

The Environmental Impact of Aruba's Food Consumption

using Life Cycle
Assessment (LCA)



Adjusted version – without
preliminary research –
slides have been removed

SISSTEM

April 11, 2024
Oranjestad, Aruba
For: KIVI Kring Caribbean
By: Amber van Veghel

Content

WHO? →



Amber van Veghel, PhD Candidate
amber.vanveghel@ua.aw

WHY? →



ARUBA →



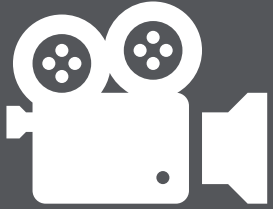
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General announcements



Filmed by Natalie
Manzanares – Film
producer and content
creator

Instagram: [_creativenm](#)



Content

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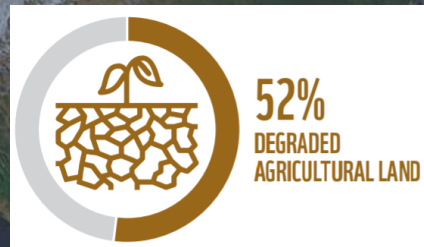
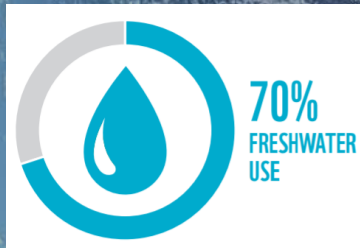
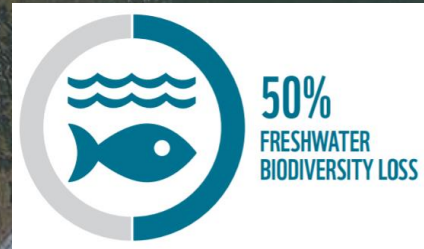
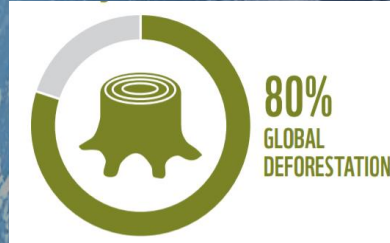
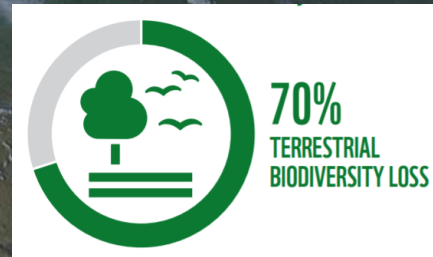


Figure 15: The environmental impacts of food production

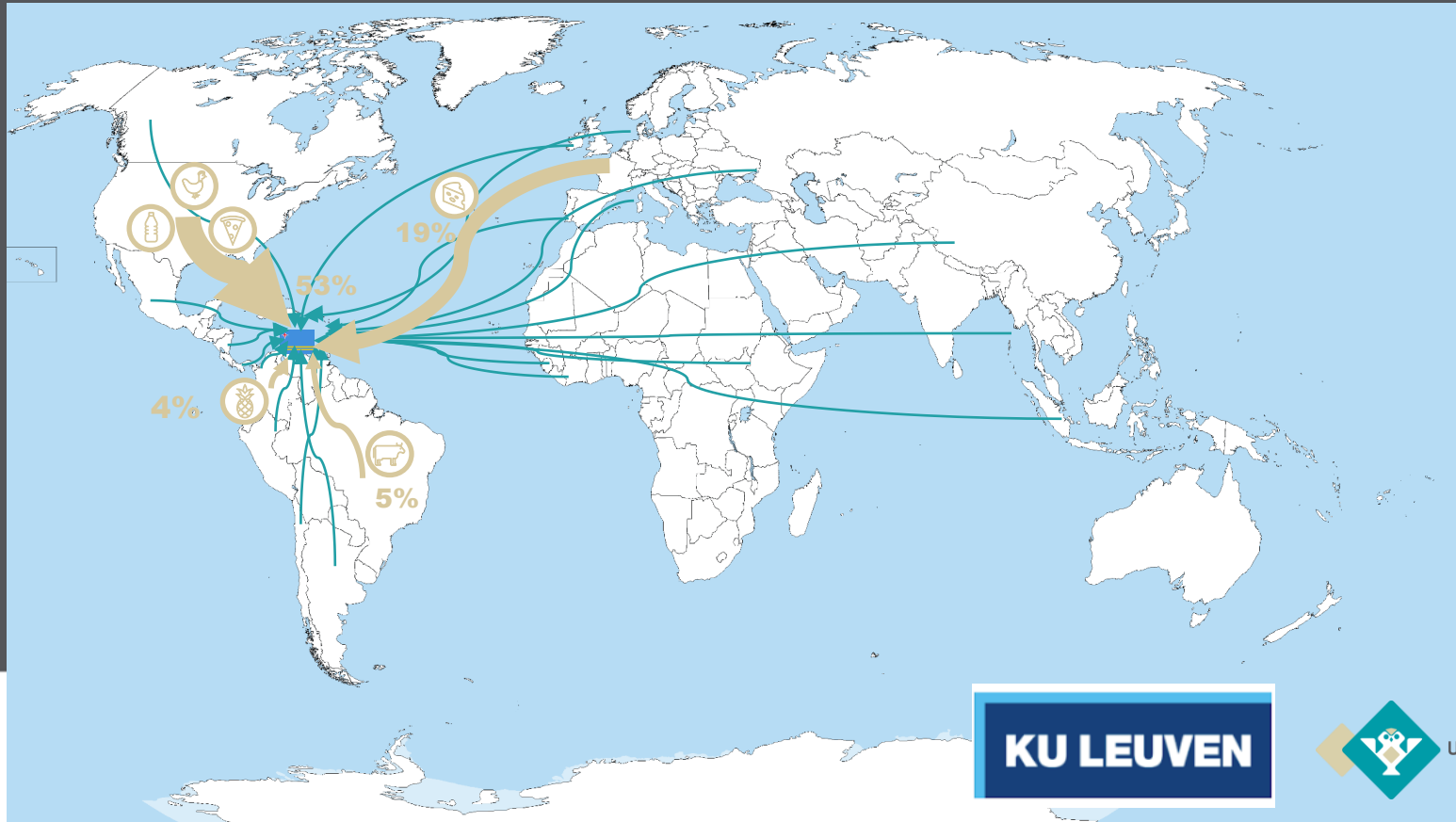
Sources: Adapted from CBD (2014)⁹⁸, GSDR (2019)⁹⁹ and ELD Initiative (2015)¹⁰³.

