

Current and future sustainability challenges in the dairy industry

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Our mission is to produce food in a sustainable way

Brundtland commission (1987): Sustainable food is produced and consumed in a food system that is able to feed current generations without compromising the economic, social and ecological bases necessary to feed future generations.



Prompt 'ChatGTP': Can you provide a definition of sustainability

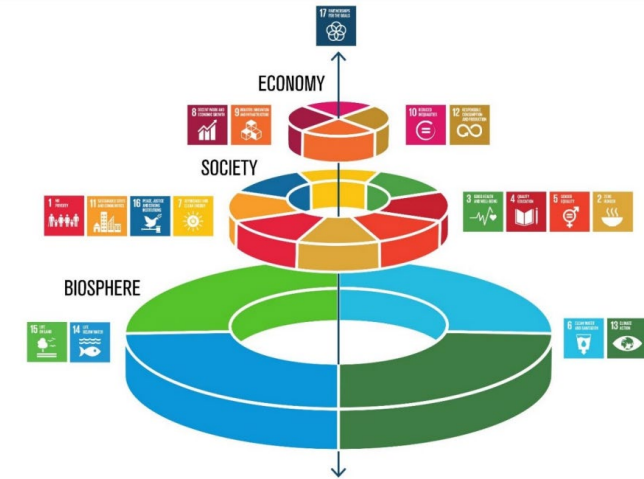
*Sustainability is the practice of **meeting the needs of the present without compromising the ability of future generations to meet their own needs**. It involves a balance between **environmental stewardship, economic stability** and **social equity**. The concept emphasized responsible management of resources to ensure **long-term health and well-being for both people and planet**, often focusing on reducing negative impacts such as pollution, depletion of natural resources and social inequality.*



Sustainable Development Goals (SDG) United Nations

Targets for the 2030 Agenda for Sustainable Development adopted by the world leaders in 2015

SUSTAINABLE DEVELOPMENT GOALS



High relevance for agri- and aquaculture

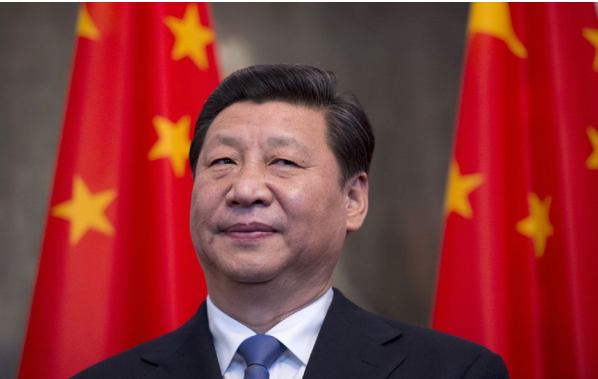
1. No poverty
2. Zero hunger
3. Good health and well being
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land

Global leaders are committed to GHG reduction

Example of how SDGs goals have been adopted world wide

Commitment to reduce GHG emission (Paris Agreement) was signed in 2016 and translated into policies thereafter

	EU	USA	Canada	Brazil	Mexico	China	India
Reduction GHG 2030 vs 2005	55%	50%	40%	43%	22% Black Carbon emission (fossil fuel) 52%	40 to 45%	45%
'Net Zero' Target	2050	2050	2050	2050	No	2060	2070



GHG emissions need to be reduced by 45% by 2030 and reach net zero by 2050.



EU legislation developments related to sustainability

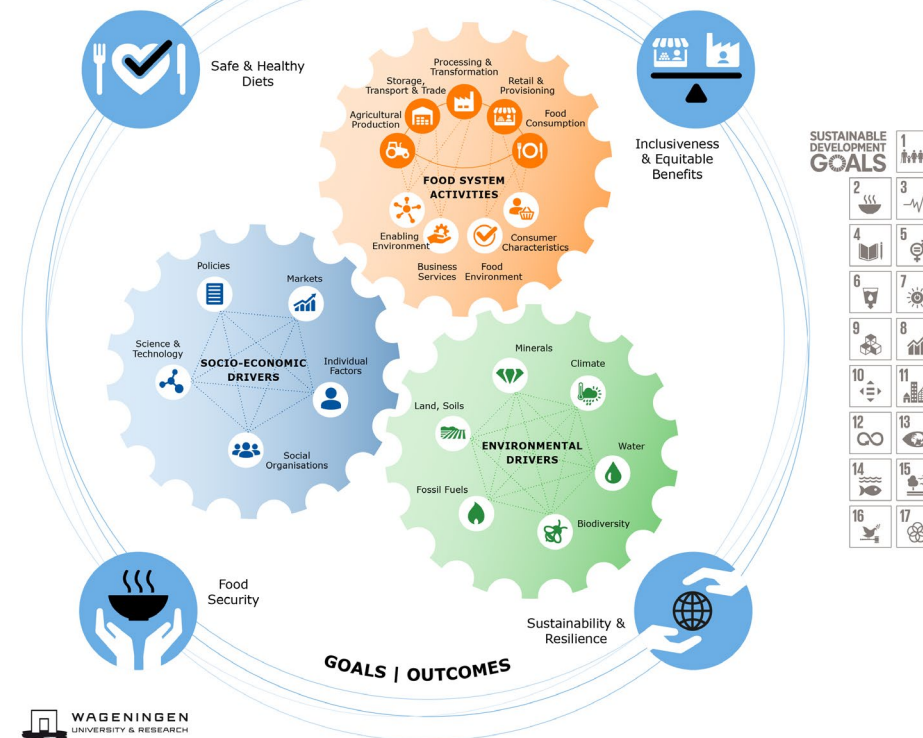
Affecting animal-source food production

- Green Deal
- Sustainable Food System Framework
- Farm to Fork Strategy
- Corporate Sustainability Reporting Directive
- Green claim initiative
- EU Deforestation Regulation
- **...and many others to comply with now and in the near future**

Note → Sustainability regulations will affect our competitive position of animal-source food in the global market, but may also offer chances

Food systems framework

Van Berkum et al. 2018, Wageningen University & Research







EU sustainability targets and farmers' protests

GHG reduction targets remain to have a high priority



55% reduction by 2030, net zero 2050

2030 Targets for sustainable food production

PESTICIDES	NUTRIENT LOSSES	ANTIMICROBIALS	ORGANIC FARMING
			
Reduce the overall use and risk of chemical and hazardous pesticides	Reduce nutrient losses by 50% whilst retaining soil fertility, resulting in 20% less fertilisers	Reduce sales of antimicrobials for farmed animals and aquaculture	Increase the percentage of organically farmed land in the EU

#EUFarm2Fork #EUGreenDeal

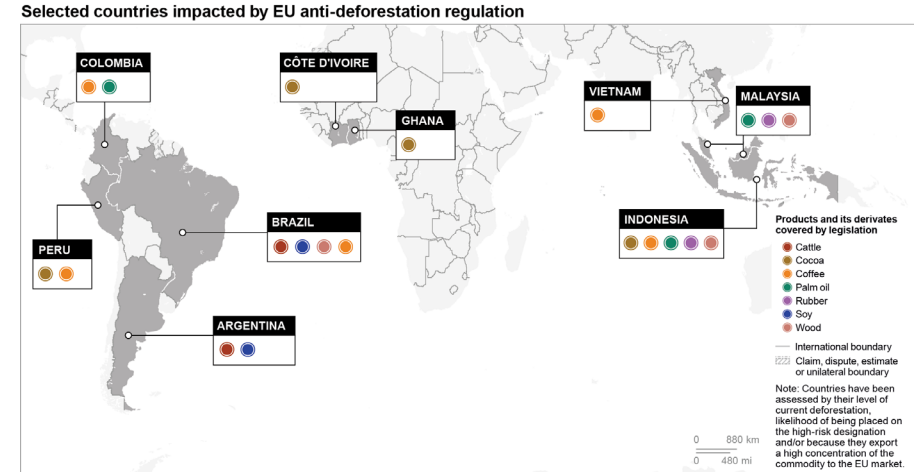


Farm to Fork strategy



EU Deforestation Regulation

To go into force 30 December 2024



Data compiled June 21, 2023.
Source: S&P Global Market Intelligence: 2009894.
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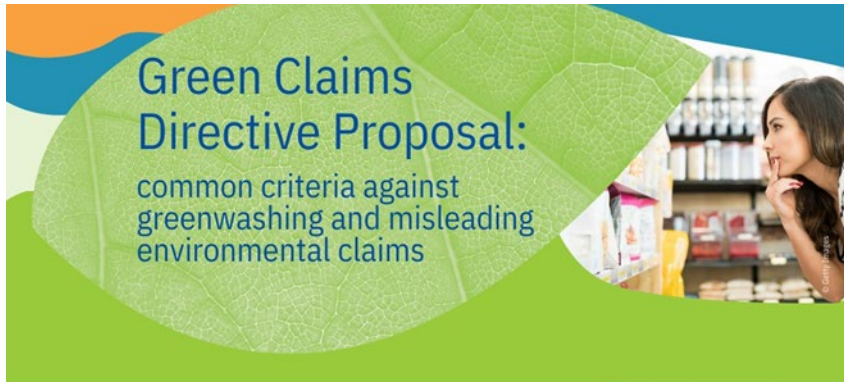
Companies will have to ensure that:

1. Those commodities and products have not been produced on land deforested or degraded after 31 December 2020.
2. They have been produced in accordance with the laws of the country of production.

A key requirement will be to collect the geographic coordinates of the land where the commodities they place on the market were produced.

Green Claim Directive

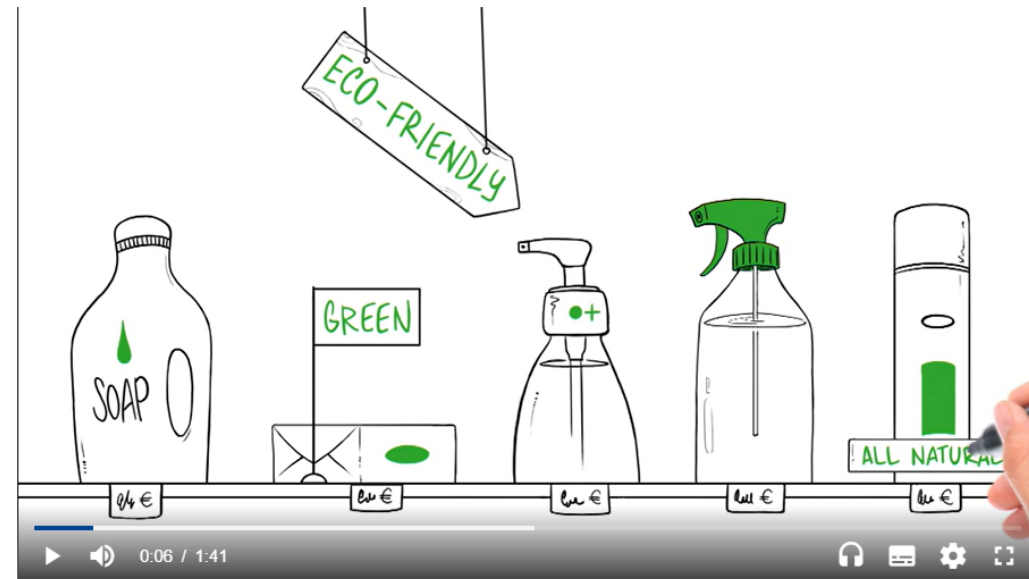
To assure that sustainability claims are proven and compliant



Key measures

- **common criteria** on how companies should **substantiate environmental claims**
- **clear requirements** to address the proliferation and credibility challenges of **environmental labels**
- **sound system** of independent verification and support to SMEs

