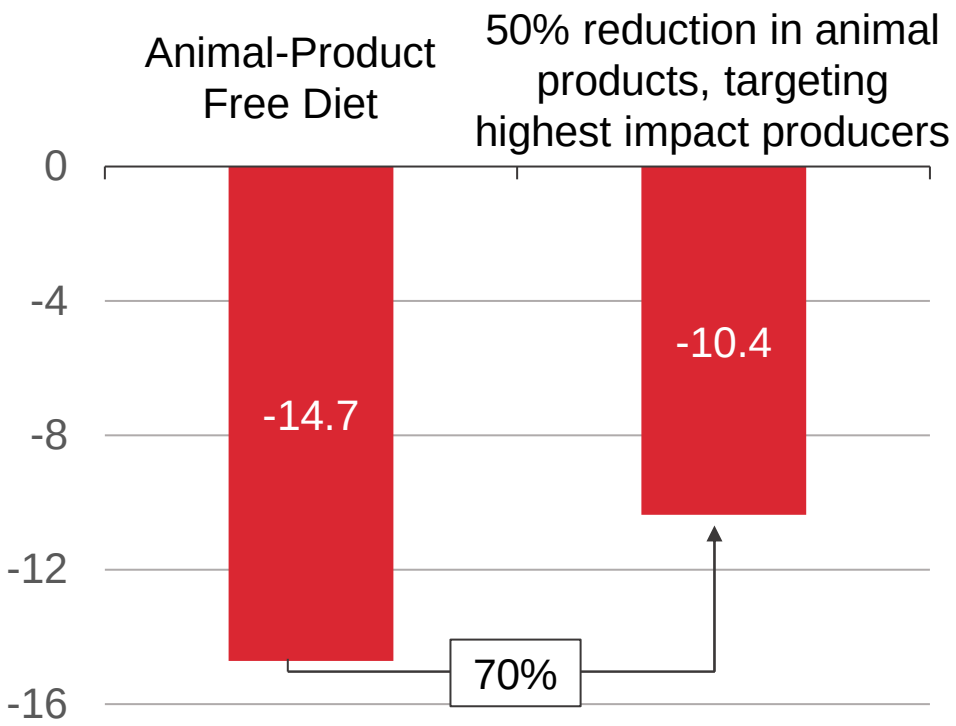
Sources: Van Vuuren et al (2018)

Greenhouse Gas Emissions Saved Per Person (tonnes CO_2eq, Europe)



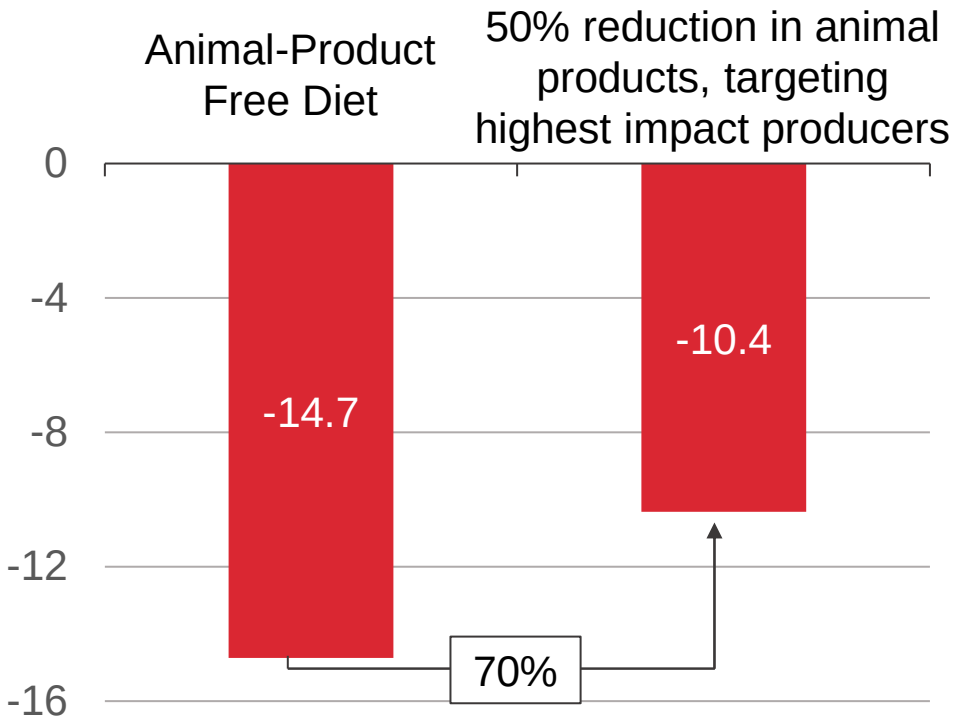
Sources: WWF (2023); Wynes & Nicholas (2017)

