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IDF DAIRY SUSTAINABILITY OUTLOOK

COP27 Sharm El-Sheikh Egypt 2022

There is NO planet B


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PREFACE

MESSAGE FROM THE IDF DIRECTOR GENERAL

The United Nations COP27 on Climate, which will take place this November in Egypt, will be an opportunity to discuss agriculture and food systems and how dairy climate actions can be part of the solution. The global dairy sector is fully committed to reducing its impact on GHG emissions, water and land use and at the same time optimising the positive contribution to soil and ecosystem services. This commitment is expressed in the Dairy Declaration of Rotterdam, signed in 2016 between the IDF and the FAO. COP27 constitutes an unparalleled opportunity to communicate the many efforts that the dairy sector is already engaged in to mitigate environmental impact and enhance Climate Action.

The Pathways to Dairy Net-Zero initiative was launched on September 22, 2021. Over 100 leading organisations, and 11 of the 20 largest dairy companies already support the initiative, including IDF. The initiative has been described as a "vibrant, growing movement, the first of its kind in the world". Pathways to Dairy Net Zero will be the highlight of the side event that IDF, GDP and Uruguay will be organising to convey the ongoing efforts that the global dairy sector is already putting into practice all around the world to foster climate action.

We also invite you to look at our new edition of the IDF bulletin dedicated to a new update of the IDF global Carbon Footprint standard for the dairy sector that aims at creating an LCA Global Standard to assist the dairy industry in its efforts to reduce GHG emissions across all its value chains.

IDF also released a bulletin on LCA guidelines for calculating carbon sequestration in cattle production systems. This guideline provides the cattle sector with an appropriate science-based approach to quantifying the sequestration as part of the GHG footprint calculation.

For 5 years in a row, IDF has published this Outlook to provide insight into ongoing projects within the dairy sector. We hope that the new research on the sustainable development for the dairy sector presented on this special COP27 edition is of your interest and we wish you a good read.

Caroline Emond
IDF Director General

MESSAGE FROM THE SCIENTIFIC EDITORS

Dear Reader,

The International Dairy Federation is committed to finding solutions for sustainable development in this climate crisis. The dairy sector is committed to reducing GHG emissions while continuing to deliver high-quality nutrition and support the livelihoods of 1 billion people.

This publication presents different solutions applied in eight different countries. It is intended to be an inspiration for everyone in the dairy sector to achieve climate action.

We hope you find them interesting.

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CONTENTS

NEWS FROM IDF MEMBER COUNTRIES

ICELAND

Sustainable energy use in the Icelandic dairy industry

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ENERGY PRODUCTION IN ICELAND

Making a living on an island in the North Atlantic Ocean, bordering the Arctic circle, with regular volcanic eruptions, earthquakes, and inhospitable climate is obviously challenging. For those willing to brave these elements, sustainable use of Iceland's natural resources has been and still is vital.

Iceland's geographical location and harsh climate necessitates much energy use. Since the beginning of the 20th Century, Iceland has made extraordinary progress in the use of her geothermal and hydroelectric renewable energy resources. Today, the country is at the forefront in the field of renewable energy use. 99,99% of the country's electricity comes from renewable energy sources, with hydropower accounting for three quarters and geothermal a quarter. As a result, Iceland's electricity generation is one of the most environmentally friendly in the world. Iceland, no doubt due to its volcanic nature, is, moreover, a global leader in the technology of harnessing geothermal energy, of which the largest part is not used for electricity generation but for direct heating of houses.

Having ample, renewable, stable and inexpensive energy resources offers a great advantage to all Icelandic industries. Iceland's dairy farming sector has been in the forefront of utilizing this advantage.

ACCELERATION IN THE TECHNOLOGICAL DEVELOPMENT OF FARMING

The supply of affordable renewable energy and stronger electrical distribution systems has accelerated the adoption of technological improvements in both dairy farms and dairy processing. In 2021, 47% of cowsheds in Iceland had robotic milkers, and 65,2% of the total milk production came from farms with robotic milkers. Every year, more farmers install automatic feeding systems. These changes have led to better feed utilization, healthier cows and higher yield. Investments in improved feeding systems and manure robots have also reduced the use of fossil fuels and helped the production process to lower its carbon emissions. Government grants for investments in carbon reduction technology have provided a further impetus for these advances.

PROCESSING DAIRY PRODUCTS WITH ENTIRELY ENVIRONMENTALLY FRIENDLY ENERGY

MS Dairy, Iceland's largest dairy production company, places heavy emphasis on sustainable production methods. This emphasis appears both in changes in production equipment and choice of energy sources. In 2020, by replacing the company's last oil powered steam boiler for milk pasteurization with an electric one, MS Dairy became, to the best of our knowledge, the only dairy company in the world that uses exclusively environmentally friendly, renewable energy in its production of dairy products.

"Having ample, renewable, stable and inexpensive energy resources offers a great advantage to all Icelandic industries. Iceland's dairy farming sector has been in the forefront of utilizing this advantage."

Margrét Gísladóttir

Before that, in 2015, the company replaced its previous oil powered milk powder production equipment with electrically powered equipment. This action alone reduced carbon emissions of milk powder production by 95%, while, at the same time, the production volume has increased by 43%.

GETTING MORE FROM THE SAME

Increased sustainability can be viewed in the same way as increased efficiency; getting more from the same. One way to do this is to obtain higher value from the same volume of raw milk. In 2017, a new factory processing a high-quality protein from whey, an unavoidable byproduct of cheese production, commenced

operation. This factory, which transforms an essentially worthless byproduct that was previously discarded, not only produces more value from the same inputs, it also represents a significant step toward a more environmentally friendly dairy processing. This coming winter, when the production of ethanol from the lactose content of whey will begin, there will be no waste products from cheese production whatsoever.

ICELAND TO BE FOSSIL FUEL FREE IN 2040

The Icelandic government has adopted the goal that Iceland will use no fossil fuels by the year 2040. As transportation is a big part of the dairy production process, MS Dairy closely monitors the latest technical advances that contribute to better fuel utilization and lower carbon emissions of transport vehicles. Thus, in 2021, the first methane-fueled transport truck was put into service, and earlier this year, we replaced the car-pool of the sales team with electric and plug-in hybrids. Over just one year, between 2020 and 2021, the fossil fuel consumption of MS Dairy has decreased by 9.6%. Currently, the company is looking into the possibility of electric transport trucks to reduce carbon emissions even further.

Iceland is a sparsely populated country, and the distances are long. To achieve the goal of energy transition before 2040, the country's infrastructure must be developed at a faster pace and in line with the needs for transportation. There is a great deal to gain. With the electrification of the car fleet, Iceland could be entirely self-sufficient in green energy for transportation as well as for electricity generation and heating within the next two decades.

IRELAND

Key Initiatives for Addressing Climate Change in the Agri-food Sector

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ALIGNMENT WITH SDGS

12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
15 LIFE ON LAND

ABSTRACT

Ireland is at the forefront of a global research response on climate change initiatives in the agri-food sector. Its roadmap (https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/) for action aims to halve greenhouse emissions by 2030 and reach net zero before 2050. The agriculture sector has been given a target of a 25% reduction by 2030. The route towards lower emissions includes an ambition to address circularity in Ireland's bio-economy. While there are many ongoing research activities, this communication focuses on examples of methane reduction and soil carbon sequestration strategies as key climate actions relevant to the dairy and broader agriculture sectors.

> "Ireland is undertaking research to support greenhouse emissions reduction and carbon sequestration strategies in the Agri-food sector. Its broader climate action plan 2021 will create jobs and economic opportunities while contributing to food security and global sustainable development goals."