Source: WWF, 2020

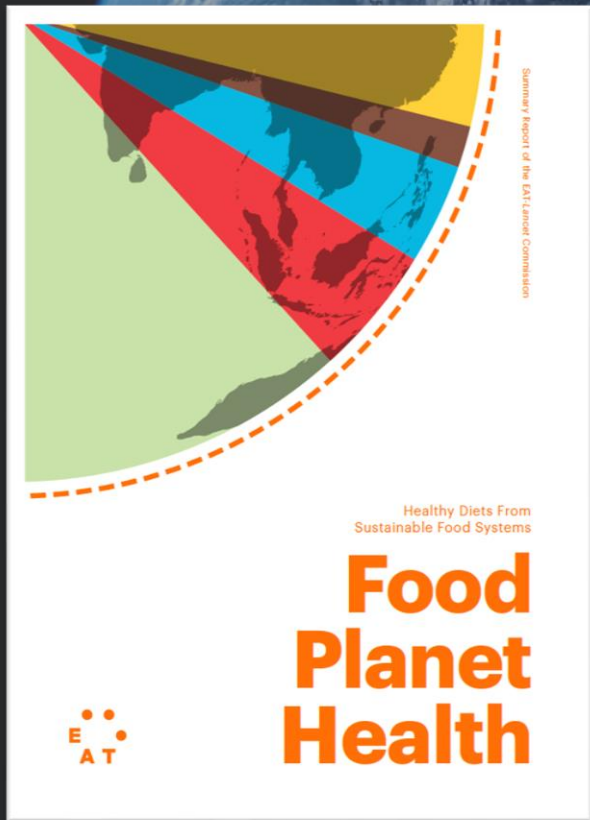
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Aruba is dependent on the global food system



Can we feed a future population of 10 billion people a healthy diet within planetary boundaries?



2019
Eat Lancet Commission
37 scientists

Further reading
www.eatforum.org

YES

BUT

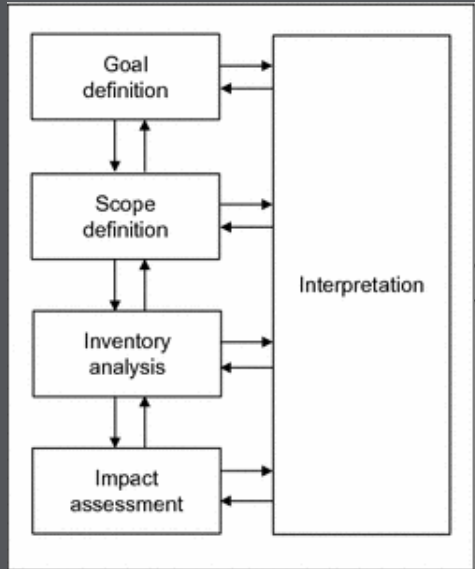
- Better agricultural production methods
- Reduce food waste
- Dietary shift
- + Increase local food production and consumption