EU measures to tackle greenwashing

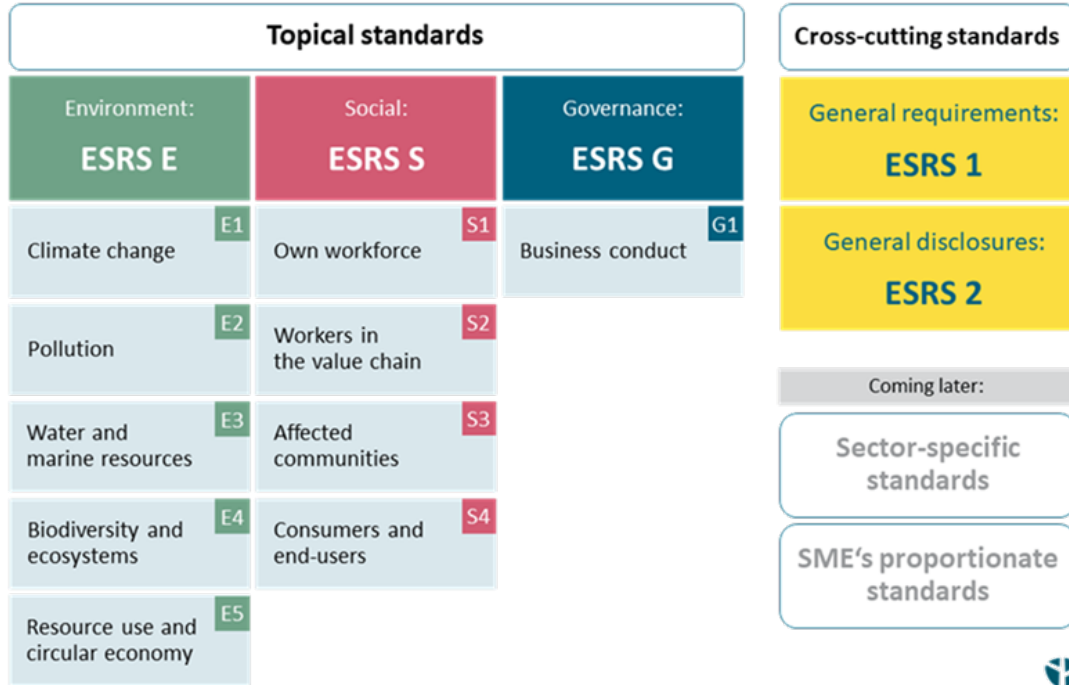


<https://audiovisual.ec.europa.eu/en/video/l-239279?language=EN>

Check marketing claims in sustainability with global marcom or our regulatory group!

Corporate Sustainability Reporting Directive

Compulsory in the EU for large and medium size companies from 2024–2025 onwards



2025 to be first CSRD reporting year Nutreco

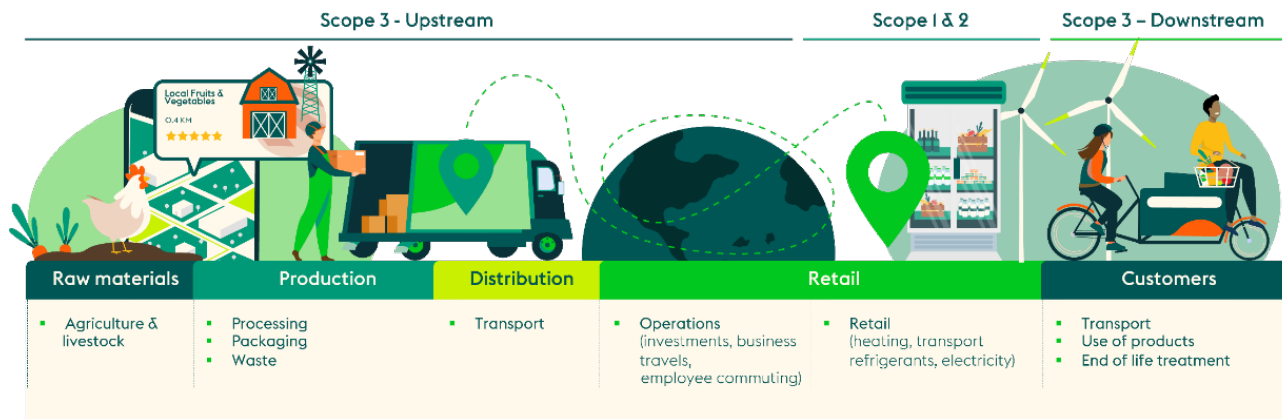
Double materiality matrix For Farmers



Retailers ask suppliers to reduce CO₂eq with 30–50% by 2030*

Example Ahold Delhaize: Target –45% reduction CO₂eq in 2030 (versus 2018)!

99% of GHG Albert Heijn comes from suppliers, of which 48% from animal source food



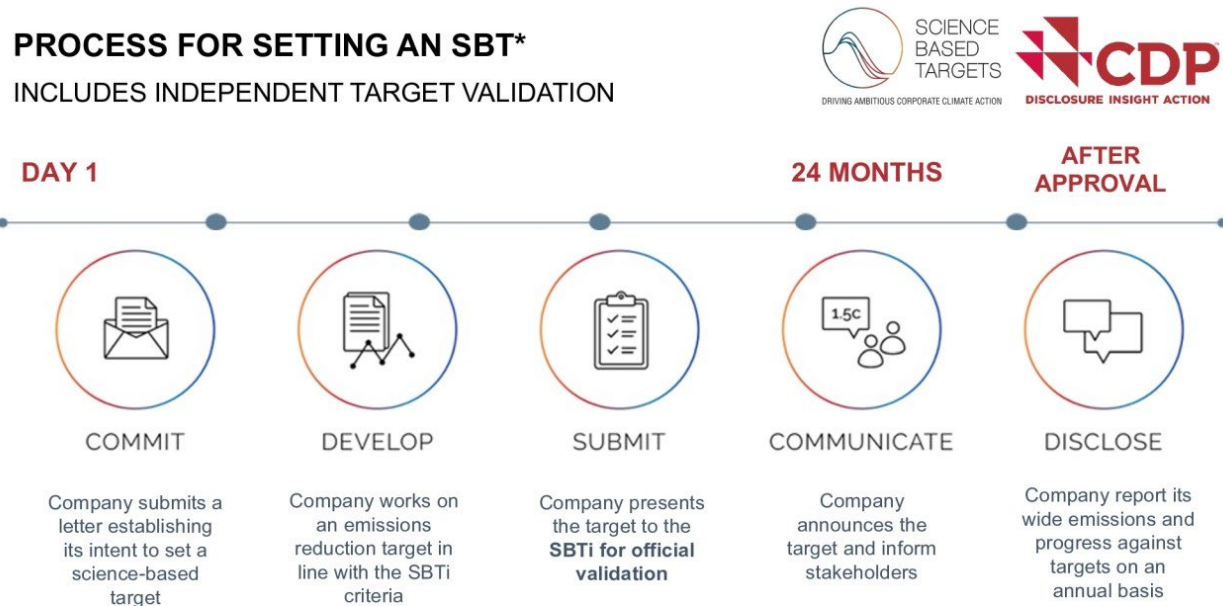
Food purchased	Carbon footprint Mt CO ₂ eq
Beef, Pork, Chicken, Fish	5.2
Dairy, Eggs	1.5
Vegetables, Fruit	1.1
Other foods	4.2
Non and near food	2.0
Total	13.9



Science Based Target initiative (SBTi)

Voluntary participation, majority leading food companies have joined

SBTi is a partnership of **CDP**, **United Nations Global Compact**, **World Resources Institute (WRI)** and **World Wide Fund for Nature (WWF)**: Companies joining are committed to reach the Paris Agreement targets



Nutreco joined SBTi in 2020

*Process for large companies. SBTi offers a streamlined route for SMEs.

Approx. 7000 companies joined the SBTi, 4,204 companies validated by the SBTi by end of 2023

Retailers informing consumers about nutritional value & sustainability

Steering consumers towards more sustainable food choices

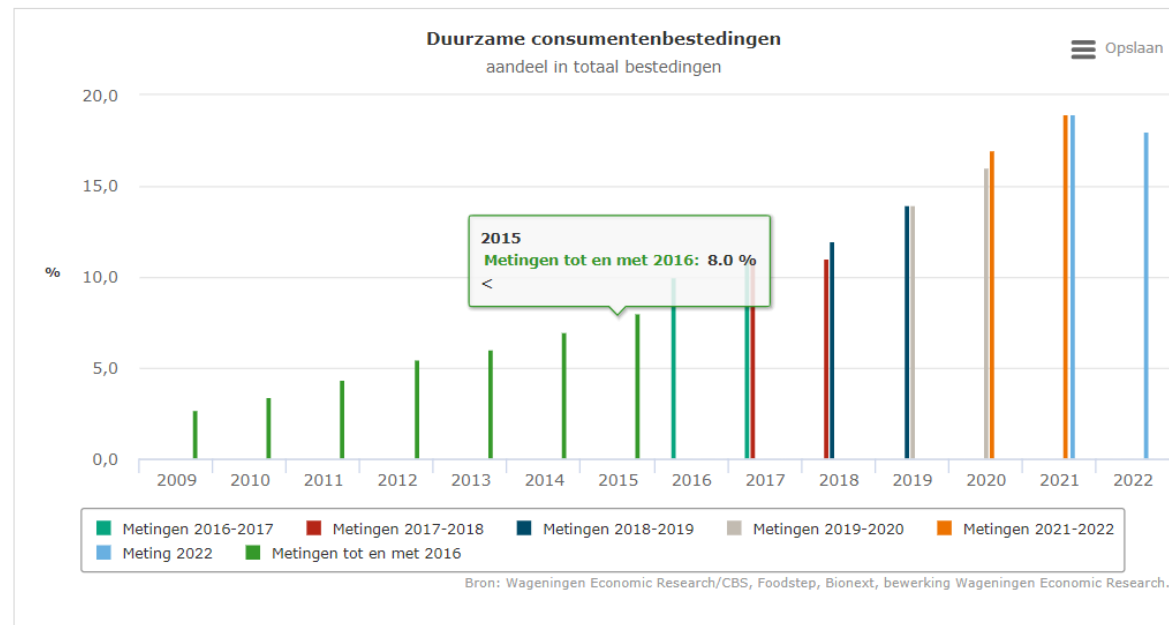


Retailers are actively engaged to support the 'protein transition' in North-West EU

Market share of food with sustainability label on the rise in NL

Growing in supermarkets from 8 to 23% in period 2013 to 2022

Market share food with sustainability label in supermarkets, food service, specialized food shops

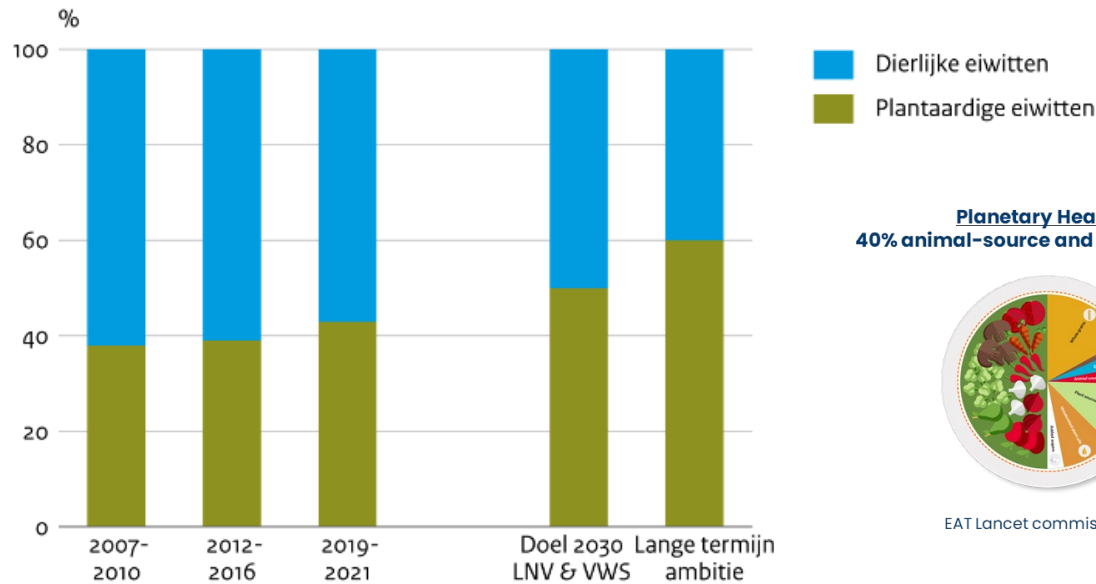


Sustainability labels included: **ASC, Organic, Beter Leven, Fairtrade, MSC, On the way to PlanetProof, Rainforest Alliance, UTZ Certified, SRP, Vrije Uitloop**