THE IMPACT OF SELECTING COWS USING THE ECONOMIC BREEDING INDEX ON METHANE OUTPUT

The contribution of genetics to environmental impact, including methane production, is considerable, as breeding is cumulative, permanent and compounded with successive generations. Ireland has developed an economic breeding index (EBI) to identify animals that increase profitability in a pasture-based dairy system. However, all dairy cows are treated equally when enteric methane emissions are counted nationally through inventory models. These models assume that increased productivity through genetic selection increases feed intake, leading to greater enteric methane emissions. Methane emissions were measured between March and October 2021 in a group of high (Elite; EBI = €233) and national average EBI (Nat Av; EBI = €133) (Table 1) animals. The Elite group had greater milk fat and protein %, which resulted in an 8% greater milk solids yield with no significant difference in methane emissions. Despite this, the methodology applied in the national inventory models calculated the Elite to emit significantly more methane per day compared to the Nat Av. This research highlights that further work is required to include genetic merit within inventory models. A new carbon sub-index will be incorporated into Ireland's EBI later in 2022. This sub-index will rank animals based on greenhouse gas emissions and will be linked to the calculation of the EBI measure through a price per tonne of carbon. The revised EBI will emphasise traits which reduce carbon emissions, such as fertility and maintenance, allowing for savings in greenhouse emissions over the next decade.

SOIL CARBON SEQUESTRATION

Ireland has a dynamic research programme investigating carbon sequestration by soil. Grassland soils have been shown to contain large quantities of carbon, approximately 440 t CO_2/ha or an estimated 1,800 Mt CO_2 across all Irish mineral soils. Ireland's national GHG emissions are about 60 Mt per year, meaning that mineral soils store equivalent to 30 years' of emissions. Our peat soils store even more per ha, about 4,000 t CO_2/ha. So while there are vast carbon stocks in Ireland's soils, is there an 'addition' (sequestering) or 'reduction' of these stocks taking place over time?

Soil carbon sequestration is essential for removing carbon dioxide from the air and storing it in the soil while improving its health. Carbon stored in soils is often called soil organic carbon, and its benefits include improved workability, water holding capacity, and productivity. Ecosystems that can sequester more CO_2 than they release are termed carbon sinks, while those that emit more than they sequester are termed carbon sources. Forestry is good for sequestering carbon, and agricultural soils can also be carbon sinks (but they can also be sources). Thus carbon sequestration is important, considering Ireland must be climate neutral by 2050.

Scientists at Teagasc are using computer modelling and flux towers to measure gaseous exchange above the soils. Given its importance to agricultural GHG balances, these are essential research tools for quantification, policy-making and farmer decision-making. The research shows that grasslands are generally a carbon sink, with values for carbon sequestration ranging from 1.5 to 4 t CO_2 /ha/yr. In contrast to mineral soils, grasslands on drained organic (peat) soils are assumed to be a substantial source of CO_2 of circa. 20 t CO_2 /ha/yr. This is because they contain large carbon stocks (approx. 4,000 t CO_2 per ha), and this is rapidly decomposed and released as CO_2 upon draining. These soils are assumed to account for 5-6 Mt CO_2 emissions in addition to the ~20 Mt CO_2 from agriculture. Measuring and establishing robust emissions information and then restoring small areas of peat soils can deliver considerable CO_2 savings.

Research is currently focusing on establishing Irish-specific emission factors for soil carbon

Trait	Elite	Nat Av	*P*-value
Milk yield (kg)	22.3	22.4	0.96
Fat (%)	5.00	4.50	<0.001
Protein (%)	3.84	3.68	<0.01
Milk solids (kg)	1.94	1.80	<0.001
Methane (g)	302	298	0.86
Methane / milk solids (g/kg)	162	174	<0.05
Calculated methane (g)	402	377	<0.001

Table 1. Effect of genetic group on milk production and methane output

Measure to increase C sequestration	Sequestration potential
Avoid soil compaction	✔
Increase the proportion of grazing	✔ to ✔✔
Allow existing hedgerows to be taller & wider	✔ to ✔✔
Improve soil fertility	✔✔
Establish clover/multi-species swards	✔✔
Planting extra hedgerows	✔✔
Planting additional woodlands/forests	✔✔✔✔✔
Restoring a drained wetland	✔✔✔✔✔✔

Table 2 – Ways that Ireland will increase carbon sequestration on farm

sequestration for inclusion in the national inventory. Through the National Agricultural Soil Carbon Observatory (see link below), the Agricultural Catchments programme, the Signpost farms, and the Science Foundation Ireland (Sfi) funded VistaMilk research centre, Ireland is developing an extensive European infrastructure to measure and report emissions. The research is also investigating a number of the measures in Table 2 to generate scientific data and advice for farmers that will see major improvements to the national greenhouse gas inventory. Emissions from the Land-use, Land-use change and forestry sectors have to be reduced in line with all sectors to assist Ireland in achieving the 51% greenhouse gas reduction target. While science improves the measurement of carbon and refinement of emission factors, the measures identified in Table 2 above will deliver on carbon savings now. Many of these measures improve incomes and agronomic yields, benefiting biodiversity and water quality.

Taking account of the science and policy targets, Ireland's Signpost Farms initiative will drive the adoption of greenhouse gas mitigation actions on individual farms in Ireland. A cohort of farms has been selected, and their sustainability performance and adoption of mitigation actions are now being tracked through time. These farms will then serve as

- a proving ground for real-world implementation of greenhouse gas mitigation actions and;
- a peer-to-peer learning platform for the wider farm population designed to promote more widespread adoption of these mitigation actions.

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ISRAEL

The Israeli dairy industry - an example of sustainable milk production

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ALIGNMENT WITH SDGS

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

ABSTRACT

Israel is characterized by a subtropical climate with summer with no rain at all. The Israeli dairy industry has about 120,000 cows that produce close to 1.5 billion liters per year. The annual milk yield per cow is the highest in the world and stood at more than 12,000 liters in 2021. The founding fathers of the Israeli dairy industry began nearly a hundred years ago to breed a cow adapted to local conditions, using a local breeding system. They also understood that, due to climatic reasons, the cows must be completely confined, without grazing and learned how to develop feeding methods that replace the missing high-quality roughage with agro industrial and human food industry by-products.

Over the years and the genetic progress in milk production, the milk producers in Israel had to develop and implement advanced methods to cope with heat load, through intensive cooling of the cows. This makes possible to achieve the high milk yields, even within the climatic and environmental limitations that exist in the country.

ISRAEL'S DAIRY INDUSTRY AMONG THE MOST SUSTAINABLE

Israel's dairy industry among the most sustainable

The Israeli dairy industry is one of the leaders in the world, in regards to sustainable milk production, thanks to the following:

1. The lack of water and the need for irrigation to grow fodder, led Israeli farmers to purify large volumes of municipal wastewater (Israel is a world leader in this matter), as well as to develop water-saving irrigation methods such as drip irrigation (a method developed in Israel).

> "The Israeli dairy industry is small but sophisticated and very efficient environmentally and economically. The experience gained in Israel is learned these days by dairy farmers from countries with the same climatic limitations."
>
> **Dr. Israel Flamenbaum**

2. The scarcity and high cost of high quality roughages in Israel led the milk producers to replace part of this ingredient with leftovers and by-products from the agricultural and food industries, thus earning twice. On the one hand, to save and replace the use of part of the conventional food and on the other hand to save on transportation costs of waste materials for landfilling in the desert areas of southern Israel.
3. The high cost of man power in Israel led to the development of advanced technologies for management and control, that enable savings in the investment of working time per liter of milk produced. Israel is a world leader in the development of computerized milking systems that include the early detection of management and health problems and their treatment in real time. One more way to enable obtaining high milk yields per cow.
4. Using intensive measures to cool cows in the summer that were developed over the past 40 years in Israel, allows for a significant reduction in the decrease in milk production in this season, as is the case in most hot countries, and recently also in Europe and the North of the USA. The benefits from the implementation of these means are in different aspects as:

- From an environmental point of view, the higher the milk yield, the more the industry can satisfy the country's milk needs with fewer cows and hence the methane greenhouse gas emissions to the atmosphere per liter of milk are lower.
- In terms of the health of the cows, preventing cows from being in "heat stress" strengthen their immune system and reduce morbidity, especially in the critical period around calving, as well as reduce the number of cows suffering from mastitis. Beyond the economic advantage that this has, you can expect savings in the use of medicines, for the positive aspect that this has from an economic and environmental point of view.
- From an economic point of view, as the yield of cows is higher and fewer cows are required for its production, the feed required for their maintenance of these cows is saved, and as a result, the food requirement per liter of milk produced is lower, so production costs decrease.