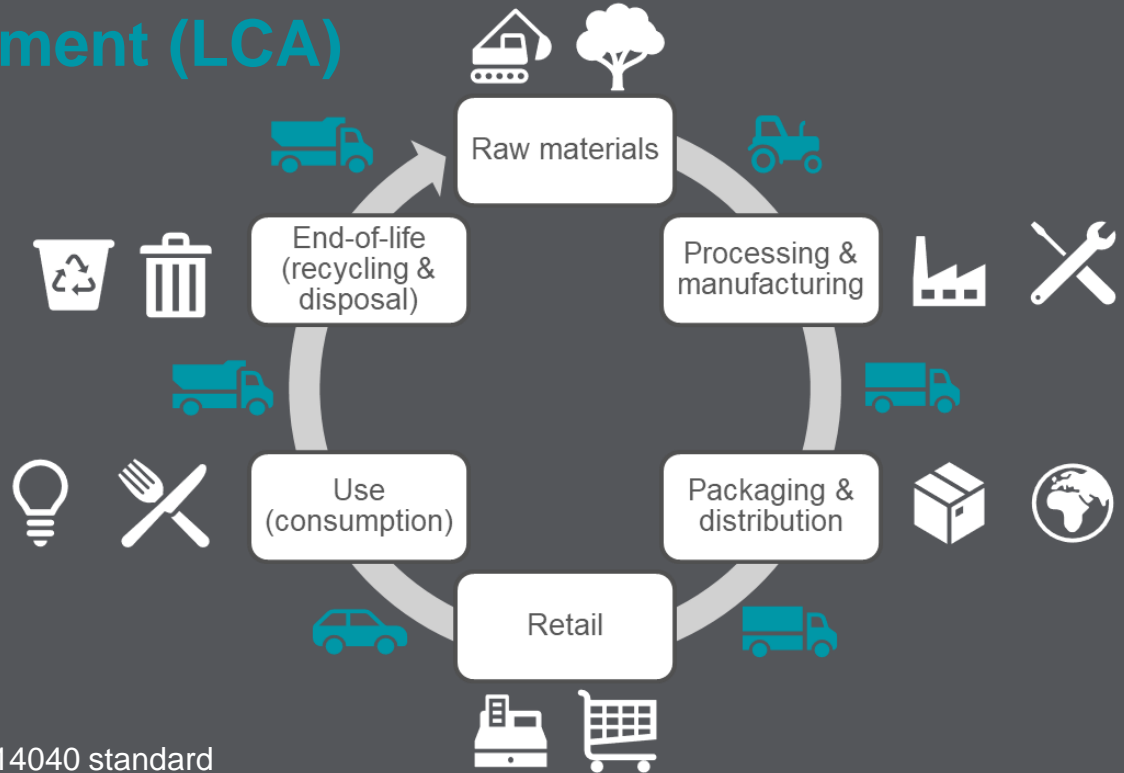
Need for dietary shift



Life Cycle Assessment (LCA)



LCA framework according to the ISO 14040 standard (Hauschild, 2018)