Less animal protein, more plant (or microbial) protein

Ratio animal/plant protein shifted from 62/38 to 57/43 in 10 years in NL

Verhouding dierlijke en plantaardige eiwitten in Nederlandse eetpatroon



Planetary Health Diet
40% animal-source and 60% plant based



EAT Lancet commission, 2019

Bron: Van Rossum et al. 2011, RIVM 2018, Klimaatakkoord 2019, Grondstoffenakkoord 2018, LNV 2022, RIVM 2023

PBL/jul23
www.clo.nl/nl059802

What are 5 trending alternative protein sources in Europe?



meat & dairy analogues with plant proteins
look and taste like meat made with vegetables, pulses, seeds etc.



cultured or cultivated meat
growing meat in a lab with stem cells from animals



fermentation-derived protein (e.g. mycoprotein)
biomass and precision fermentation using microorganisms



edible insects
so far, 4 species approved in Europe



algae
macroalgae (seaweed) & microalgae



<https://www.eufic.org/en/food-production/article/5-trending-alternative-protein-sources-to-meat-in-europe>

Majority retailers in NL are committed to 'push' towards 60% alternative protein in 2030

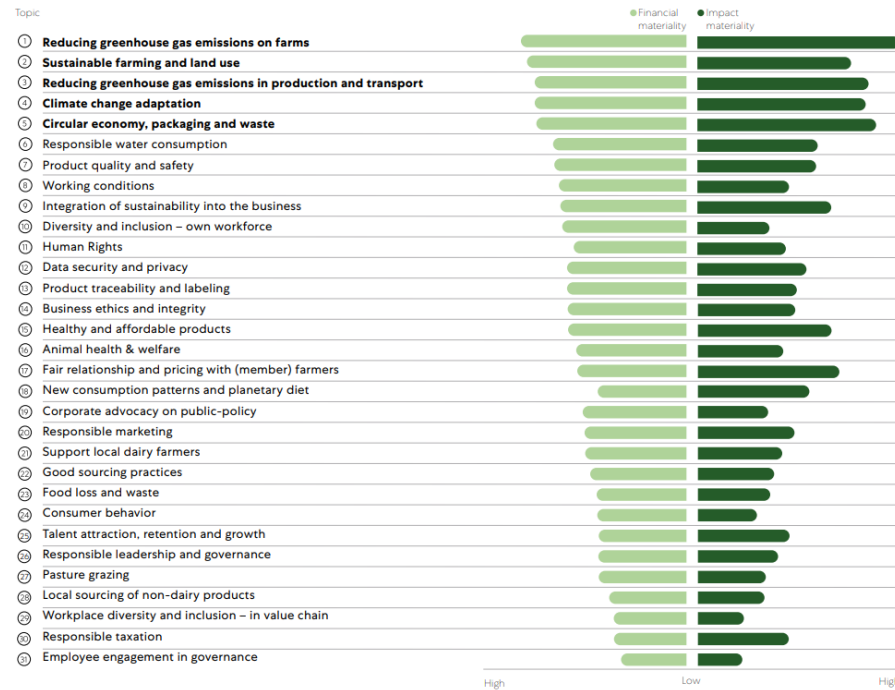
Sustainability priorities large animal-source food and feed companies

Published Materiality Assessment of 14 companies reviewed

Example of outcome materiality analysis: Friesland Campina



Results materiality analysis

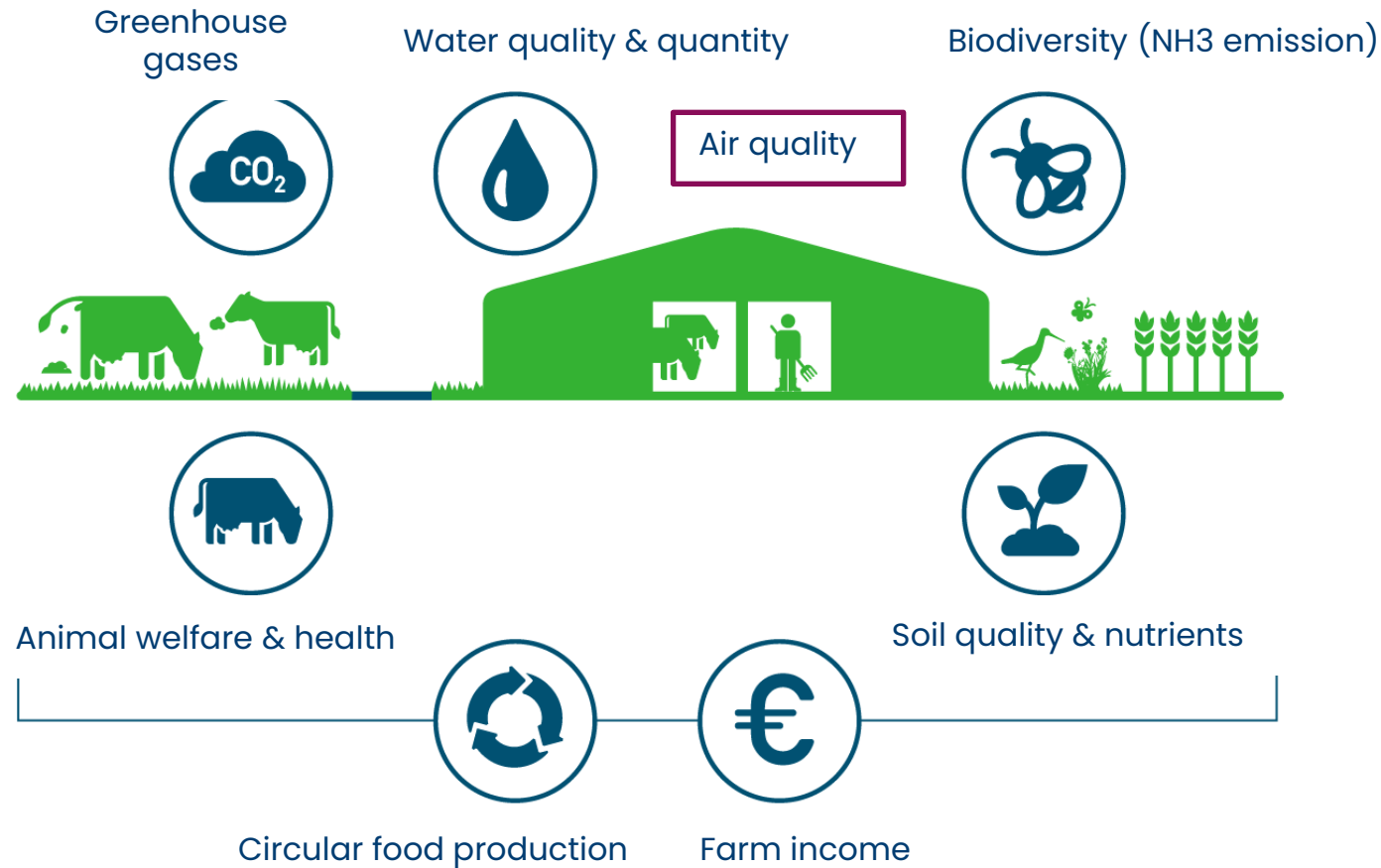


Priorities most frequently mentioned by all reviewed companies

- Climate change
- Animal health & welfare
- Feed & food safety
- Efficient use of resources, circularity
- Water use, scarcity
- Biodiversity

Companies reviewed: **Dairy Farmers of America (US), Tyson (US), OSI Group (US), Cargill (US), JBS (BR), Danish Crown (DK), For Farmers (NL), Nutreco (NL), Friesland Campina (NL), Lactalis (FR), Nestlé (CH), Fonterra (NZ), CP Foods (TH)**

Farmers are confronted with many sustainability demands and have to comply now and in the future with many challenging regulations



Sustainability animal-source food

Value-Approval

**Nutritional
Value**

**Pleasure of
eating it**

Healthy



Concerns-Disapproval

**Animal
welfare
issues**

**Environ-
mental
impact**

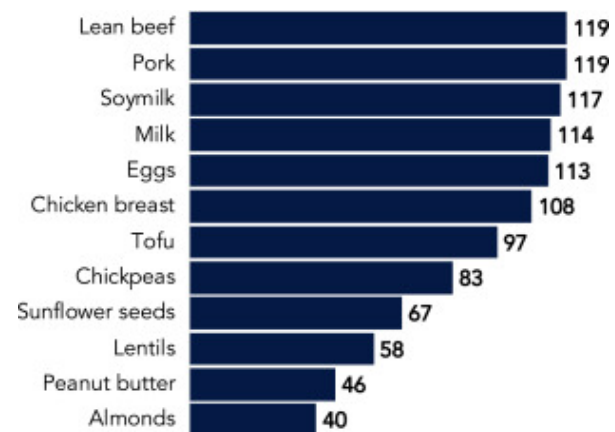
Not Healthy

Animal-source food has excellent nutritional value

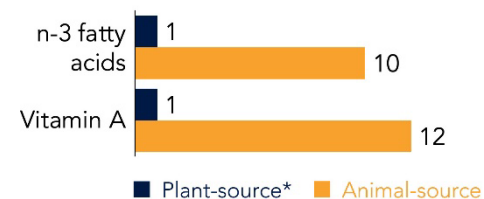
- Highly digestible, available nutrients
- Excellent source of protein
- Contains various essential nutrients
- Consistent nutrient content
- Mostly hypoallergenic



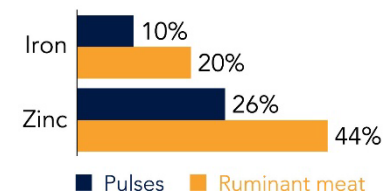
Digestible Indispensable Amino Acid Score (DIAAS)



Bioavailability (proportion of plant-source)



Bioavailability (% absorbed)



Low-income countries: Food security and safety nr 1

Animal-source food (meat, milk, eggs, fish, shrimp, etc.) pivotal for protein supply