A SMALL BUT EFFICIENT DAIRY INDUSTRY

In conclusion, the Israeli dairy industry is a small but sophisticated and very efficient environmentally and economically. The knowledge and experience gained during the production of milk in Israel is learned these days by dairy farmers from all over the world, especially those who come from "developing countries", who try to establish dairy farms in difficult conditions, similar to those existing in Israel. Making use of the knowledge accumulated from the 120 thousand cows in Israel by the 270 million dairy cows existing today in the world, and increasing milk yield of each "world cow" by only 10% beyond what it currently produces, will allow produce global milk with about 30 million cows less, for all the environmental and economic benefits that this entails, and which are presented in this article.

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KOREA

Moving forwards to Net-Zero Dairy to fight climate change

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ALIGNMENT WITH SDGS

3 GOOD HEALTH AND WELL-BEING
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION

OVERVIEW

With the global warming, abnormal climate such as heat wave, heavy snow, floods are happening all around the world. In Korea with high proportion of fossil fuel use and manufacturing business, the average temperature has rose by 1.4°C in last 30 years that the warming has been expanding fast.

Meanwhile, it had been emphasized that as a responsible member of the international community, Korea should also be part of the global action that 2050 Carbon Neutral Plan was announced in October, 2020.

In line with this trend, ESG (Environmental, Social and Corporate) governance has emerged as an essential and key value in corporate management worldwide that not only the dairy but also the livestock sector are also joining this vision. Accordingly, major dairy industries are also taking the lead in realizing sustainable dairy sector citing their own distinct ESG visions and goals.

OBJECTIVES & MOVING THE WHEEL

First of all, the nation's largest dairy cooperative newly launched "ESG Committee" in 2021 to strengthen ESG focused management. Accordingly, under the philosophy of "For a healthy world with milk", carbon emission reduction plan has been announced from raw milk production to the stages of distribution and consumption.

As a part of its efforts to reduce carbon emission, the cooperative has introduced 'Green Label' and to practice carbon neutrality in daily basis, it collects milk carton packs to recycle. In addition, it is expanding the investment to facilities for energy saving and recommending the use of multi-use cups or recycled papers within the cooperative. It also supports the education program on ESG governance to address the problems of methane gas generated and accumulated from the livestock environment. The cooperative also plans to make a further investment in eco-friendly facilities and animal welfare in the entire dairy chain.

> "Lead Net-Zero Dairy and Livestock sectors to fight climate change through Environmental, Social and Corporate Governance."
>
> **Byung Gab Son**

Another largest dairy company is also taking the lead in carbon neutrality by adopting ESG governance. In particular, it plans to reduce greenhouse gas emissions by 10% in 2025 compared to 2021 by establishing mid and long term environmental goals and is setting detailed plans to improve energy efficiency at workplaces. As a part of these efforts, the company plans to reduce mobile combustion by developing and expanding the use of renewable energy, optimizing transportation routes and replacing to eco-friendly vehicles. In addition, it conducts various campaigns such as encouraging the use of eco-friendly shopping bags, participating greenhouse gas reduction pledges to fight against climate change.

A livestock related organization also announced its plan to complete carbon neutral by 2050 in the manufacturing process under the vision of sustainable livestock sector along with ESG governance and practicing carbon neutrality through energization of livestock manure, low carbon feed and development of methane reduction feed.

In an effort to achieve this, it aims to create low-carbon specification management and eco-friendly livestock by developing low carbon feed and reducing odours along with creating resource and energy facilities and smart manufacturing processes. In addition, use of renewable energy and eco-friendly fuels are also being promoted that it is expected that 80,000 tons of greenhouse gas would be reduced by 2030.

MOVING FORWARD

At the end of 2021, Ministry of Agriculture, Food and Rural Affairs has set "2050 Agri-food Carbon Neutral Strategy" to achieve the national carbon-neutral goal and convert existing high-input agriculture practice into low input and carbon structure to strengthen the basis of greenhouse gas reduction in the agriculture sector.

Accordingly, it plans to distribute so called DNA (Data, Network and AI) based precision agriculture technologies to as much as 60% of all farms by 2050 and will push forward for R&D projects to secure future technologies such as intelligent agricultural machinery and robots starting from 2024. As an effort to reduce greenhouse gas, it plans to expand eco-friendly agriculture area up to 30% of the total cultivated area by 2050 along with strengthening soil management and improving soil storage capacity.

In particular, greenhouse gas in the agriculture sector is inevitably caused by chemical fertilizers and livestock feed used in rice cultivation and livestock breeding processes so it plans to reduce it as much as possible by water management and low methane feed to minimize the negative impact on food security.

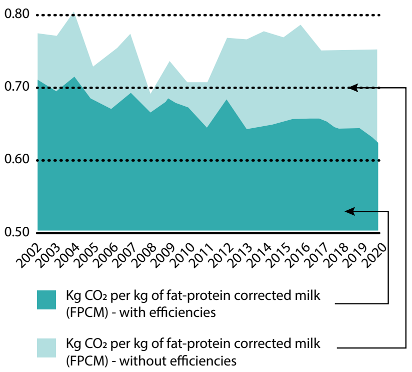
Moreover, the livestock sector plans to expand supply of low-methane feed, improve livestock productivity through scientific based management using ICT technology, increase the proportion of livestock manure purification and reduce greenhouse gas emission from livestock manure by 11% compared to 2018.

NEW ZEALAND

New Zealand milk: continued investment in R&D, science, and efficiencies produces lower carbon footprint

New Zealand's pasture-based dairy farming is unique and provides an outdoor lifestyle for animals as well as contributing to milk with amongst the world's lowest level of carbon emissions. The New Zealand dairy sector has continued to refine practices, develop new technologies and driven efficiencies – all without subsidies.

In 2020, New Zealand dairy farmers produced 20% less emissions per kg of Fat-Protein Corrected Milk (FPCM) thanks to this continued investment in R&D, science, and supporting on-the-ground implementation.



Source: NZ Dairy Statistics 2019-20, DairyNZ and LIC

Analysis undertaken by AgResearch also supports that New Zealand is amongst the most efficient producers, at 0.77 kg CO_2e per kg FPCM. The study calculated that the average of the 18 countries analysed (55 percent of global milk production) was 1.47 kg CO_2e per kg FPCM .

With an increasing global focus on climate change, New Zealand's dairy sector has committed to continued and ongoing efforts to produce low emissions milk. Under He Waka Eke Noa – a Primary Sector Climate Action Partnership – New Zealand dairy farmers are likely to be the first to face a government-implemented pricing mechanism to reduce greenhouse gas emissions. Through the partnership there is also a significant amount of work underway to support farmers to reduce greenhouse gases through non-pricing mechanisms.

He Waka Eke Noa is a partnership between 13 partners representing primary sector organisations, including DairyNZ and DCANZ (Dairy Companies Association of New Zealand), the Federation of Māori Authorities, Federated Farmers, the Ministry for Primary Industries and the Ministry for the Environment.

In 2020 New Zealand farmers produced 20% less emissions per kg of Fat-Protein Corrected Milk (FPCM) thanks to continued investment in R&D, science, and efficiencies.

He Waka Eke Noa will equip farmers and growers with the information, tools and support to reduce emissions and build resilience to climate change. The partners are working together to implement a framework by 2025 to reduce agricultural greenhouse gas emissions and build the sector's resilience to climate change.

The framework will include incentivising farmers and growers to take action through an appropriate pricing mechanism by 2025, in line with legislation.

NEW ZEALAND DAIRY FARMS ALREADY MAKING GREAT PROGRESS

The New Zealand dairy sector is ahead of agreed targets under He Waka Eke Noa, with 93 percent of dairy farms already having received an emissions report and 40 percent having a GHG plan (as of August 2022). More than 10,000 New Zealand dairy farmers received emissions reports in 2022. The reports mainly focus on biological emissions and include total farm, per hectare, and per kg milksolids emission metrics.

Key outcomes under He Waka Eke Noa

1 January 2022

A quarter of farms have a written plan in place to measure and manage their greenhouse gas emissions (achieved by the dairy sector, 26%)

A quarter of framers know their greenhouse gas emission (emissions report). (achieved by the dairy sector, 92%)

1 January 2023

All farms have a greenhouse gas emissions report.