Carbon footprint of foods

CO₂eq

CO₂

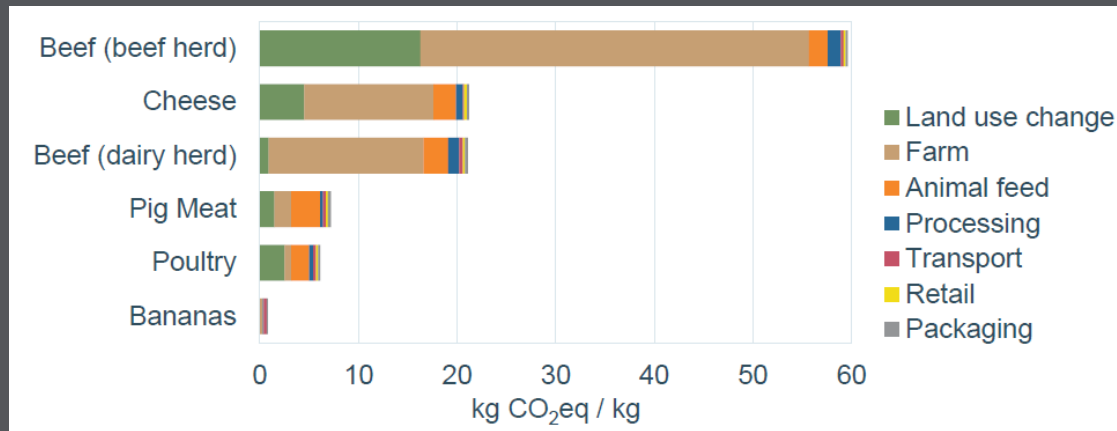
1x

Methane

25x

N₂O

298x

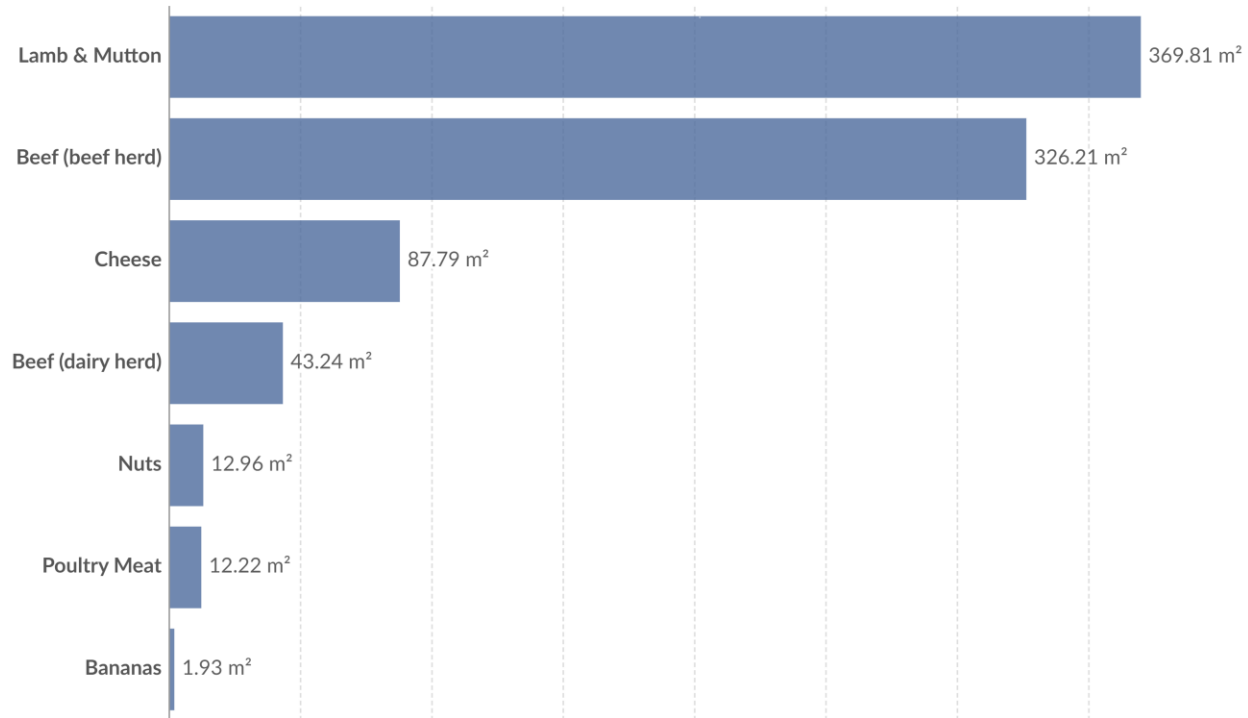


Based on Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360, 987–992. <https://doi.org/10.1126/science.aag0216>

For more foods and more environmental impacts: <https://ourworldindata.org/grapher/food-emissions-supply-chain>

Land use per kilogram of food product

Land use is measured in meters squared (m²) per kilogram of a given food product.