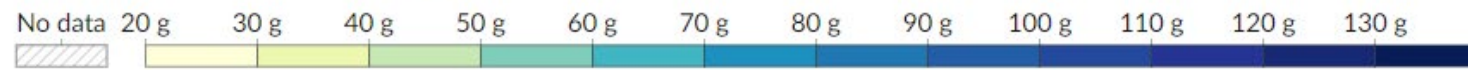
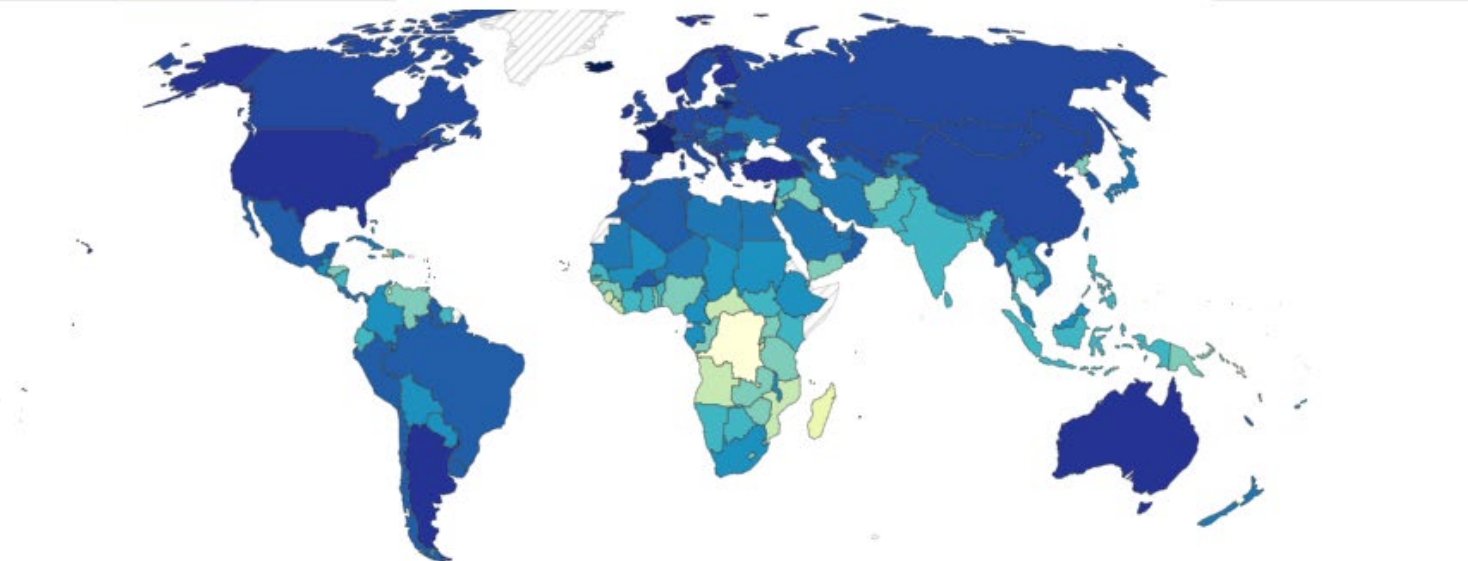
Daily per capita protein supply, 2020

Average daily per capita protein supply, measured in grams of total protein per day.

Our World
in Data

Table Map Chart

World

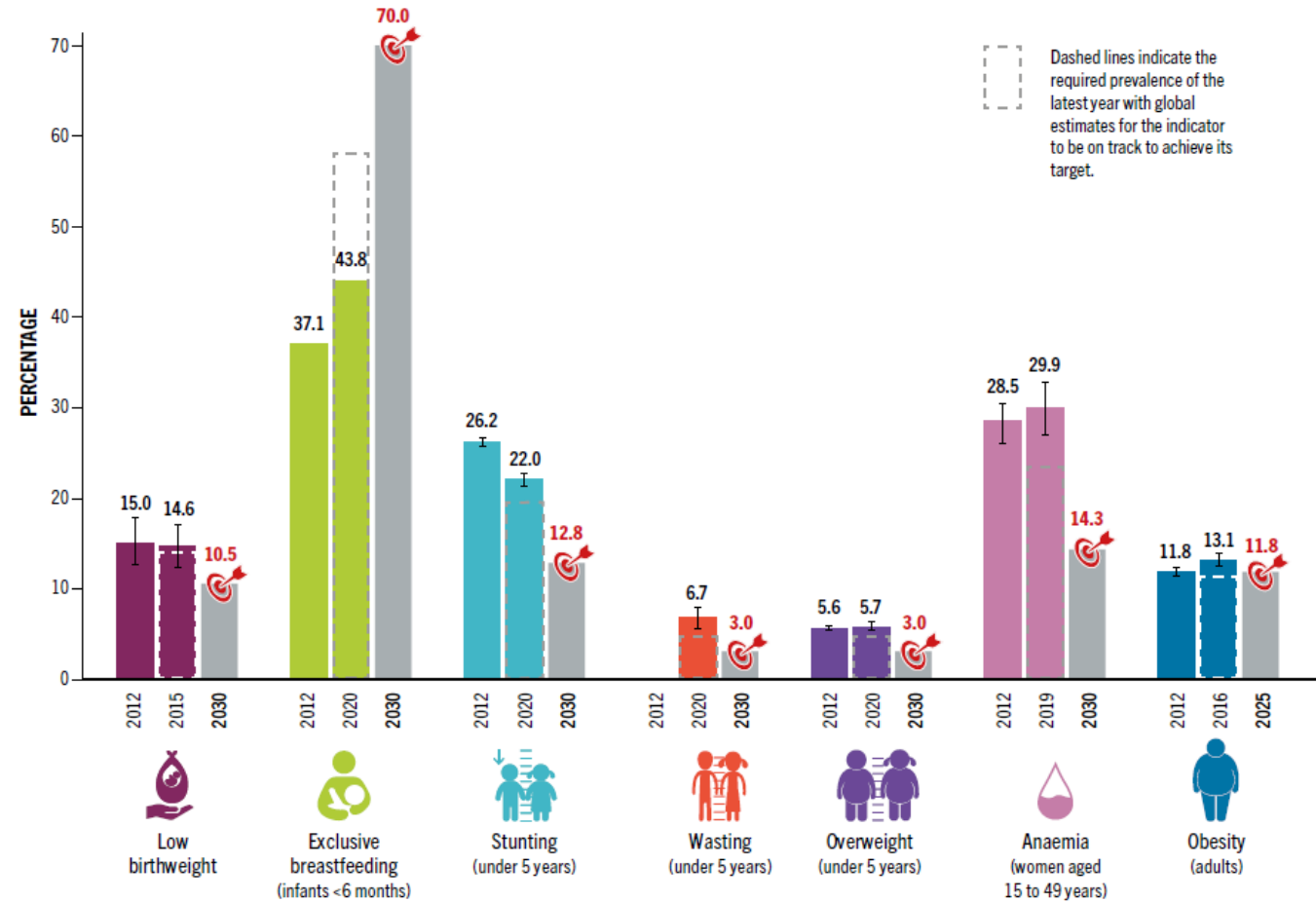


The daily protein requirement of adults is about 50-60 g/day

Animal-source food contributes to prevention of nutrient deficiencies, but also contributes to obesity



Figure A1. Progress towards World Health Assembly global nutrition targets



Full fat milk has been recently downgraded to Nutriscore 'C' Water has Nutriscore A



Update of the Nutri-Score algorithm for beverages

Second update report from the Scientific Committee of the Nutri-Score
V2 – 2023

The second update report from the Scientific Committee of the Nutri-Score was voted on February 1st, 2023
and accepted with a majority of votes. No minority opinions were expressed.



Nr of glasses needed to equal protein intake of 1 glas milk

Milk's advantage on the nutritional value side versus alternatives



*Wat is CO₂eq? Door het gebruik van de rekeneenheid CO₂eq is het mogelijk om het effect van de verschillende broeikasgassen onderling te vergelijken.

Source Royal A-ware, Linked-In, 2024; based on Singh-Pavel et al., 2022

Nutrition & Health: It is all about a well-balanced diet!

Have plenty of
vegetables and fruits

Eat protein foods

Make water
your drink
of choice

Choose
whole grain
foods



...and emphasize the nutritional value
and pleasure of eating dairy products

Dairy efficient in converting non-edible into edible protein

Net contribution of Belgian livestock to human protein supply. (ILVO studie C. De Cuyper, et al., 2022)	Edible protein efficiency (Belgian corrected edibility list)
Fattening pigs	1.36
Broilers	0.96
Layers	1.30
Dairy cattle kept intensively, with maize-rich feed	1.26
Dairy cattle kept intensively with grass-rich feed	1.81
Dairy cattle kept extensively with grass-rich feed	3.59
Beef cattle kept extensively with grass-rich feed	1.72
Beef cattle kept intensively with maize-rich feed	1.09

Grass-rich fed dairy cow delivers 3.6x more human edible protein output than input

Circularity of dairy compound feed is high!

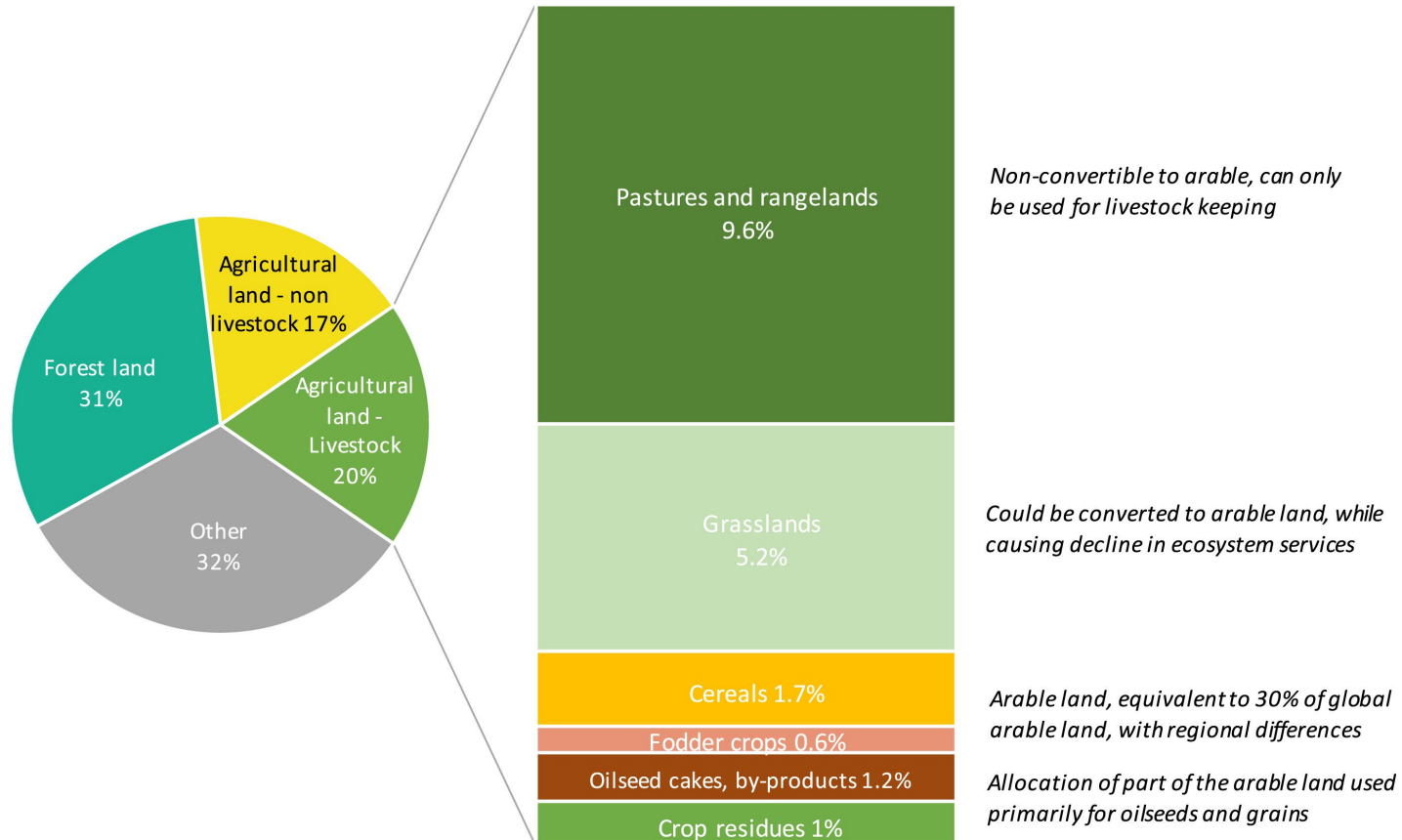
% Rest-, byproducts and former foodstuffs in NL

- 54% ruminants
- 35% swine
- 21% poultry

NB: Soybean meal is not a classified as circular ingredient NEVEDI, 2024

Competition between land-use for feed is (currently) limited

But may in the future become more evident with the global increase in food demand



- **5 billion ha arable land**
- 2.5 billion ha used for livestock farming
- 2 billion ha of this is grassland
- **0.7 billion ha is convertible for food crops**
- 1.3 billion not convertible

Conflicts often the main cause of food insecurity besides extreme weather conditions causing poor crop yields