2025

All farms have a written plan in place to measure and manage their greenhouse gas emissions.

A system for farm-level accounting and reporting of 2024 agricultural greenhouse gas emission at farm level Is in use by all farms.

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SOUTH AFRICA

The use of buffer zones for the improved management of watercourses on dairy farms in South Africa

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WATER SCARCITY – A KEY DRIVER

South Africa is a water-scarce country. Its socioeconomic development has been and will continue to be directly hampered by climate change and associated drought conditions. Water demand in South Africa has been witnessing a steep increase, with three major sectors driving the demand. The agriculture sector is the highest at around 63%, with the major water uses including the irrigation of crops and land used for water-intensive grazing of livestock. Water demand is expected to exceed supply in South Africa by 2030.

The scarcity of water is a key driver of the increasing pressure on freshwater aquatic ecosystems. Impacts include regulation of flow by impoundments, pollution, over-extraction of water, and the breakdown of natural biogeographical barriers all affecting the ecological condition of these resources. It is in this context that establishing buffer zones for rivers and wetlands can play a meaningful role in reducing impacts on freshwater aquatic ecosystems and in doing so, protect the range of ecosystem services that these resources provide to society.

"Implementing buffer zones, along with sustainable pasture management practices, will lead to improved wetland and river health."

Ian Bredin

Dairy farming is a water-intensive land use and one which can degrade water quality. Examples of potential impacts include:

- Nutrient enrichment into watercourses from runoff of slurry and fertilizers applied to pastures, or from slurry dam spillages;
- Sedimentation caused by soil erosion or soil disturbance during pasture rotation; and
- Bacterial contamination (e.g., E. coli) caused by cattle directly accessing watercourses and defecating in the water.

These impacts are compounded by high levels of water abstraction leading to reduced dilution capacity of surface waters.

All of these potential impacts require management interventions and mitigation. A watercourse buffer zone is an effective option for contributing to the protection of watercourses.

BACKGROUND AND STUDY OBJECTIVES

The Institute of Natural Resources NPC, in partnership with Confluent Environmental and WWF-SA, was awarded a three-year research project through Milk South Africa's (MilkSA) Research and Development programme. The objective of the project was to assist MilkSA in working towards its sustainability goals for the dairy sector in South Africa. A key activity for achieving sustainability, according to MilkSA's focus areas is the "implementation of riparian buffer zones".

The project will contribute to the sustainability of the dairy sector through the development of best practice guidelines for improved wetland and river management through the implementation of buffer zones on dairy farms.

WATERCOURSE BUFFER ZONES

Definitions of buffer zones vary depending on their purpose. According to guidelines in South Africa, buffer zones have been defined as a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another. Watercourse buffer zones are typically designed to act as a barrier between human activities and sensitive water resources in order to protect them from adverse negative impacts from diffuse surface runoff. The need to ensure that buffer zones provide adequate protection for biota and species movement is also addressed in the South African guidelines.

Buffer zones associated with watercourses have been shown to perform a wide range of functions and have, therefore, been adopted as a standard measure to protect watercourses and associated biodiversity in South Africa. Some of these key functions include:

- Maintaining basic aquatic processes (e.g., water infiltration, shading, sediment trapping);
- Reducing impacts on watercourses from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species;

- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits (e.g., reduced flood risk, enhanced visual quality, control of noise levels).

Despite the range of functions potentially provided by buffer zones, they are not the appropriate mitigating measure for addressing all watercourse-related problems. For example, buffer zones can do little to address impacts such as hydrological changes caused by stream flow reduction activities or changes in flow brought about by abstractions or upstream impoundments. Buffer zones are also not the appropriate tool for mitigating point-source discharges (e.g., slurry dam outflows), which can be more effectively managed by targeting these areas through specific source-directed controls (e.g., constructed wetlands). Contamination or use of groundwater is also not well addressed by buffer zones and requires complementary approaches such as controlling activities in sensitive groundwater zones.

Despite clear limitations, buffer zones are well suited to perform functions such as sediment trapping and nutrient retention, which can significantly reduce the impact of activities taking place adjacent to watercourses. Buffer zones are, therefore, proposed as a standard mitigation measure to reduce impacts linked with diffuse stormwater runoff from land uses/activities adjacent to watercourses. These must, however, be considered in conjunction with other mitigation measures which may be required to address specific impacts for which buffer zones are not well suited.

While watercourse buffer zone guidelines are available in South Africa, they do not adequately address the interconnectedness of activities that typically take place on a dairy farm. There is also a lack of practical guidance for dairy farmers and other key stakeholders in the dairy sector.

Establishing watercourse buffer zones on dairy farms has consequences for the dairy farmer, the environment and broader society. These outcomes result in both local (on-farm) and broader (societal) costs and benefits. These costs and benefits are not evenly distributed, both between the current land user and society, and between current and future generations. The costs and benefits also occur at different spatial scales, generally with the costs accruing at the local scale (to the land owner) and the benefits at a larger catchment scale. Increasingly, however, local scale benefits are being identified, particularly those related to soil moisture and soil health.

Watercourse on a dairy farm in the Western Cape, South Africa (Source: Jackie Dabrowski)

From the perspective of the dairy farmer, the main cost associated with establishing watercourse buffer zones is the income forgone from reduced pasture area in the case where pasture has been planted near to, up to, or into, the watercourse (i.e., within the buffer zone or watercourse itself). This cost is associated with the conversion of pasture area to buffer area (and/or back to unplanted watercourse) and is variable, depending on the farm context and specifically the productivity of the affected pasture. Pasture productivity within the buffer zone or watercourse area may be marginal relative to elsewhere on the farm. In addition, there are costs associated with the establishment and maintenance of buffer zones. Establishment activities include the removal of pasture crops from the buffer area and the planting of replacement vegetation, erosion control, and fencing. Maintenance activities include the management of biomass and alien plant encroachment within the buffer zone and watercourse. On the other hand, there is a growing recognition that sustainable management practices within agriculture can provide numerous on-farm benefits such as erosion control and topsoil retention, and aesthetic and cultural benefits associated with well-functioning natural habitats. Further, rehabilitated watercourses (and especially wetlands) are associated with an improvement in water quality and more water being retained, and for longer periods, in the catchment.

BEST PRACTICE BUFFER ZONE GUIDELINES FOR DAIRY FARMS

Watercourse buffer zones are increasingly recognised as part of a broader management approach towards sustainable agriculture. The guidelines being developed within this project will provide a framework for guiding the design of appropriate watercourse buffer zones and practical information on buffer zones, and how they should be considered in conjunction with alternative sustainable management practices for improving wetland and river management on dairy farms in South Africa.

The project concludes at the end of February 2023, after which the guidelines will be made available.

THE NETHERLANDS

Determining the pathway to net zero for Dutch dairy

AUTHOR

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ALIGNMENT WITH SDGS

ABSTRACT

Our peer review study on the evolution of the carbon footprint of Dutch raw milk unveiled a 35% reduction in the carbon footprint of raw milk between 1990 and 2019. This translates into a reduction of 1.1% per year. The carbon footprint reduction of total Dutch milk delivery was with 15% smaller due to an increase in total Dutch raw milk production.

INTRODUCTION

For many years we worked with a team of experts in FrieslandCampina to finding possibilities to reduce the carbon footprint of dairy. However, we never took the time to exactly determine, what had already been achieved in terms of carbon footprint reduction in the past and to learn lessons from that for the future. However, in the process of setting new (science based) 2030 climate targets for the company we finally took up this challenge. An important reason to do this was to show the farmers in our cooperative that they have already achieved a lot. We want our farmers to feel proud and empowered to further reduce the carbon footprint of milk in the future.

In January 2021 we assembled a research team to investigate 'the evolution of the carbon footprint of Dutch raw milk between 1990 and 2019' and to have it peer reviewed. The team consisted of four FrieslandCampina experts and four external experts from Wageningen University, Blonk Consultants and Schothorst Feed Research with expertise in the field of carbon footprint, dairy farming, soil carbon modeling and dairy cattle feed composition.