Greenhouse Gas Emissions (Gt CO_2eq)



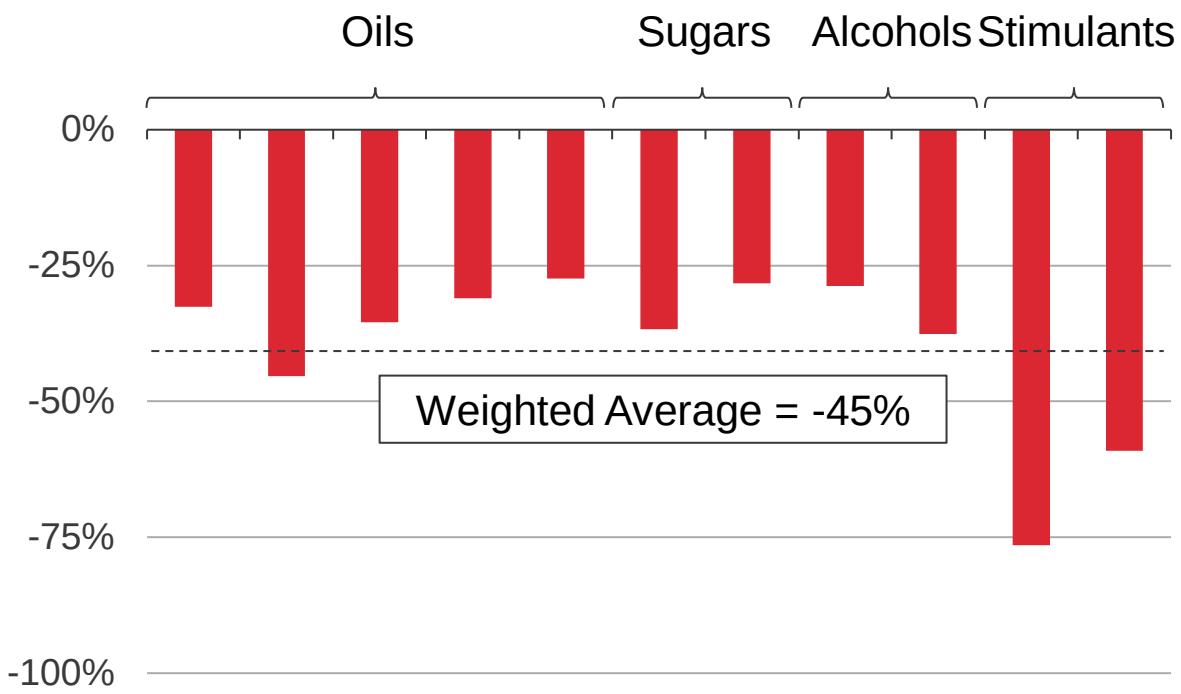
Source: Poore & Nemecek (2019)

Greenhouse Gas Emissions (Gt CO_2eq)



Change in Greenhouse Gas Emissions

Consume 20% less, targeting the highest impact producers



Source: Poore & Nemecek (2019)

PLANTBASED TREATY

What if Edinburgh went vegan?