Food and Agriculture Organization of the United Nations



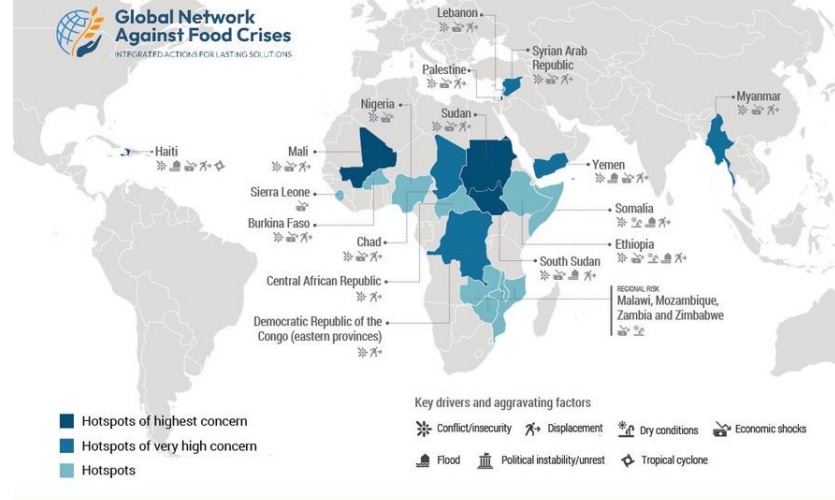
World Food Programme



Hunger Hotspots

FAO-WFP early warnings on acute food insecurity

June to October 2024 outlook

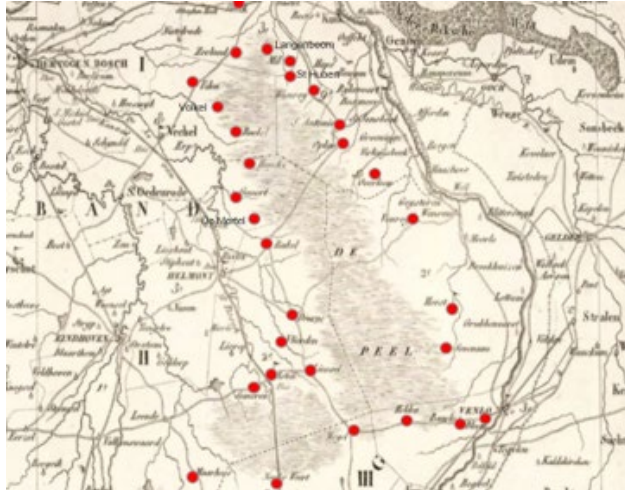


South Sudan



Livestock farming is a way to get out of poverty

My grandfather and grandmother were among the first settlers in De Peel in 1923



They started in reclaimed land a small farm with a few cows, pigs and layers

Sustainability animal-source food

Value-Approval

**Nutritional
Value**

**Pleasure of
eating it**

Healthy



Concerns-Disapproval

**Animal
welfare
issues**

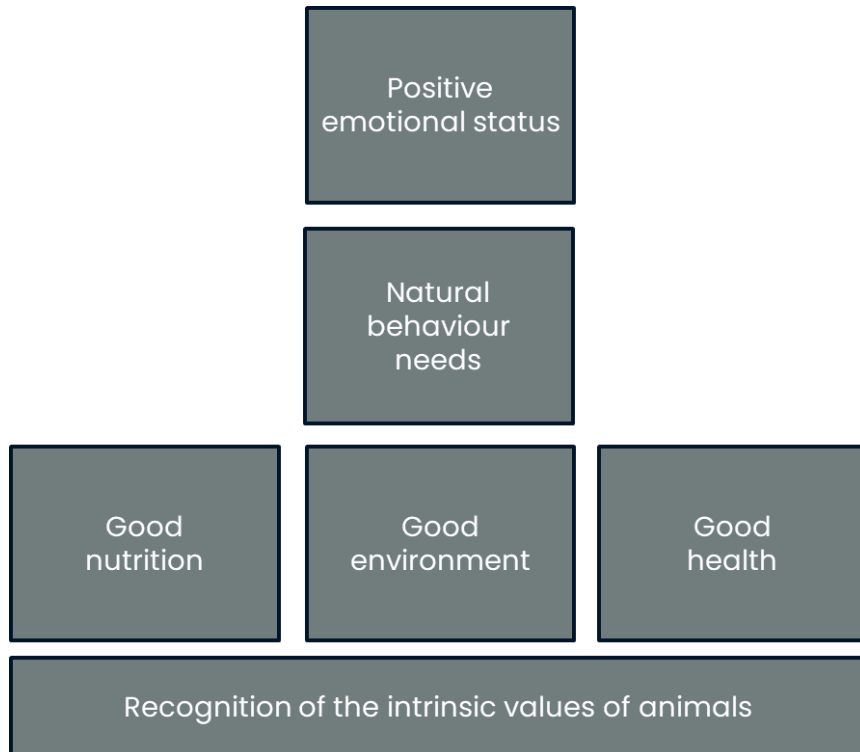
**Environ-
mental
impact**

Not Healthy

Animal welfare remains to be high on the agenda

The 6 guiding principles of animal welfare

Raad van Dieraangelegenheden, 2021



Happy cow



Welfare topics

- Early age weaning calves
- Productivity related disorders, diseases
- Nr days housed indoor vs grazing
- Comfort, space, richness environment
- Longevity

Animal welfare on top of regulation

Welfare labels or broader sustainability labels with welfare demands inside

'Beter Leven' most successful welfare label in NL
(but less for dairy cows, compared to swine, poultry)



Example more broad sustainability labels:
'Koe, Natuur & Boer', **'On the way to planet proof'**

	Gangbaar	★ ★ ★ 1 ster	★ ★ ★ 2 sterren	★ ★ ★ 3 sterren
Aantal ligboxen	Geen eis	Eén ligplek per koe. Loopruimte min. 5m2 per koe.	Eén ligplek per koe. Loopruimte min. 7,5m2 per koe.	Eén ligplek per koe. 5% meer ligplaatsen dan aantal koeien. Loopruimte 10m2 per koe.
Afleidingsmateriaal	Geen eis	Borstels in de stal vereist	Borstels in de stal vereist	Borstels in de stal vereist
Bodembedekking ligbox	Geen eis	Koematrassen van rubber of diepe strooisellaag	Koematrassen van rubber of diepe strooisellaag	Koematrassen van rubber of diepe strooisellaag
Weidegang	Geen eis	Melkkoe: 120 dagen, 6 uur per dag. Jongvee minimaal 100 dagen in eerste twee levensjaren.	Melkkoe: 150 dagen, 8 uur per dag. Jongvee minimaal 100 dagen in eerste twee levensjaren.	Melkkoe: 180 dagen, 8 uur per dag. Jongvee minimaal 100 dagen in eerste twee levensjaren.
Zogen kalf	Geen eis	Gescheiden, nadat kalf door moederkoe is drooggelikt.	Gescheiden, nadat kalf door moederkoe is drooggelikt.	aanbeveling: gedurende 3 maanden kalf bij de moederkoe

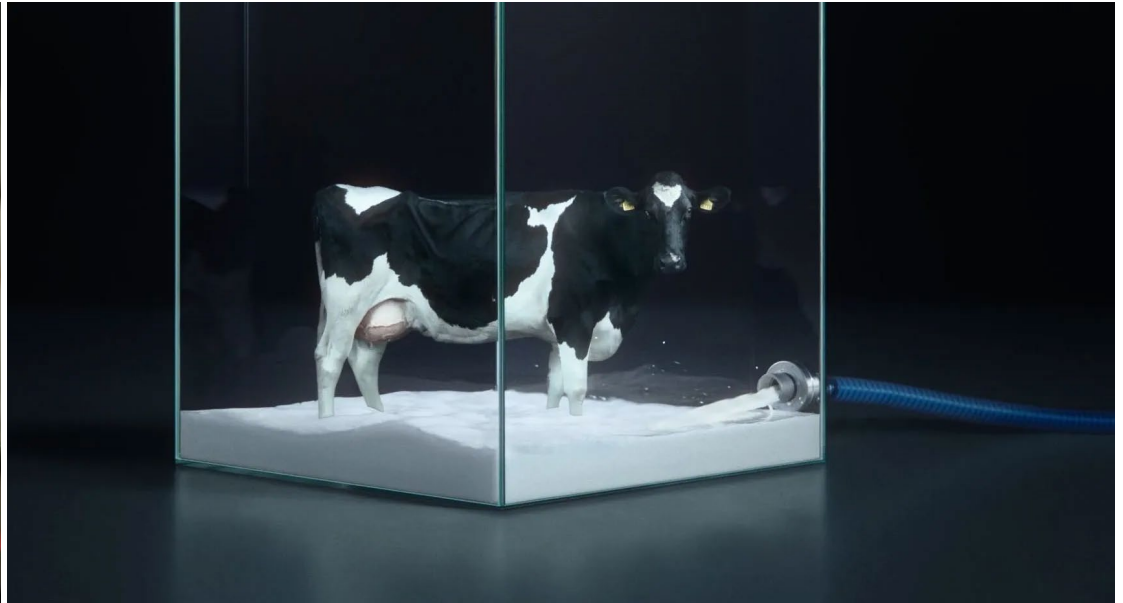
Requirements for dairy cow farms to obtain 1, 2 or 3 stars



Emotional 'framing' of animal-source food is common To influence the perceptions and beliefs of consumers



Nederlands Agrarisch Jongeren Kontakt (NAJK)



Wakker Dier

The degree of 'industrialization' also counts

and perceptions of what is large or small have a huge variation across the globe

A 'mega' farm in NL is defined as a farm with >250 dairy cows



Picture taken from internet of a typical modern dutch family owned dairy farm

'... has 1500 dairy cows and 1000 angus beef, in the USA this is seen as a small farm'



Screen shot from Food for Thought, critical documentary about food production in the world (VPRO, 2024)

Strong reduction in N, P emission from 1990 onwards in NL

After a strong period of rise from 1950 to 1990

Sterke afname stikstof vanaf de jaren negentig

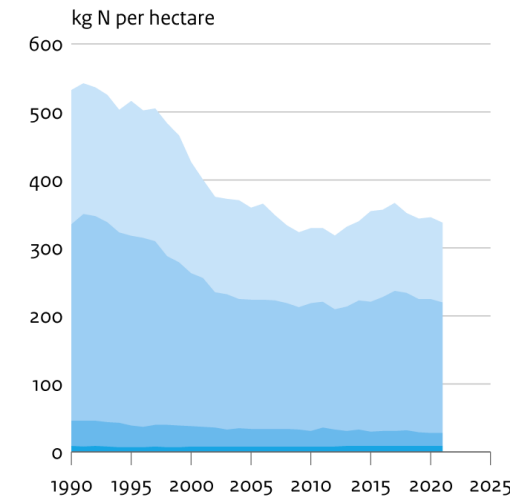
Deposities van stikstof, in kilo's per hectare