> "It was a big effort to collect all the data to determine, what we already knew from experience, that the carbon footprint of Dutch milk had decreased a lot since 1990. This will help the sector in making more concrete efforts to reduce their footprint towards the goal of climate neutrality."
>
> **Sanne Dekker**

CHALLENGING DATA COLLECTION

The first challenge was to collect all the data needed to calculate the carbon footprint of raw milk over such a long period. We really wanted to make an effort to capture all the different trends and developments over time that affect the carbon footprint. To calculate a carbon footprint you need data over the entire life cycle of a product. As this was a cradle to farm gate carbon footprint study, we had to collect data about Dutch dairy farming, as well as the life cycle of the purchased resources on the farm, such as compound feed, dairy cattle, electricity, natural gas, diesel, artificial fertilizers, pesticides, silage plastic and capital goods. For all variables we needed to know how they had changed over time and how that affected the greenhouse gases emitted while producing them. We managed to incorporate all those trends and variabilities in this study. We dug through all the different statistics available and found good data.

For the purchased compound feed, for example, we needed to determine the changes over time about: how much was used, how the composition changed overtime, which ingredients were used, where the ingredients came from, how the ingredients were grown, their yield and fertilization, how much fuel was used, how the carbon footprint of the fuel and fertilizers changed and how did deforestation develop. Fortunately, Dutch dairy farms are among the most well registered farms in the world. So, we were able to find several sources of farm data about for example farm size, milk yield, herd composition, feed ration, manure and field management.

Something that was not readily available from statistics was the soil C stock or C sequestration development over time. For this the currently best model available was used, the Roth C model, to determine the carbon stock development on Dutch dairy farms over time. The model considers the effects of soil type, temperature, moisture content and soil cover on the decomposition of organic carbon. It was surprising to see how carbon stock on dairy farms changed over such a long period of time and see the huge fluctuations between years due to annually different weather. For the compound feed it was unfortunately impossible to include soil carbon stock changes, because we had to deal with so many different regions, but we were able to include land use change developments in relation to deforestation over time.

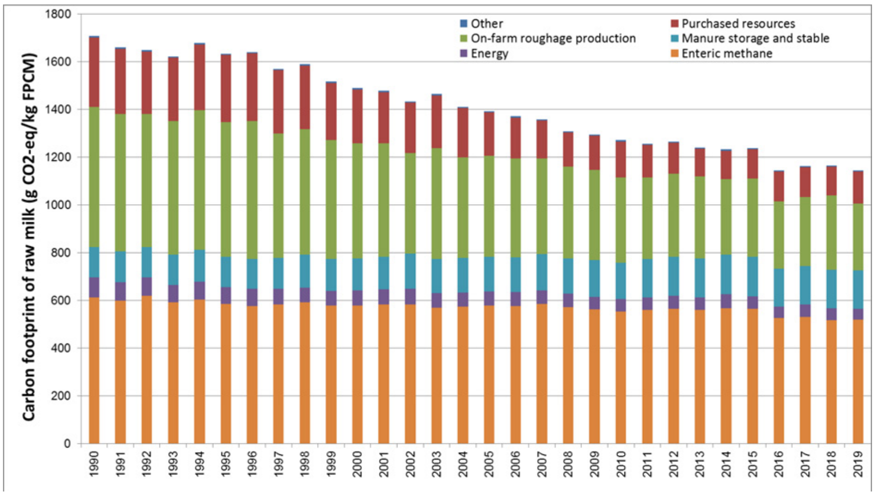

Figure 1. Annual CF of Dutch raw milk between 1990 and 2019 segregated in GHG emission excluding direct land use change and soil organic carbon balance differentiated by the subsystems; enteric methane (orange); roughage production on farm (green); purchased resources (red); manure storage and stable (light blue); energy (purple) and other (dark blue)

DUTCH DAIRY DATA TRENDS OVER TIME

So, after this job was finished, we had a fantastic overview of how the Dutch dairy sector from cradle to farm gate developed between 1990 and 2019 and this was very valuable even without calculating the carbon footprint of the raw milk.

The most obvious trend when looking at the development of Dutch dairy farming between 1990 and 2019 is the increase in dairy farm size and the improvement of production efficiency. Farms size has increased from 20.8 hectares and 40.6 dairy cows in 1990 to 52 hectares and 97 dairy cows in 2019. Dairy cow performance also improved between 1990 and 2019, i.e., replacement rate decreased from 42% to 29%, milk production increased from 6003 to 8807 kg per cow per year and feed efficiency improved from 1.1 to 1.25 kg fat and protein corrected milk (FPCM) per kg dry matter intake. Because dairy cow efficiency improved, the relative amount of live cattle sold per kg of FPCM sold from the farm halved from ~0.04 in 1990 to 0.02 in 2019. Total milk production in the Netherlands was largely stable hovering around 11700 mil kg per year until 2007 after which it steadily increased. In 2015 the milk quotum was abolished, after which milk delivery peaked in 2016 at 14324 mil kg per year and then reduced again towards 13802 in 2019 due to the implementation of environmental policies to reduce phosphorus pollution. This legislation also had the effect that farmers tried to have as little youngstock on their farms as possible in the last few years. Another substantial change was the reduction in electricity use and compound feed use per kg of milk.

Between 1990 and 2019 land management on dairy farms also changed a lot. First, though grazing of cows was maintained, the total time spend by cattle in the meadow decreased. This resulted in a larger part of the dairy manure ending up indoors in the manure storage. Second, around the year 2000 legislation imposed that dairy farms halved the amount of chemical N fertilizer per hectare and also the amount of manure N from fertilizer was reduced. The total amount of N applied per hectare reduced from ~600 kg of N per hectare in 1990 to 330 kg of N per hectare in 2019. Third, though the ratio between maize land (10%) and grassland (90%) on dairy farms remained rather stable over time; grassland use switched from fully permanent grassland in 1990 to partly temporary grassland in 2019. Farmers renewed the grassland to make it more productive and applying a crop rotation for grass and maize became more common. Fourth, due to enhanced crop breeding and management maize yield per hectare increased drastically from 11.7 tons of dry matter per hectare in 1990 to 14.8 tons of dry matter per hectare in 2019. However, grass yield per hectare remained largely stable. Fifth, milk production per hectare increased from 13 to 18 tons of FPCM per year.

CARBON FOOTPRINT METHODOLOGY

The functional unit was defined as 1 kg of FPCM at the dairy farm gate in the Netherlands. The life cycle stages included the following: production of resources purchased on the dairy farm, dairy cattle, compound feed, electricity, natural gas, diesel, artificial fertilizers, pesticides, silage plastic and capital goods. Life cycle stages also included the greenhouse gas emissions related to the following dairy farm processes: fertilization, enteric fermentation, manure management, soil carbon balance and combustion of fossil fuels. Global Warming Potentials for a one-hundred-year time horizon (GWP-100) from IPCC (2021) were used to calculate total greenhouse gas emission. This implies a GWP-100 of 27.2 kg CO_2-eq. per kg biogenic methane and 273 kg CO_2 eq. per kg nitrous oxide. In line with the Product Environmental Footprint Category Rules and IDF guidelines economic allocation was used to divide the environmental impact among multiple outputs in the feed industry and biophysical allocation was used to divide the environmental impact between milk and sold cattle. The study included emissions or removals from land use change (for compound feed production) and the soil carbon balance for dairy farmland.