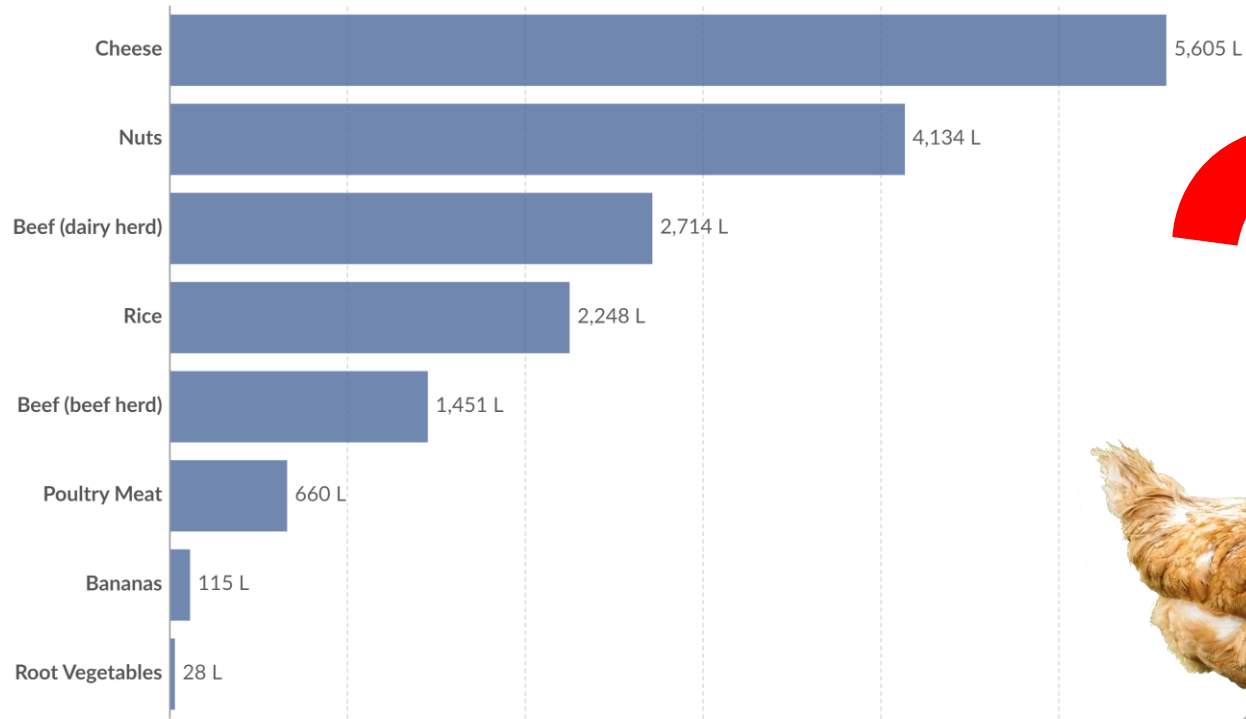
Data source: Joseph Poore and Thomas Nemecek (2018).

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.

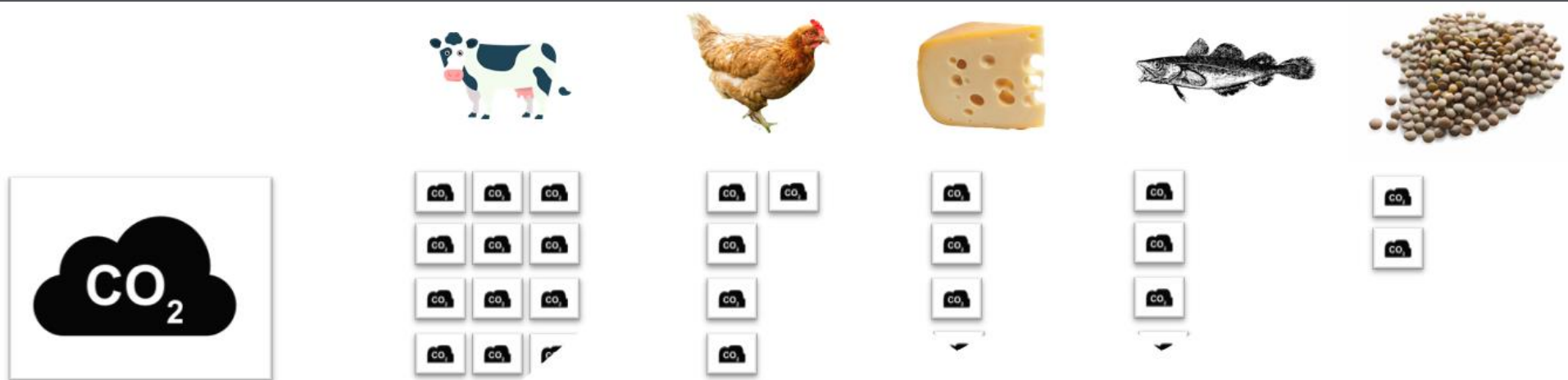


Data source: Joseph Poore and Thomas Nemecek (2018).