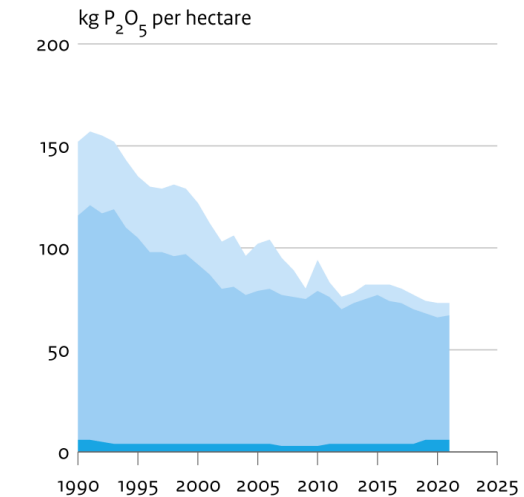
-67% Ammonia 1990-2021

Aanvoer stikstof en fosfaat op landbouwgrond

Stikstof



Fosfaat



- Kunstmest
- Dierlijke mest
- Luchtdepositie
- Overige aanvoer

-37% N and -52% P₂O₅ from 1990-2021

Bron: CBS

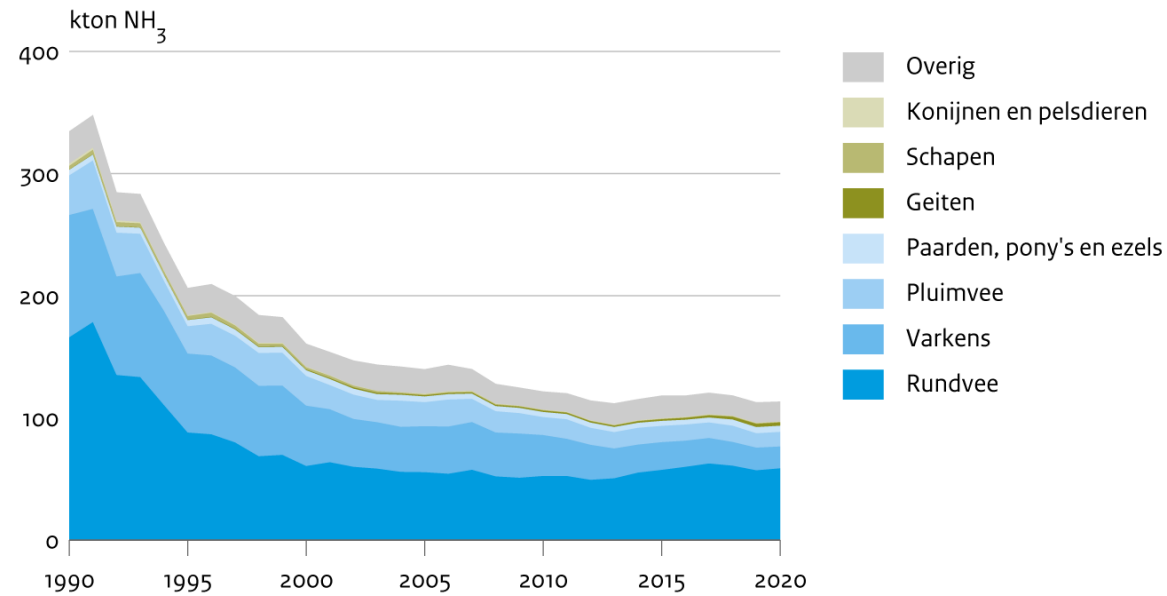
CBS/mrt23
www.clo.nl/nloog323

More reduction is needed!

Ammonia emission by species in NL

Ruminants have highest impact

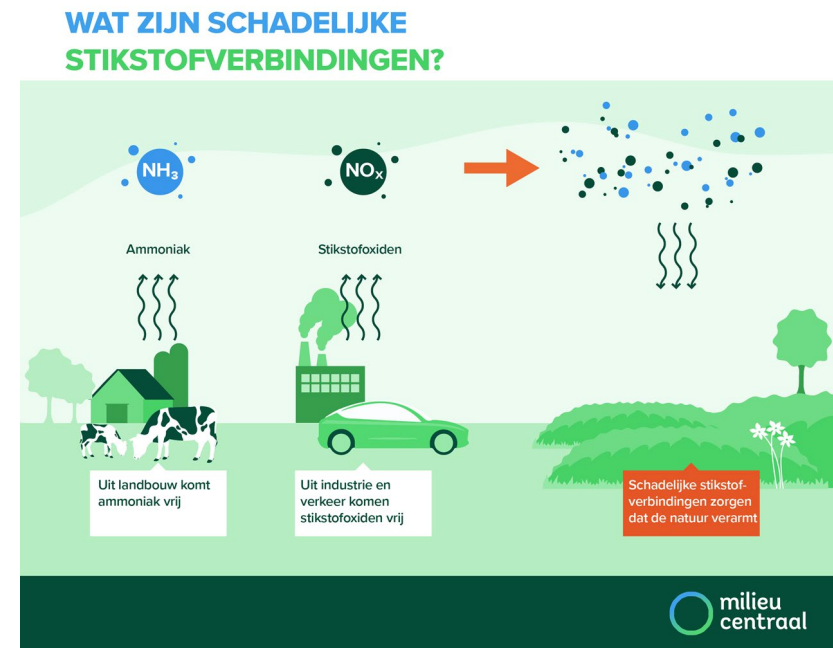
Emissie ammoniak (NH_3) door land- en tuinbouw per diercategorie



Bron: Emissieregistratie

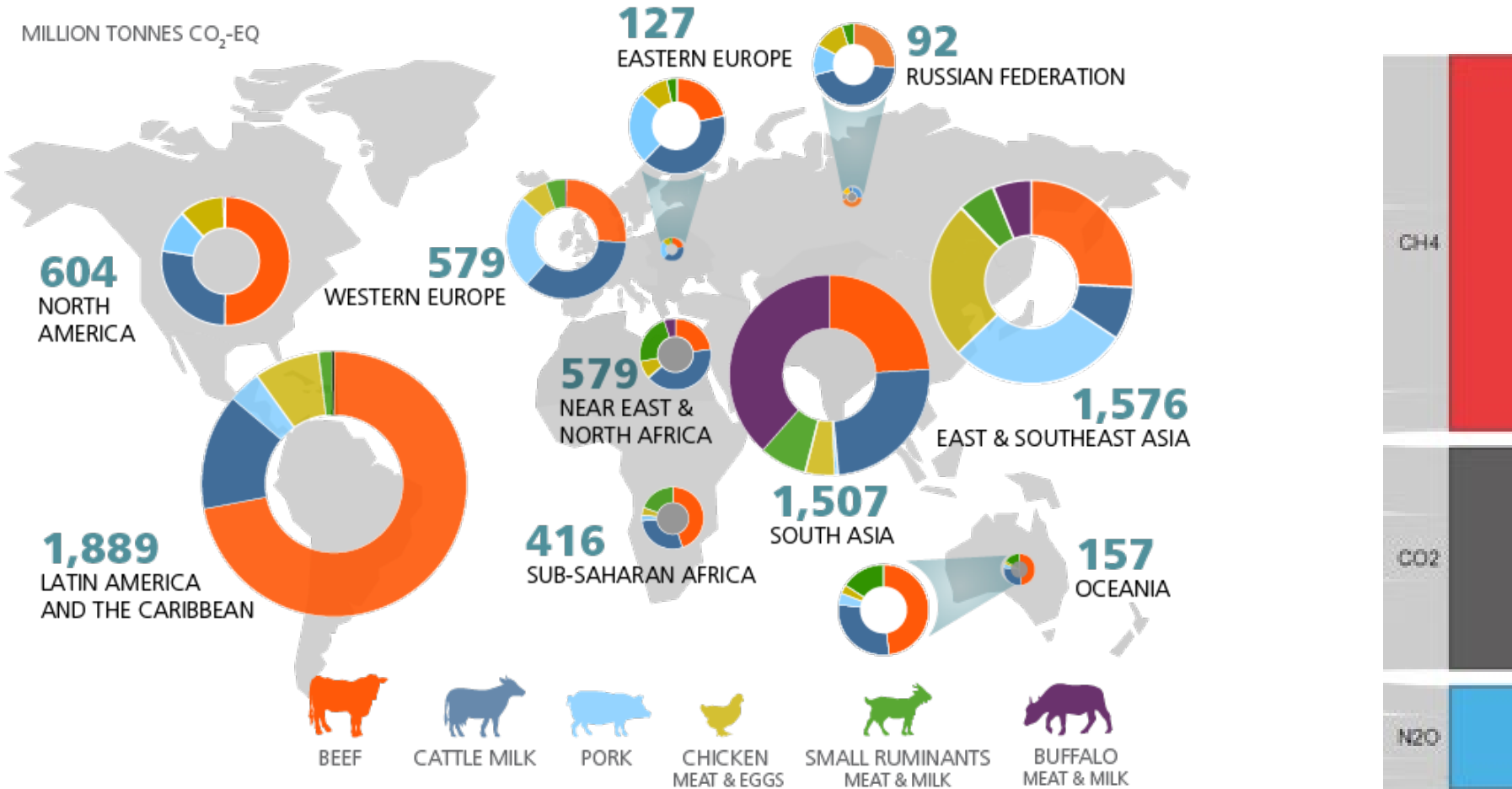
RIVM/okt22
www.clo.nl/nl010118

Deposition of N in nature reserves



Global GHG Emission Livestock = 12% of total global emission

South-America and Asia have the highest contribution



Most important GHG in Livestock = CH4

Source: FAO Gleam 2022

LCA has 16 environmental impact categories as output

Life Cycle Assessment



Climate change (carbon footprint) is one of the categories



International Development Research Network, 2023

For product LCAs we use the Product Environmental Footprint Category Rules (PEFCR)

PEFCR Feed is used to calculate and share the EF of feed

There is an EC approved PEFCR for feed and milk, but not yet for meat and eggs

- **Climate change**
 - Land Use Change (LUC)
- **Acidification**
- **Eutrophication**
- **Land use**
- **Water use** (or scarcity)
- **Particulate matter**