CARBON FOOTPRINT RESULTS

The peer review study on the evolution

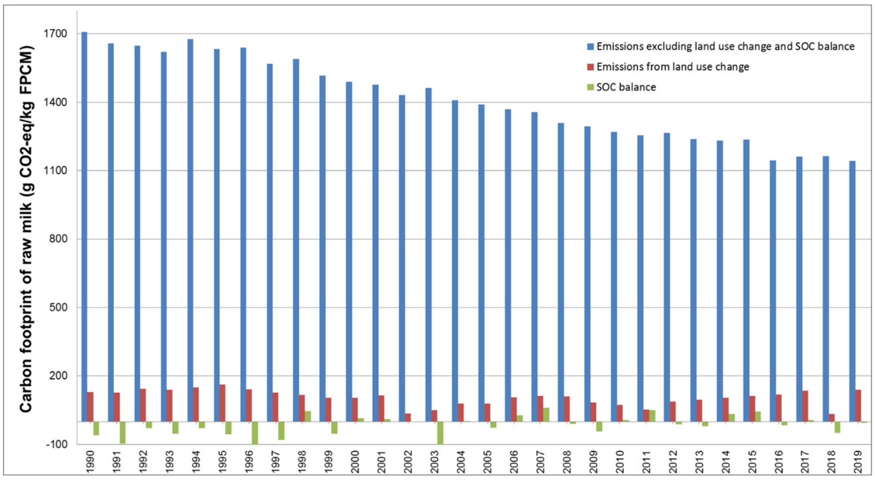

Figure 2. Annual carbon footprint of Dutch raw milk between 1990 and 2019 segregated in GHG emission excluding direct land use change (dLUC) and soil organic carbon (SOC) balance (blue), dLUC (red) and SOC balance (green)

of the carbon footprint of Dutch raw milk unveiled a reduction in the carbon footprint of raw milk of 35% between 1990 and 2019. To identify which part of the production chain contributed most to the carbon footprint, the results were divided in five main subsystems; 1) enteric methane; 2) roughage production on farm; 3) purchased resources; 4) manure storage and stable; and 5) energy use. Enteric methane was the largest contributing subsystem followed by roughage production on farm, purchased resources, manure storage and stable and energy use (Figure 1). Greenhouse gas emission from the subsystem enteric methane decreased with 15%, mainly due to a decrease in the size of the youngstock herd in response to the introduction of phosphate regulations. Greenhouse gas emission from the subsystem roughage production on farm reduced by 52% towards 2019. This reduction was caused by a reduction of nitrogen application rates, increasing roughage yields, reduced manure excretion in the pasture due to less grazing hours and less land use per kg milk due to improved feed efficiency. Greenhouse gas emission from the subsystem manure storage and stable increased by 26% in the period 1990-2019. The increase resulted from an increasing share of manure excreted in the stable due to less grazing hours. Greenhouse gas emission from the subsystem purchased resources reduced with 54% due to a reduction of the carbon footprint of compound feed and artificial fertilizer and a decrease of fertilizer and compound feed use per kg of FPCM. Greenhouse gas emission from the subsystem energy production and use decreased with 47%, due to a reduction of the carbon footprint of electricity and less energy use per kg FPCM.

The soil organic carbon balance has decreased over the last 30 years due to a decrease in organic matter application on field and a decrease of permanent pasture area and more milk production per hectare. However, the interannual variability due to weather circumstances is high and the contribution of the soil organic carbon balance to the total carbon footprint is limited.

To assure the reliability of both the absolute carbon footprint and the reduction rate, a sensitivity analysis was performed on the most important methodological choices. Results showed that though the absolute level of carbon footprint was affected by methodological choices, the reduction rate of the carbon footprint was largely unaffected.

FUTURE PATHWAYS FOR FRIESLANDCAMPINA

Like other dairy companies, FrieslandCampina has set ambitious raw milk carbon footprint reduction targets. In 2030 FrieslandCampina aims to reduce the carbon footprint of their raw milk 33% compared with 2015, i.e. on average 2,2% per year. This means carbon footprint reduction rate needs to be doubled. The reduction in the past 30 years was mainly caused by an increase in milk production per cow, milk production per hectare and feed efficiency. Of course, focus on efficiency should be maintained. To accelerate efficiency induced reduction FrieslandCampina has implemented trainings (see here), tools (see here), internal financial rewarding (see here) and sustainability labelling (see here).

Enteric methane emission and methane emission from manure storage remained quite stable over time and together currently makes up ~55% of the carbon footprint. To achieve 2030 targets, therefore the primary focus should be on reducing on farm methane emissions. FrieslandCampina has both research and practical projects in place to achieve this. For example practical projects to reduce enteric emissions by using feed additives (see here) and a collaboration to implement manure digestion (see here). FrieslandCampina also works on reduction of the greenhouse gas emissions in their supply chain. To make sure green electricity generation in the Netherlands increases FrieslandCampina has a collaboration with farmers to install solar panels on dairy stables and buy the Renewable Energy Certificates from these farms as a source of green electricity for their factories (see here). Like this electricity use of all FrieslandCampina factories in the Netherlands is green and 60% of this green electricity originates from farmers in the cooperative. However, scaling up many of the above initiatives and finding financial support from outside the company remains challenging.

THE UNITED STATES

The Greener Cattle Initiative is a funding program to support research on enteric methane mitigation from ruminants

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ALIGNMENT WITH SDGS

13 CLIMATE ACTION

ABSTRACT

Enteric methane is a major source of greenhouse gas emissions from beef and dairy production systems. A collaborative program was developed to align resources and fund projects to identify and develop new practices and technologies, or validate existing practices and technologies, that enable the sustainable decrease in enteric methane emissions from cattle. The Greener Cattle Initiative program operates as a research consortium of 10 organizations with closed participation and a flat governance collaboration model. Founding Participants include ADM, the Council for Dairy Cattle Breeding (CDCB), Elanco, the Foundation for Food & Agriculture Research (FFAR), Genus PLC, the Innovation Center for U.S. Dairy, the National Dairy Herd Information Association, Nestlé and the New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC). JBS USA joined the Greener Cattle Initiative later as a steering committee participant and its tenth member. A request for applications was developed and announced on May 18th, 2022, to award grants on projects addressing one or more of the following: cattle nutrition, cattle genetics and selective breeding, rumen microbiome, and sensing and data technology for enteric methane measurement. The request for applications is facilitated by FFAR and will award up to $4.76 million dollars in research grant funding to 3-year projects that will contribute to advancing the voluntary greenhouse gas reduction goals established by both the United States and global dairy sectors. Research findings will be communicated broadly to create shared knowledge on enteric methane mitigation after a waiting period for exclusive access to founding participants.

> "The Greener Cattle Initiative brings together stakeholders from across the dairy and beef value chains to leverage investments in the research and development of practices and technologies that reduce enteric methane emissions."
>
> **J. M. Tricarico**

MITIGATION OF ENTERIC METHANE EMISSIONS IS A MAJOR FOCUS OF FARMER-LED VOLUNTARY EFFORT

Enteric methane is the single largest source of direct greenhouse gas emissions in the beef and dairy sectors. Methane is emitted on farms through two primary sources: manure degradation and enteric fermentation. Enteric fermentation is part of the normal digestive process in ruminants, with methane emissions primarily resulting from animals belching or exhaling. While several efforts to advance the sustainability of livestock production are currently underway, few specifically address enteric methane emissions. Mitigation of enteric methane emissions is a major focus of farmer-led voluntary efforts by the dairy sector in the United States to meet environmental stewardship goals announced publicly by the Innovation Center for U.S. Dairy in the "U.S. Dairy Stewardship Commitment". The "Pathways to Dairy Net Zero" initiative was created by the Global Dairy Platform to accelerate climate change action throughout the global dairy sector.

GREENER CATTLE INITIATIVE

SEVERAL INITIATIVES SUPPORT THIS PLAN

The Foundation for Food & Agriculture Research (FFAR) and the Dairy Research Institute (DRI) jointly developed the Greener Cattle Initiative as a pre-competitive consortium to support collaborative research on enteric methane mitigation from ruminants [1]. The Foundation for Food & Agriculture Research is a 501(c)(3) non-profit organization, created by the U.S. Congress to complement the work of the United States Department of Agriculture. The Foundation for Food & Agriculture Research builds unique public-private partnerships to support innovative science addressing today's food and agriculture challenges. The Dairy Research Institute is a 501(c)(3) non-profit organization affiliated with the Innovation Center for U.S. Dairy, created to strengthen access to and investment in the technical research required to drive innovation and demand for dairy products and ingredients domestically and abroad. Both FFAR and DRI agreed to identify additional organizations from the food and agriculture industry, commodity groups, and non-profits that share similar scientific and educational objectives for enteric methane mitigation and were willing to contribute financially to join the initiative. A steering committee was formed once the 10 consortium participants were identified and the initiative was announced. The steering committee first had to align on research priorities (Figure 1). Identifying and aligning on an approach to develop a request for applications followed. Raising awareness about the initiative's existence and goals through presentations at conferences and printed materials was necessary to increase the number of applications leading to the request for applications announcement on May 18th, 2022.