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



Carbon footprint pastechi



Source: Calculations by Amber van Veghel, based on the public RIVM table 'Milieubelasting voedingsmiddelen – wieg tot consumptie' from 2019

Content

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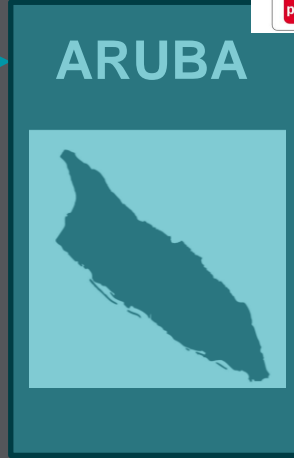


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Environmental impact of Curacao's food imports

Preliminary results

- » Land use: $\sim 2,000 \text{ km}^2 \cdot \text{year}$
More than 4x size of Curacao
- » Climate change: $\sim 900 \text{ kton CO}_2\text{eq}$
 $\sim 1 \text{ million people flying from Amsterdam to Curacao}$
- » Acidification: $\sim 3.5 \text{ kton SO}_2\text{eq}$
- » Eutrophication: $\sim 3 \text{ kton PO}_4^3\text{eq}$
- » Freshwater use: $\sim 76 \text{ giga L}$

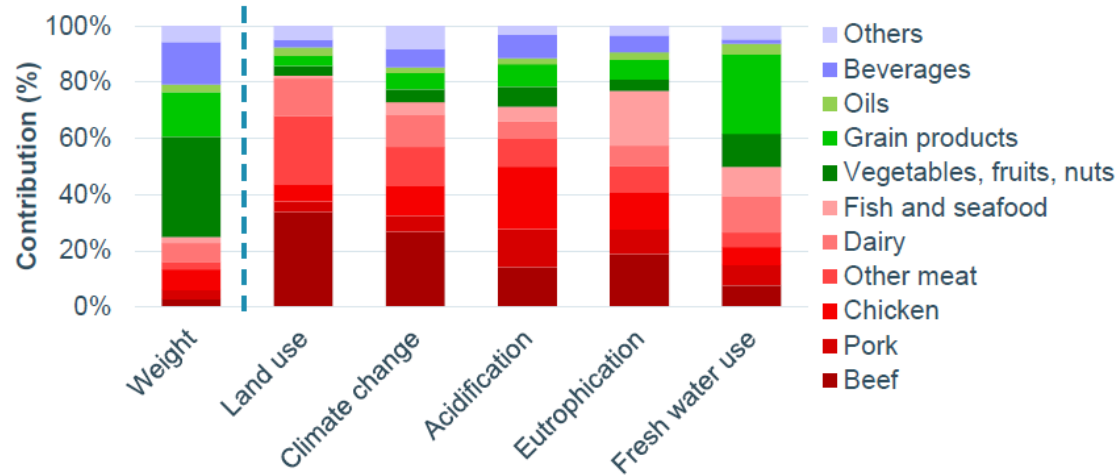


Fig. 2 Contribution of food groups to weight and environmental impact of imports

Based on: Poore & Nemecek (2018)

Acknowledgements: BSc thesis *Emma Couwet, Seppe van Hoof, Yarno Vanhee, Julie Tombeur*

Environmental impact of Curacao's food and beverage imports

Amber S. van Veghel^{1,2}, Emma Couwet¹, Seppe van Hoof¹, Yarno Vanhee¹, Julie Tombeur¹, Anniemie Geeraerd Ameryckx¹

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² SISSTEM, Faculty of Arts and Science, University of Aruba, Oranjestad, Aruba

Background

Globally, scientists are developing methods to calculate the **environmental impact of food consumption**^{a,b}. Their methods are often not suitable for **small islands**. We aim to develop a methodology based on **food import statistics** and Life Cycle Assessment (LCA).

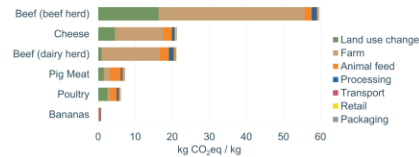


Fig. 1 Average greenhouse gas emissions and contribution of life cycle stages. Lay-out based on c, data from d

Methods

- » LCA database on environmental impact^c
- » Import quantities 2019: CBS Curacao
- » 82% of all products were included in this analysis
- » System boundaries: farm – (air)port in export country



Incl. transport in export country; food losses within food chain
Excl. transport from (air)port in export country to Curacao; transport in Curacao

Preliminary results

- » Land use: ~2,000 km²*year
More than 4x size of Curacao
- » Climate change: ~900 kton CO₂eq
~ 1 million people flying from Amsterdam to Curacao
- » Acidification: ~3.5 kton SO₂eq
- » Eutrophication: ~3 kton PO₄eq
- » Freshwater use: ~76 giga L

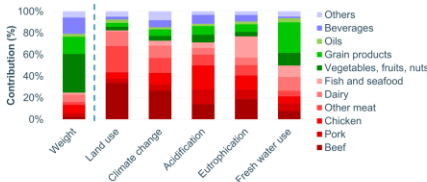


Fig. 2 Contribution of food groups to weight and environmental impact of imports

Conclusion and further research

Most environmental impact is due to animal-based products, although these products contribute relatively little to the weight. We will repeat this analysis for Aruba and a.o. add local products, add transport, and specify countries of origin.