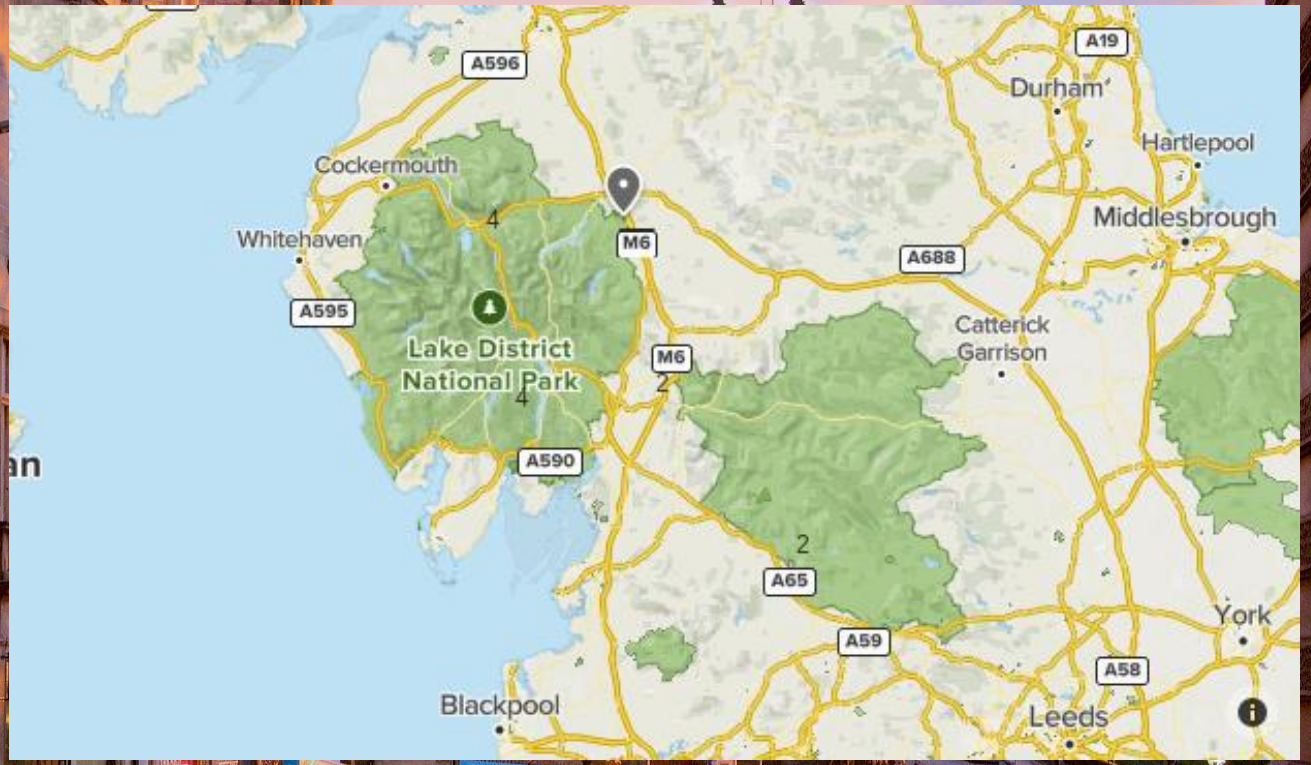
Population = 506,520

What if Edinburgh went vegan?

Population = 506,520

232,000 hectares of land

An area the size of the Lake District National Park



Source: WWF (2023) *Planet Based Diets*

What if Edinburgh went vegan?

Population = 506,520

1.7 million tonnes of CO_2eq

532,000 cars off the road

Source: WWF (2023) *Planet Based Diets*

What if Stockholm went vegan?

Population = 975,551

What if Stockholm went vegan?

Population = 975,551

176,000 hectares of land

An area the size of Sarek National Park

Source: WWF (2023) *Planet Based Diets*

What if Stockholm went vegan?

Population = 975,551

2.9 million tonnes of CO_2eq

935,000 cars off the road

Source: WWF (2023) *Planet Based Diets*

New research focus: veganic farming

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Looking for:

- *Collaborators*
- *Funders*
- *Environmental modellers*

Thank you…