THE GREENER CATTLE INITIATIVE WAS CREATED IN 2021

A group of 10 participating organizations comprise the Greener Cattle Initiative steering committee. This steering committee determines the scientific scope, the strategic direction, and the project review and approval process. Each organization has one seat on the steering committee and holds a single vote. All decisions affecting requests for proposals, projects awarded, or major decisions relative to the initiative's operations are made by majority vote. Both FFAR and DRI function as final arbiters when the decision-making process does not result in a clear outcome. The program director is an individual hired by DRI to manage day-to-day operations of the initiative according to the direction set by the steering committee. FFAR acts as disbursement facilitator for all project funds to grantees leveraging the infrastructure and processes it already has developed for this purpose. The creation of the Greener Cattle Initiative was officially announced on November 8th, 2021, and the request for applications was announced six months later on May 18th, 2022.

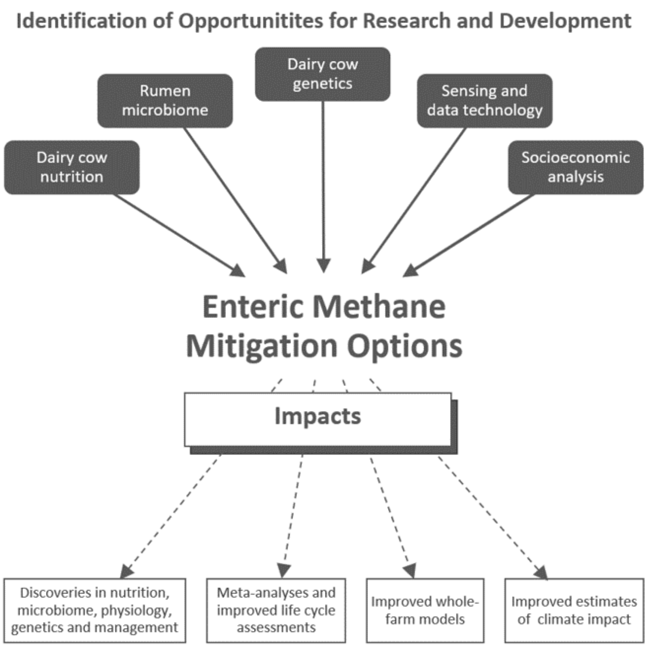

Figure 1. Identification of opportunities for research and development through the Greener Cattle Initiative.

A VEHICLE TO SHARE KNOWLEDGE AND ACCELERATE SCALABLE AND COMMERCIALLY FEASIBLE TECHNOLOGIES TO MITIGATE METHANE EMISSIONS

The Greener Cattle Initiative brings together stakeholders from across the dairy and beef value chains to leverage investments in the research and development of practices and technologies that reduce enteric methane emissions. This initiative is informed by producers and animal health, genetic, feed and nutrition research organizations and companies. The Greener Cattle Initiative serves as a vehicle for multiple stakeholders to share knowledge and accelerate the development of scalable and commercially feasible technologies that reduce enteric methane emissions and enable the production of sustainable beef and dairy.

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NEWS FROM INTERNATIONAL ORGANIZATIONS

INTERNATIONAL DAIRY FEDERATION

A newly revised IDF global Carbon Footprint standard for the dairy sector

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ALIGNMENT WITH SDGS

It is critical for the dairy sector to align on how to quantify greenhouse gas emissions and potential removals, to build credibility and avoid confusion, both inside as well as outside the sector. Thus, the IDF Carbon Footprint standard for the dairy sector is an important piece of work for the sector's journey towards net zero. The goals are to make carbon footprint numbers more comparable, to allow customers and consumers to choose low carbon products. The sector acknowledges that making fair comparisons of carbon footprint results of different studies is not yet possible, and therefore we need to step up the dialog and alignment on methodology, to achive more transparency on reporting of both methodology as well as results. A robust methodology is also important to show progress in carbon footprint performance over time and understand which mitigation options work and which do not, to achieve our climate targets. To have a life cycle perspective (as opposed to w) and assess the full value chain, from cow to consumer (or cradle to grave), is crucial to understand the full impact of the product and ensure global net reduction, and not shift of burden from one country to another. The IDF LCA action team consists of more than 50 experts from 17 different geographies, which bring very different perspectives on dairy and dairy farming, resulting in valuable discussions and exchange of knowledge on dairy and greenhouse gas accounting from very different systems and local perspectives.

WHAT ARE THE NECESSARY STEPS FOR IT TO BECOME THE GLOBAL CARBON FOOTPRINT STANDARD GLOBAL STANDARD FOR THE WHOLE VALUE CHAIN?

The IDF Carbon Footprint standard for the dairy sector is already used by many and is also incorporated in several carbon footprint assessment tools. During the last years work the IDF LCA action team has discussed differences in interpretation and implementation of the guide, and identified a need for further clarification and alignment. Thus, a next step that the IDF LCA action team will work on is validation against the IDF carbon footprint methodology. This will significantly strengthen the harmonization of carbon footprint calculations. It should however be stressed that harmonization should not compromise the accuracy of a carbon footprint, hence, the aim a should always be to use as good data as possible and emission factors of a higher tier would always be preferable. The guide is designed for everyone, and is flexible in the sense that it allows for anyone to conduct a carbon footprint study, and guidance is also given on e.g. feed production and potential data sources. It should be acknowledged, though, that when databases on feed and other inputs are not available in some regions, the time and resources required is larger than for regions where more data is readily available.

> "COP27 is the place where commitments are made at the highest possible level. Where we all sit down together how to tackle this climate crisis we are facing. But these commitments have to be translated into practical actions by governments, companies, farmers, consumers and citizens. The IDF carbon footprint standard is able to translate these high level commitments into a monitoring system to practically measure progress and then decide how to take action."
>
> **Sanne Dekker**

THE METHODOLOGY ASSIST THE DAIRY INDUSTRY IN ITS EFFORTS TO REDUCE GHG EMISSIONS

They say "you can't manage what you don't measure", and thus to have guidelines and methodology in place on how to calculate and quantify the greenhouse gas emissions and potential removals is critical in order to also identify measures to reduce the emissions. What mitigation options are that is most feasible depends on the production system and it's geographical location. The IDF guide includes a list of mitigation options to

> "The IDF carbon footprint standard explains how to calculate the contribution to global warming of dairy products from cradle to grave. To have a life cycle focus is very important, to ensure net improvements and not shift burdens across country borders. For that purpose the carbon footprint methodology is very useful. It provides us the overview of the greenhouse gas emissions for the entire value chain. "

Anna Flysjö

give a clear overview of the different possibilities that exist to reduce GHG emissions in the dairy chain. Another addition to the updated version of the IDF guide is that it addresses the whole value chain, which also enables looking at mitigation beyond the farm and factory gate, all the way to the consumer.

A PROJECT THAT FITS IN THE PATHWAYS TO DAIRY NET ZERO INITIATIVE

The IDF carbon footprint standard sets the rules for how to measure progress in the pathways to net zero initiative. It tells how to do the accounting. In pathways to net zero the aim is to measure progress and to make plans on how to reduce the carbon footprint and the total GHG emissions from the dairy sector globally. To do so it is essential to determine what is exactly the methodology to calculate the global carbon footprint. Which emissions are in and which emissions are out of scope. And the IDF carbon footprint standards gives exactly that clarity.

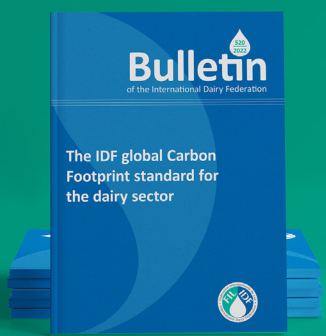
THE IDF LCA ACTION TEAM COMPRISES 50 EXPERTS FROM 17 COUNTRIES

The IDF LCA action team, started in 2009 and has been growing over the years. The update started with a discussion on determining the aim or the purpose of this guide. A review was then conducted, of the different existing standards and how they aligned with the former version of the IDF carbon footprint guideline and where there was no alignment or unclarity. Based on this information we determined which parts of the guide we would like to improve. We created 3 workstreams and we took the time to discuss and to find the scientific evidence to make changes. When we had reached consensus we started drafting the guideline. Finally we went through several review rounds.