SISSTEM PhD research:

Life cycle analysis for a more sustainable food chain in Aruba

^aSpringer, M. et al. (2018). Options for keeping the food system within environmental limits. Nature, 562(7726), 519-525. <https://doi.org/10.1038/s41586-018-0396-0>
^bCherubini, A., & Kristina, V. (2019). Country Specific Sustainable Diets Using Optimization Algorithm. Environmental Science & Technology, 53(11), 7694-7703. <https://doi.org/10.1021/acs.est.8b06033>
^chttps://www.wellbeingdata.org/arterio/food-emissions-report.shtml
^dPaen, L., & Berendse, F. (2018). Reducing food's environmental impacts through production and consumers. Science, 360, 182-189. <https://doi.org/10.1126/science.1258452>
^ePaen, L. (2018). Top Food Import: Life cycle environmental impacts of food & drink products. University of Oxford. <https://ora.ox.ac.uk/objects/uuid:af32b26c-9818-4512-a888-df8a095820a5>

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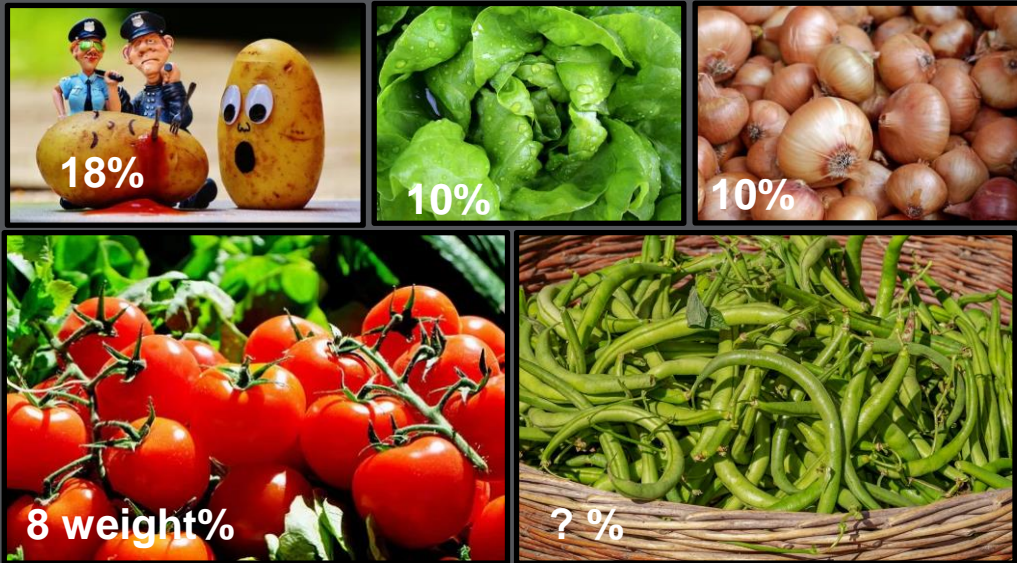
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Carbon footprint of vegetable imports into Aruba



47 weight%
of all
vegetable
imports

Five vegetables images from [Pixabay](#), free of known copyright restrictions.

Methodology

- Functional unit: 1 kg product at the supermarket in Aruba
- System boundaries: farm in export country until arrival at supermarket
- Data mainly based on Poore and Nemecek (2018)



Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360, 987–992. <https://doi.org/10.1126/science.aaq0216>

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KU LEUVEN



Poore & Nemecek 2018: LCA database

Reference	Product	Sy	Production Sys	Country	GHG Emis (kg CO ₂ eq)
Milà i Canals et al. (2008)	Lettuce	C	Open field; large	Spain	0,7
Milà i Canals et al. (2008)	Lettuce	C	Open field; large	Spain	0,5
Romero-Gómez et al. (2014)	Lettuce	C	Open field; optim	Spain	0,4
Romero-Gómez et al. (2014)	Lettuce	C	Open field; plasti	Spain	0,4
Romero-Gómez et al. (2014)	Lettuce	C	Open field; plasti	Spain	0,4
Romero-Gómez et al. (2014)	Lettuce	C	Greenhouse; opti	Spain	0,7
Davis et al. (2011)	Iceberg lettuce	C	Open field	Sweden	0,4
Wongwai et al. (2014)	Lettuce	C	Open field	Thailand	1,1
Wongwai et al. (2014)	Lettuce	O	Open field	Thailand	0,5
Milà i Canals et al. (2008)	Lettuce	C	Mixed farms ("UC	Uganda	12,0