Towards guidelines/regulations for footprint declaration

EXAMPLE OF LABEL – DECLARATION OF SOME IMPACT CATEGORIES – BATCH SPECIFIC VALUES

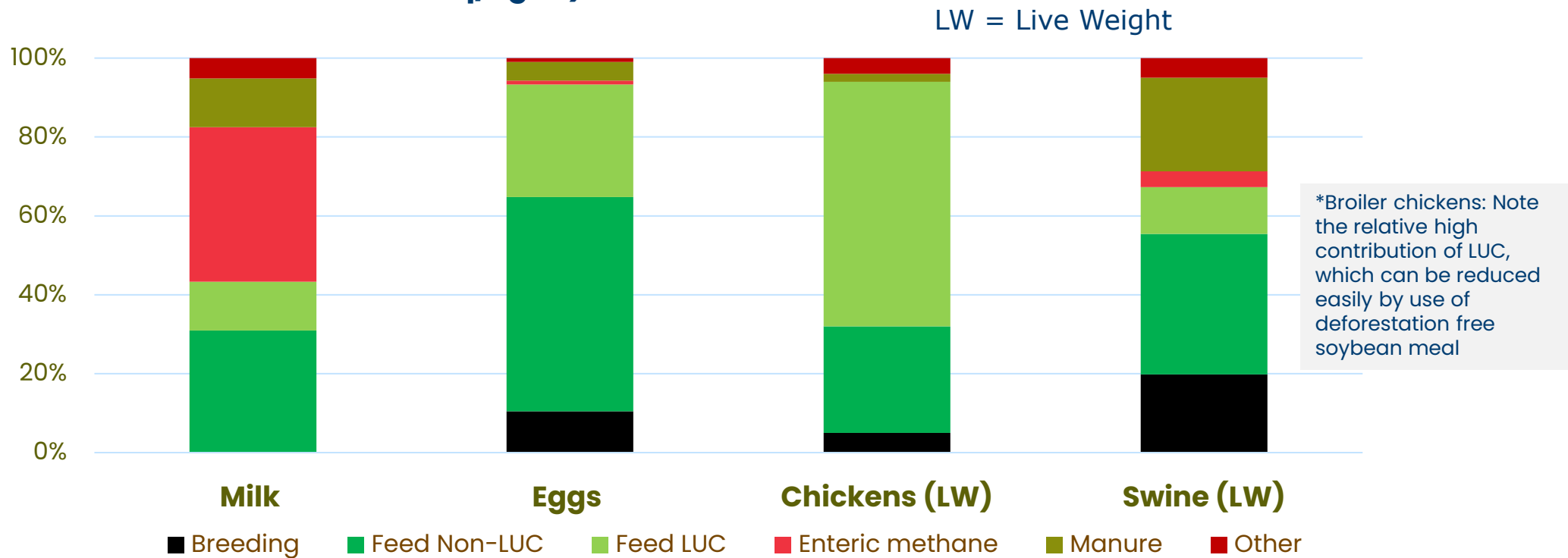


Feed/ration is high proportion of CO₂eq/kg of animal products

Land-Use Change (LUC) is a high variable

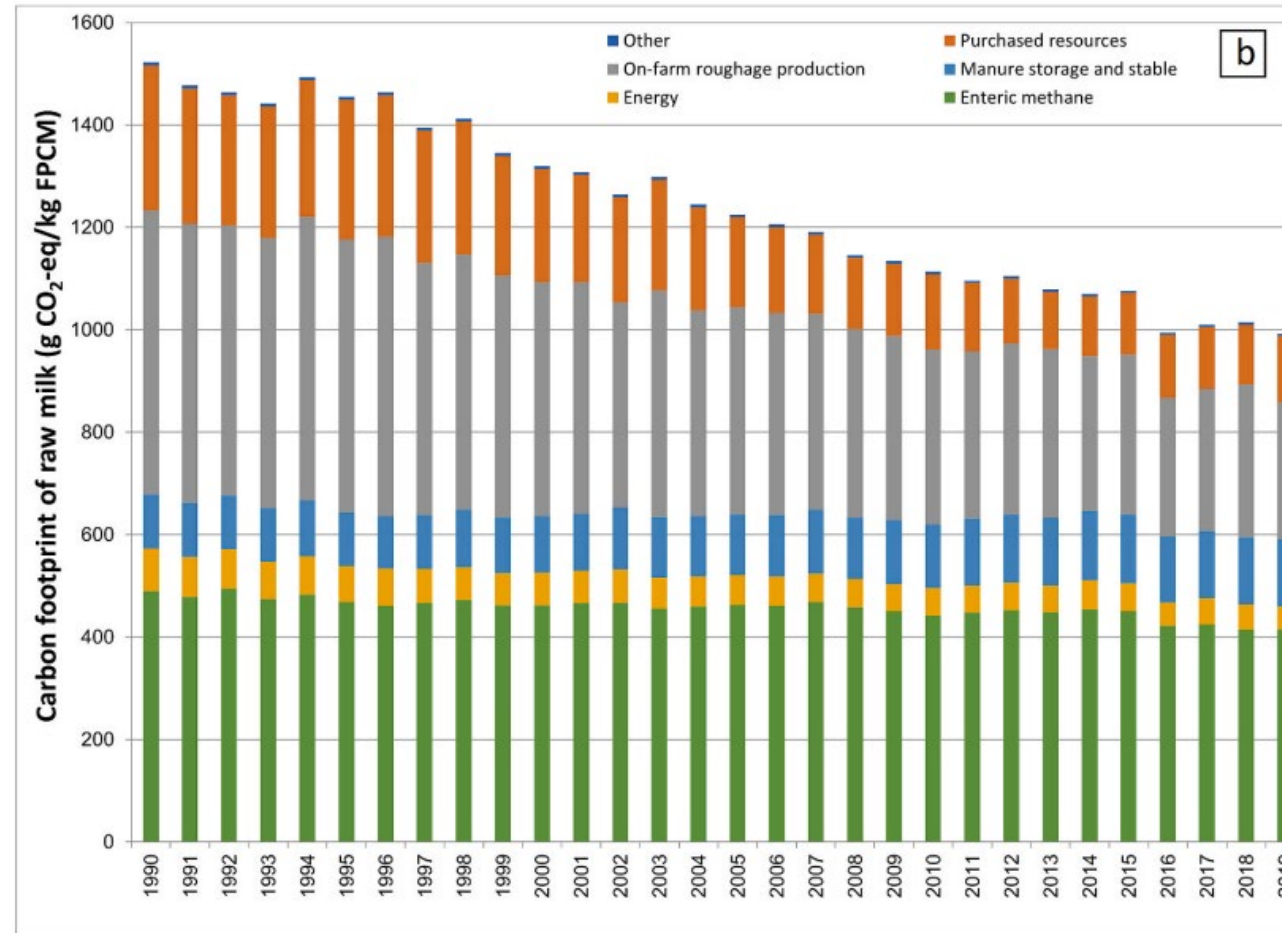
Indicative average NL, CO₂eq / kg	1.1	2.5	3.0*	3.5
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Hot Spots (relative contribution total CO₂eq/kg, %)



Indicative values; taken from various scenarios using in-house LCA models following PEFCR guidance (unpublished data), LCA info food processors, Mostert et al., 2022; Mostert et al., 2023

35% reduction CO₂eq/kg milk from 1990–2019 in NL



Hospers *et al.*, 2022

Productivity dairy farms improved significantly 1990–2019

Table 1. Development of main farm characteristics of an average Dutch dairy farm between 1990 and 2019 (CBS, 2022a; van Bruggen et al., 2021; van Bruggen and Gosseling, 2019, 2020; Wageningen UR, 2022).

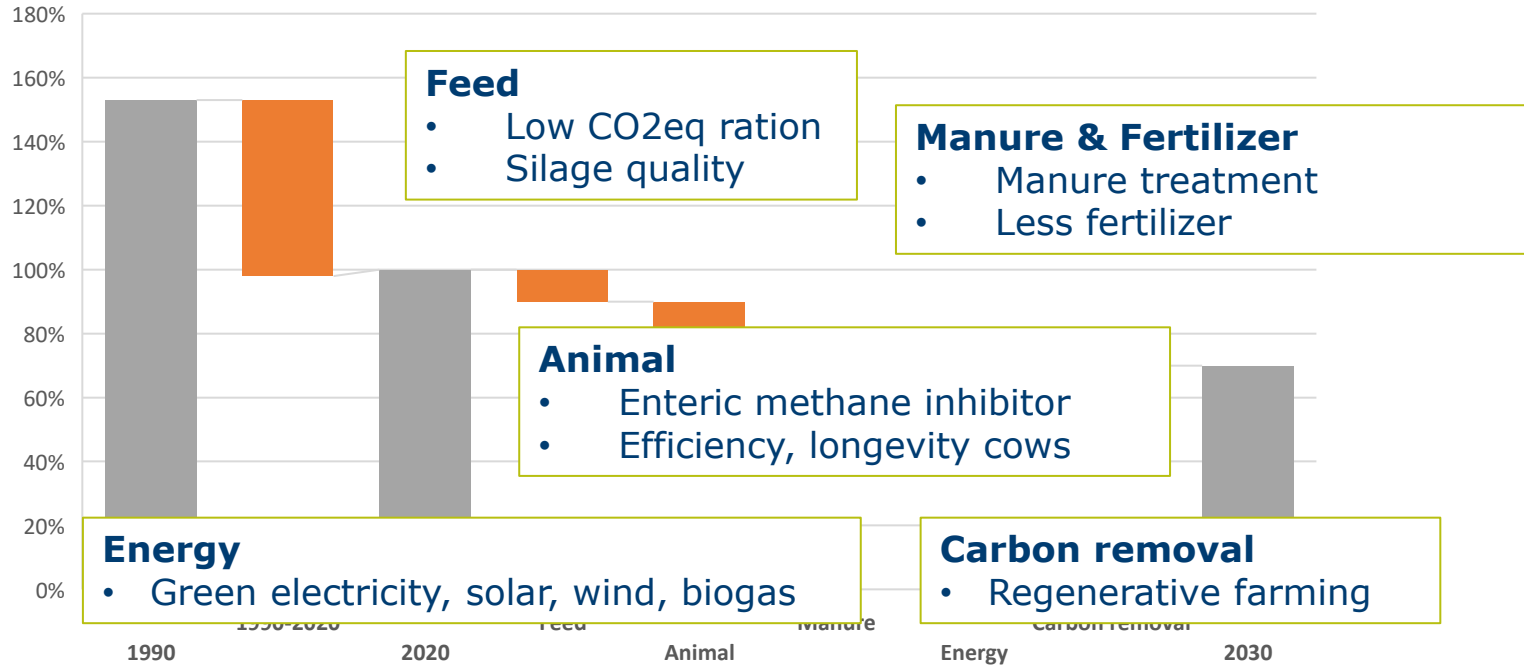
	1990	1995	2000	2005	2010	2015	2019
Total farm size (ha) ^a	20.8	25.1	29.6	35.7	43.9	49.4	52
Milk production (kg/cow/year)	6003	6580	7416	7568	8030	8277	8807
Number of cows	40.6	45.6	51.0	60.9	74.7	88.8	97.0
Replacement rate (%)	42	42	32	30	28	25	29
Compound feed efficiency (kg DMI ^b /100kg milk)	29.9	32.3	25	24.5	22.1	22.2	23.4

Hospers et al., 2022

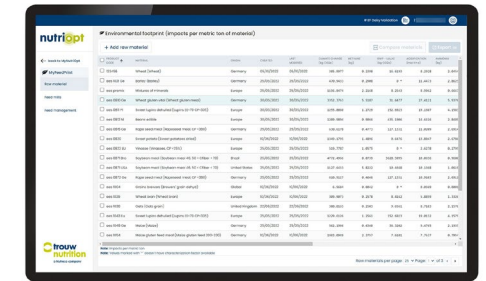
Intervention strategy to further reduce CO2eq footprint milk

A further reduction of 30% is technically feasible to 2030

A carbon footprint reduction scenario milk



Tools & Strategies
MyFeedPrint, MyMilkPrint
+ CO₂eq reduction program
Trouw Nutrition



Indicative reduction scenario as example, using in-house LCA models (unpublished data), info food processors and reports WUR

How fast? National value chain policies and regulations will drive at the end the progress in sustainability

Example dairy farmers Denmark

Bonus approach
Rewarding sustainable farming



Arla's Sustainability Incentive Model
Up to max 3 cent €/kg milk

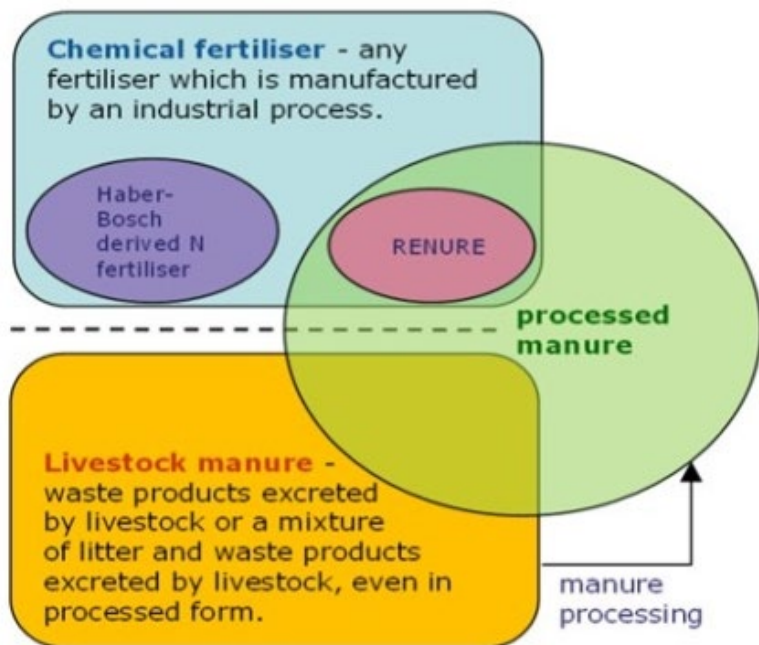
Malus approach
Taxing negative sustainability impact



Manure treatment for biogas, chemical fertilizer alternatives AND reducing CH₄ and NH₃ emission

Renure: A chemical fertilizer substitute

RENURE

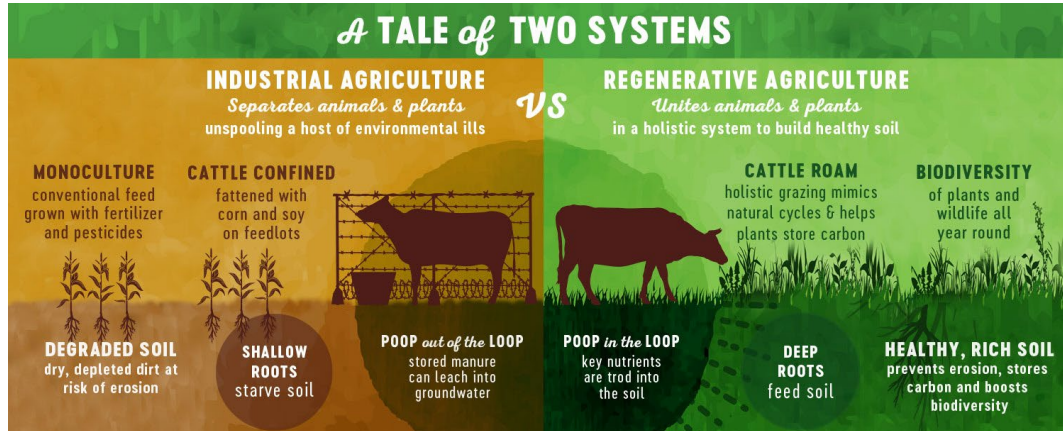


62% less NH₃ emission!