WHAT ARE ITS MOST SIGNIFICANT UPDATES?

There has been several updates in the guide, but no fundamental ones that changes the approach taken in earlier versions. The most important updates are that we have highlighted the importance of defining the functional unit, that you have to take into account the nutritional value when comparing dairy with non-dairy or dairy with dairy products, and we have added guidance on that. We have extended the scope of the guide from cradle to factory gate to cradle to grave (end of life). We have improved the guidance around system boundary setting and allocation, and updated the allocation equation of milk and meat. We have also added guidance and clearance with regard to renewable energy generation on farms and use of that in the factory, to avoid double counting. We have added more guidance on how to incorporate land use change emissions and carbon sequestration in a carbon footprint. We have also added an extensive overview with regard to the alignment and use of other standards in combination with this guide. We have added information in the annex about mitigation options to reduce GHG emissions from dairy production. We have also added some guidance about how to extend your carbon footprint to an environmental footprint, which includes more environmental categories than just contribution to global warming. Finally, we have also slightly updated the structure of the guideline to better align with the ISO way of working.

We are proud to present this edition of our Bulletin dedicated to **Life Cycle Assessement (LCA)** methodology: IDF's global standard for assessing Carbon Footprint in the dairy sector. Grab your copy!



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WWF

Taking deforestation and conversion out of the dairy supply chain to reaching the Paris 1.5ºC goal

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On December 12, 2015, the Paris Agreement was adopted by 196 Parties during COP 21 in Paris. The agreement goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this important target and cut its footprint by 80% by 2050, the food system has made public commitments to reduce its Greenhouse gas (GHG) emissions. The dairy sector has been informing to be engaged in the fight against climate change, through initiative such as Pathways to Dairy Net Zero launched on September 22, 2021, with 40 leading organizations, including 11 of the 20 largest dairy companies in the world, supporting the effort[1]. Many actions have been taken to reduce GHG emissions on farm, post farm and downstream supply chain, but unfortunately efforts will not be sufficient to meet the Paris agreement goal if the dairy sector does not cut deforestation and conversion out of its supply chain.

THE SOY FOOTPRINT, AN URGENT PROBLEM TO BE SOLVED BY THE DAIRY SECTOR

The dairy sector is not directly pointed out for deforestation nor conversion of natural ecosystems and the immense majority of milk producers are not directly responsible for cleaning land to enhance their business. On the other hand, the dairy sector is accountable for much greater indirect impacts, through the embedded soy entering the dairy supply chain, broadly used in dairy cow's feed. For instance, it has been estimated in a study in the UK that 25 g of embedded soy is present in the production of 100 g of cheese[2].

> "Soy for animal feed represents an important input in the dairy supply chain and its sustainable production needs to be taken care of."
>
> **Guillaume Tessier**

Native vegetation conversion to give room for soy expansion is responsible for up to 14% of the food system Land Use Change (LUC) emissions[3]. As an example, the GHG emissions from LUC resulting from the Netherlands' soy imports are an estimated 21.9 million tonnes CO2-equivalent per year between 2017 and 2021 – representing 12% of the Netherlands domestic emissions from all sources in 2019. A non negligeable part of this imported soy ends up in the Dutch dairy supply chain[4].

Soy for animal feed represents an important input in the dairy supply chain and its sustainable production needs to be taken care of. The dairy sector needs to take action to start greening supplies to ensure its supply chain is not contaminated by soy produced in converted land, linked to a high carbon footprint.

Around the world, the soy demand is a huge driver of natural ecosystems destruction, not only forests, but also savannahs and grasslands. These natural habitats are being lost at an alarming rate, driving biodiversity loss, disrupting freshwater cycles, eroding soils and most importantly driving climate change. In Brazil, the main soy producer and exporter worldwide, the situation is critical in the Cerrado biome, the world most biodiverse5 savannah were 50% of the original area has already been lost[6]. In 20 years, the area of soy planted in the Cerrado has almost tripled - driven by the high demand for soy protein in animal feed – from 7.5 Mha in 2000 to 20 Mha in 2020, an increase of 12.5 Mha[7] of soy planted in the biome, representing half the size of the entire United Kingdom.

SOLUTIONS FOR THE DAIRY SECTOR

Fortunately, it is within reach for the dairy sector to green suppliers by committing to Deforestation and Conversion Free (DCF) supply chains. Such commitments will help companies to meet their target to reduce GHG emissions and are now mandatory to report scope 3 emissions to the Science Based Targets initiative (SBTi)[8], the standard for setting corporate net-zero targets in line with the Paris agreement's goal of keeping global warming to 1.5ºC.

The scope and ambition of DCF commitments need to cover all natural ecosystems in all regions - not only forests - to protect them from expansion of commodity production and trade. These include savannahs, grasslands, woodlands, peatlands, wetlands and mangroves, among others. Also, full traceability to the polygon at farm level is imperative to ensure concrete elimination of deforestation and conversion from all commodity supply chains[9]. Commodity export companies, such as soy traders, are accountable to provide full transparency to the downstream companies on the commodity they are selling.

Catlle ranching, Mato Grosso do Sul Estate, Brazil Jaime Rojo / WWF-US

On their side, dairy companies need to adopt DCF policies at the group level, across their entire business, assets, operations, and supply chains, including all commodities (soy, corn, cocoa, palm oil etc.). They must cascade these requirements to their direct and indirect suppliers (milk producers > feed companies > traders > commodity producers) to the origin to greening suppliers and not just their own supplies, based on the shared responsibility of market players[10].

To ensure alignment, scale, credibility and adequate monitoring and reporting, as per the SBTi's guidance as well as other market benchmarks, the dairy companies' policies and practices must align with the principles, criteria and definitions of the Accountability Framework[11]. Dairy companies must include in their DCF commitments a cutoff date, after which deforestation or conversion are no longer possible to reach DCF compliance for produced commodities and thus should not enter the market[12]. Companies must also include in their commitment a target date, a date in the near future by which a given company intends to have fully achieved its DCF commitments[13]. To be aligned with main emission reduction standards, such as the SBTi or the GHG Protocol, the cutoff date must be set as early as possible and no later than 2020, while the target date must be set no later than 2025.

Frequently, companies do not trace all risk commodities entering their supply chain, due to lack of knowledge or low transparency from their suppliers. Today, several tools are already available to support companies to assess their supply chain and to develop and implement a plan of action to clean its supply chain from deforestation and conversion. WWF developed a Deforestation and Conversion Free (DCF) Implementation Toolkit to help companies move from commitment to action in alignment with the Accountability Framework. The toolkit contains activities and materials for companies to achieve DCF supply chain[14]. These business solutions help companies shift towards more sustainable practices and reduce their carbon footprint.

The dairy sector has been making progress on reducing its GHG emissions during the last two decades, especially due to the improvement of ruminant fermentation, better manure management and more efficient energy uses. To reach the Paris agreement goal, companies focus must be set on every aspect of their supply chain. Deforestation and Conversion of natural ecosystems play a critical role in the 1.5°C pathway and can no longer be ignored, especially by consumer countries. Members of the European Union parliament have recently sent a strong signal to the world's market by approving a strong deforestation and conversion free law, also including associated human rights protection, to helping reduce the EU's footprint[15]. Once the law will enter into force, the EU will no longer accept commodities linked to deforestation nor conversion to be placed on the market, meaning that full traceability will be required for the listed risky commodities and their derived products.

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HELPING NOURISH THE WORLD WITH SAFE AND SUSTAINABLE DAIRY

The IDF is the leading source of scientific and technical expertise for all stakeholders of the dairy chain. Since 1903, IDF has provided a mechanism for the dairy sector to reach global consensus on how to help feed the world with safe and sustainable dairy products.

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