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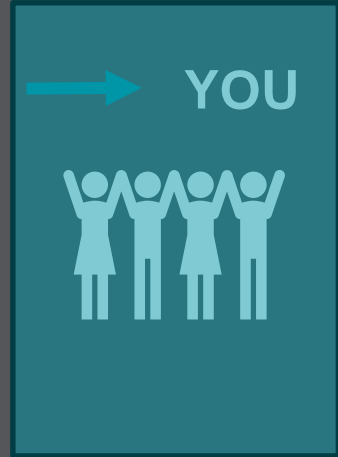
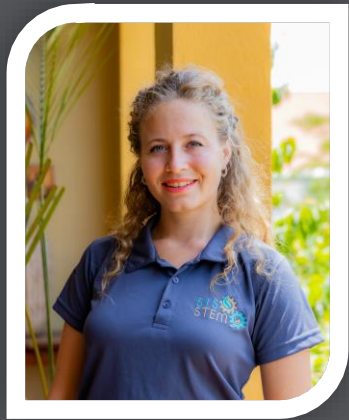
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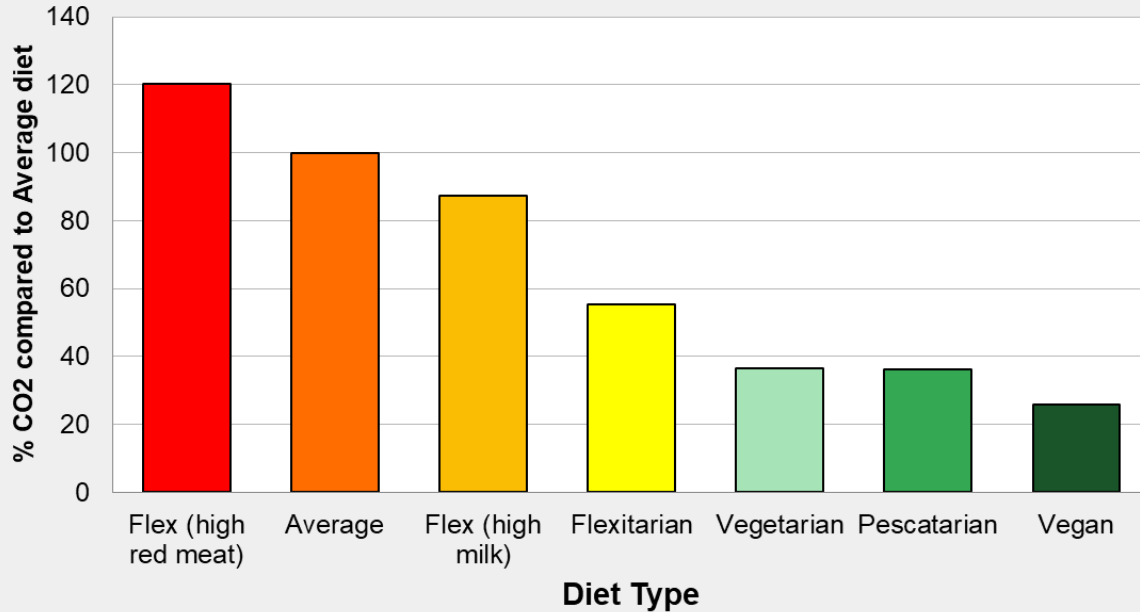
PRODUCTS →

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Carbon footprint of Diets (Base = "Average Diet")



Based on Willet et al.
2019



Willet, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., ... Murray, C. J. L. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)

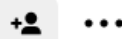
Raffle



veganaruba

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AW www.veganaruba.com

Founded by @meredithmarin @vegan.hospitality

🔗 linktr.ee/veganaruba

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Entry in even years

<https://master.sisstemaruba.com/>

SEMESTER 1 (15 EC)

- Sustainability & Economy: implementing and assessing sustainability policies and projects (5 EC)
- Quality Control, accreditation and certification (5 EC)
- Thesis proposal & research plan (5 EC)

SEMESTER 2 (15 EC)

- Entrepreneurship and circular economy (5 EC)
- Water-Energy-Food nexus in SIS and the Metabolism of Islands (5 EC)
- Thesis (5 EC)

SEMESTER 3 (15 EC)

- Life Cycle Assessment (5 EC)
- Modeling, data science & data visualization (5 EC)
- Thesis (5 EC)

SEMESTER 4 (15 EC)

- Sustainability and Materials Engineering (5 EC)
- Earth systems and Industrial ecology (5 EC)
- Thesis (5 EC)

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