

The content of this publication represents the views of the author only and is his/her sole responsibility. The European Commission and the Consumers, Health, Agriculture and Food Executive Agency (CHAFAEA) do not accept any responsibility for any use that may be made of the information it contains.



2021
Sustainable dairy in Europe
Safeguarding our resources

Denmark, The Netherlands, United Kingdom (Northern Ireland), France, Belgium, Ireland





Table of content

04	Preface: Paving the way for a sustainable European food system	36	Efficient concentrate use – case study
06	Farm to Fork Strategy: Promoting the health of people and planet	40	Additives for cows’ feed can boost climate efforts
10	Chapter 1: The paths towards a sustainable European dairy sector	44	An influencer among cows
12	Dairy farming occupies its rightful place	46	Chapter 2: Experts on climate change and sustainability
16	Assessment tool brings farmers attention to biodiversity	48	Metrics matter in sustainable diet
20	Nature Check increases biodiversity at the farm	50	LCA: An attempt to define environmental impact
24	The importance of biodiversity	52	Sustainable diet is a delicate balance
26	Results from sustainability monitor	56	Dairy is part of most low emission diets, according to new research
30	Tech solutions for more sustainable farm management and animal welfare	58	Chapter 3: Facts of the European dairy sector
32	Improving farm sustainability through efficient concentrate use		

Preface

Paving the way for a sustainable European food system

Entering the 2020's, the European dairy sector is devoted to meet the challenges of our changing climate providing the global population with healthy, sustainable foods. Our aim is clear: We must produce more food for more people whilst protecting nature and environment which secure our livelihood.

By 2030, the EU has set a goal to reduce at least 40 percent of the emission of greenhouse gases from 1990 levels, to be at least 27 percent more energy efficient, and at least 27 percent of the energy consumption should be renewable energy.

The European dairy sector wants to be at the frontier of a green, sustainable transformation and we are

supporting the EU goals by taking action in every part of our supply chain – from farm to fork. We are implementing sustainable solutions at farms and stables, we are attentive to effective farm management, we focus on protecting biodiversity, we produce green energy, and we fund research of innovative technologies, new types of feed and more.

In other words, a sustainable European food system is in the making, but we still have a way to go – and we cannot walk it alone. We need engagement and close cooperation with industries, politicians, experts, and consumers.

The European consumers are increasingly aware of the changes

in our climate and the need for sustainable action. Following, we see still more Europeans taking action by changing their behaviour and consumer habits.

We want to support this positive development and pave the way for a continuously well-informed and qualified dialog to ensure healthy, sustainable food for future generation.

In this paper, we have gathered some of the best practices and interviews with esteemed experts with the purpose to inspire and show how the European dairy sector is on track.

Have a good read.



Laurent Damiens, EMF



Dr. Mike Johnston MBE, DCNI



Renaat Debergh, VLAM



Caroline Le Poutier, CNIEL



Zoe Kavanagh, NDC



Jørgen Hald Christensen, DDB



Oscar Meuffels, NZO

EMF coordination: **Dominique Poisson, Siobhan Kane, Sophie Bertrand**

Promoting the health of people and planet

By 2050 Europe is to be the first climate-neutral continent. The European Green Deal maps the European quest for a sustainable growth improving people's health and caring for nature. In achieving this, the Farm to Fork Strategy – presented by The Commission in May – is key.

Furthermore, the Farm to Fork Strategy is presented in the context of the Covid-19 pandemic underlining the need for a resilient food system providing all citizens with affordable, healthy food.

The strategy evolves around four areas accelerating the transition to a sustainable European Food System, namely: Sustainable Food Production, Sustainable Food Processing and Distribution, Sustainable Food Consumption, and Food Loss & Waste Prevention.

To succeed with this transition of the food system the European farmers play a vital role.

But other stakeholders throughout the value chain need to play their part too. Moving towards a circular economy, the food processing and retail sectors must act on transport, storage, packaging and food waste.

Last but not least the consumers must act too. Therefore, The Commission will seek new ways to inform the consumers' choice of healthy and sustainable diets and reducing food waste. Achieving this the European food could become the global standard for sustainability.

Food systems greatly contribute to pollution of air, soil and water and to greenhouse gas emissions, as well as to biodiversity loss. Furthermore, in the European Union, about 20 percent of the food produced is currently wasted, whilst 33 million citizens cannot afford a quality meal every second day.

The European Green Deal cannot be achieved without addressing the issue of food

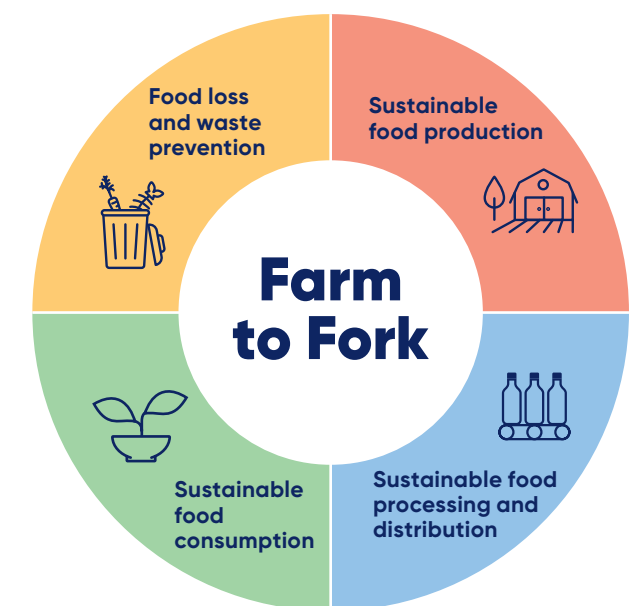
sustainability. European citizens' health, the planet's environmental health and the economic and social health of coastal and rural areas go hand in hand.