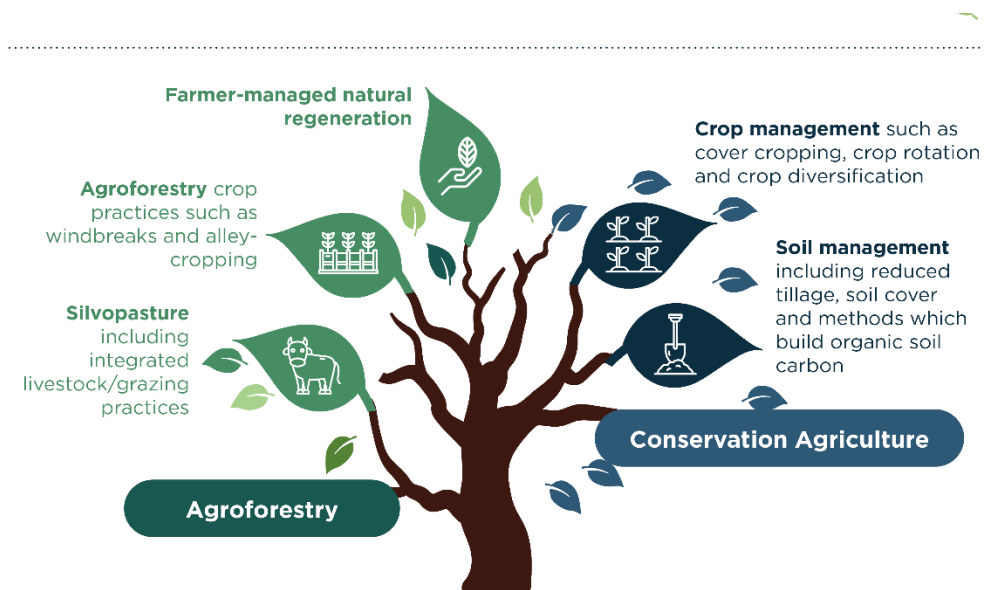
Regenerative agriculture, nature conservation

What is or will be the incentive for the farmer?

<https://appgate.zendesk.com/hc/en-us/articles/4995811733908-What-is-Regenerative-Agriculture>

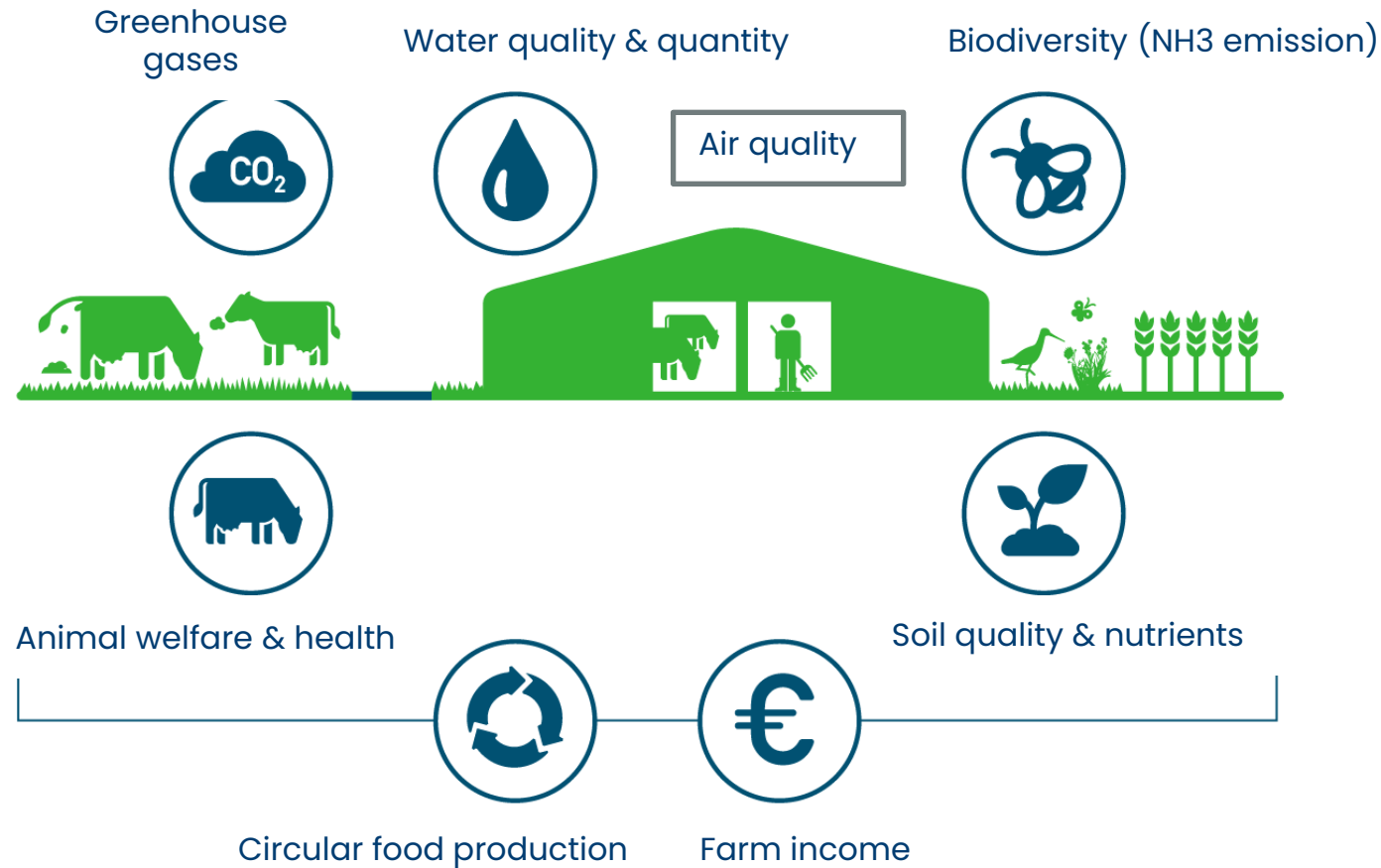


'Herb-rich, biodiverse' grassland



<https://www.weforum.org/agenda/2022/10/what-is-regenerative-agriculture/>

Sustainability is optimization model with many 'trade offs' inside



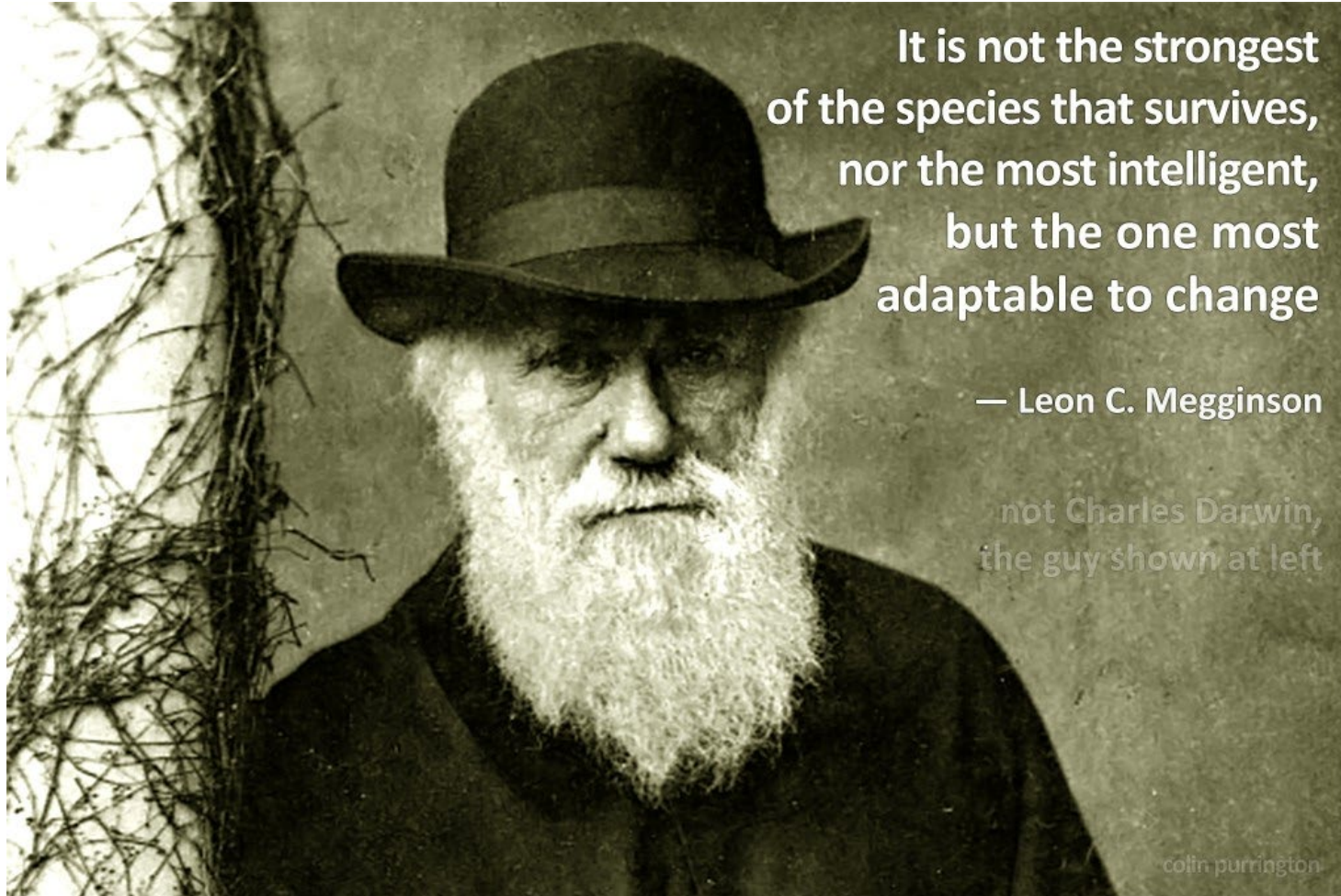
Prompt ChatGTP: Create image of the dairy farm of the future, meeting all future sustainability requirements

Text generated by ChatGTP:

A highly advanced dairy farm of the future, designed with **cutting-edge technology** and sustainability at its core. The barn is powered by **renewable energy sources**, such as **solar panels on the roof and wind turbines** nearby. The cows are in **large, comfortable, open spaces** with green pastures visible in the background, and the structure incorporates **vertical gardens and vegetation for natural insulation** and **air purification**. The milking process is fully automated with **state-of-the-art robotics**, including **AI-controlled feeding and health monitoring systems**. The farm also has a **water recycling system**, ensuring efficient use of resources, and the entire operation runs on **minimal emissions**. The landscape around the farm is designed to **support biodiversity**, with **flower-rich meadows** and **sustainable crop fields** visible nearby.



Thank you



May the force be with you – Obi Wan Kenobi