The strands of the Green Deal are strongly interlinked and mutually reinforcing. In particular, the Farm to Fork Strategy has strong connections with and directly contributes to the new Circular Economy Action Plan, the 2030 EU Biodiversity Strategy, the Forestry Strategy, the EU Climate ambition and the Zero Pollution Strategy.

The recent report on Climate change and Land of the Intergovernmental Panel on Climate Change stresses that food production and land management must be changed to keep global temperatures at safe levels. The report estimates that 25-30 percent of global greenhouse gas emissions are attributable to the food system. Furthermore, extreme weather events due to climate change are severely affecting the agricultural sector.

The Farm to Fork Strategy aims to accelerate our transition to a sustainable food system that should:

- Have a neutral or positive environmental impact
- Help to mitigate climate change and adapt to its impacts
- Reverse the loss of biodiversity
- Ensure food security, nutrition and public health, making sure that everyone has access to sufficient, safe, nutritious, sustainable food
- Preserve affordability of food while generating fairer economic returns, fostering competitiveness of the EU supply sector and promoting fair trade



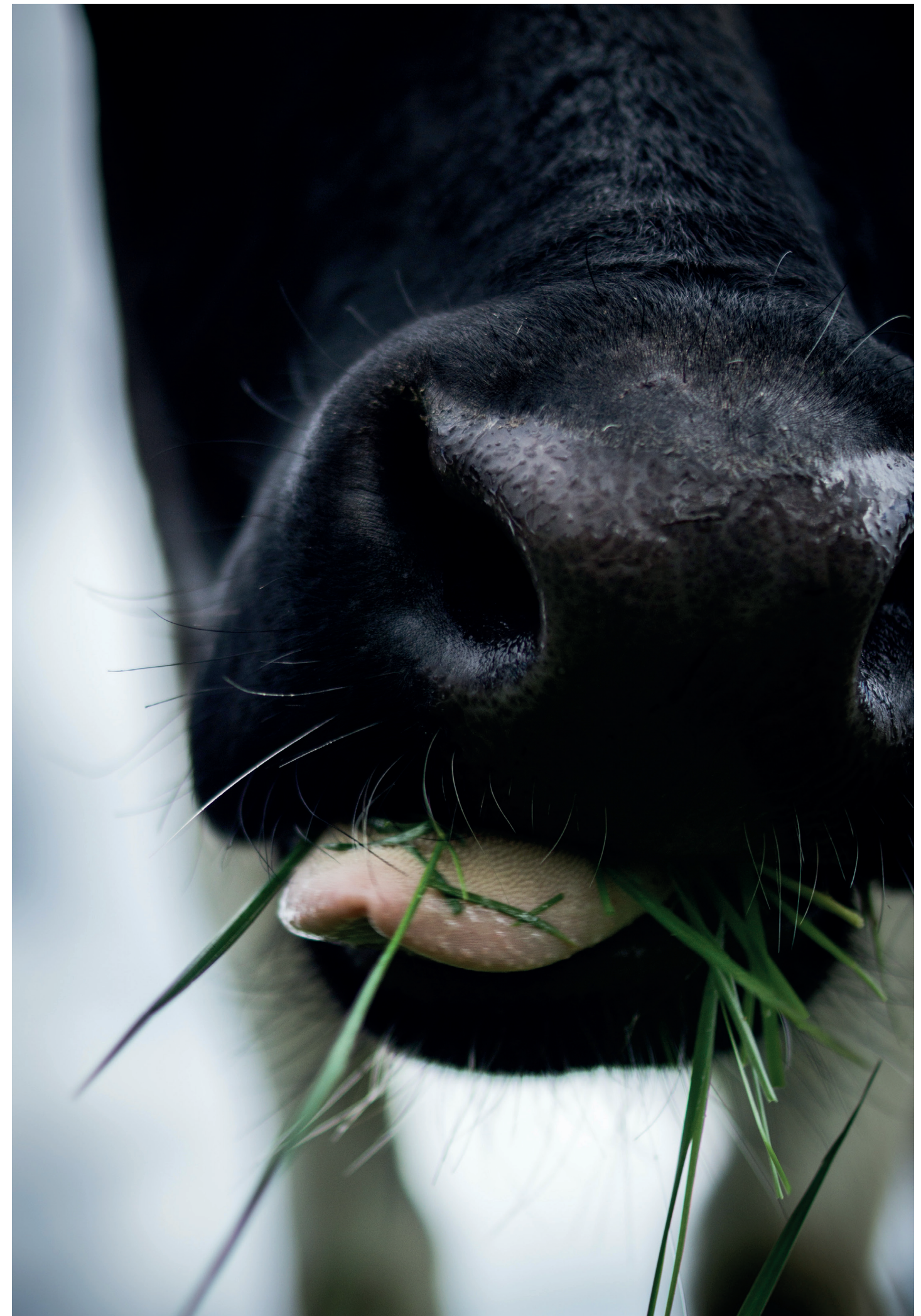
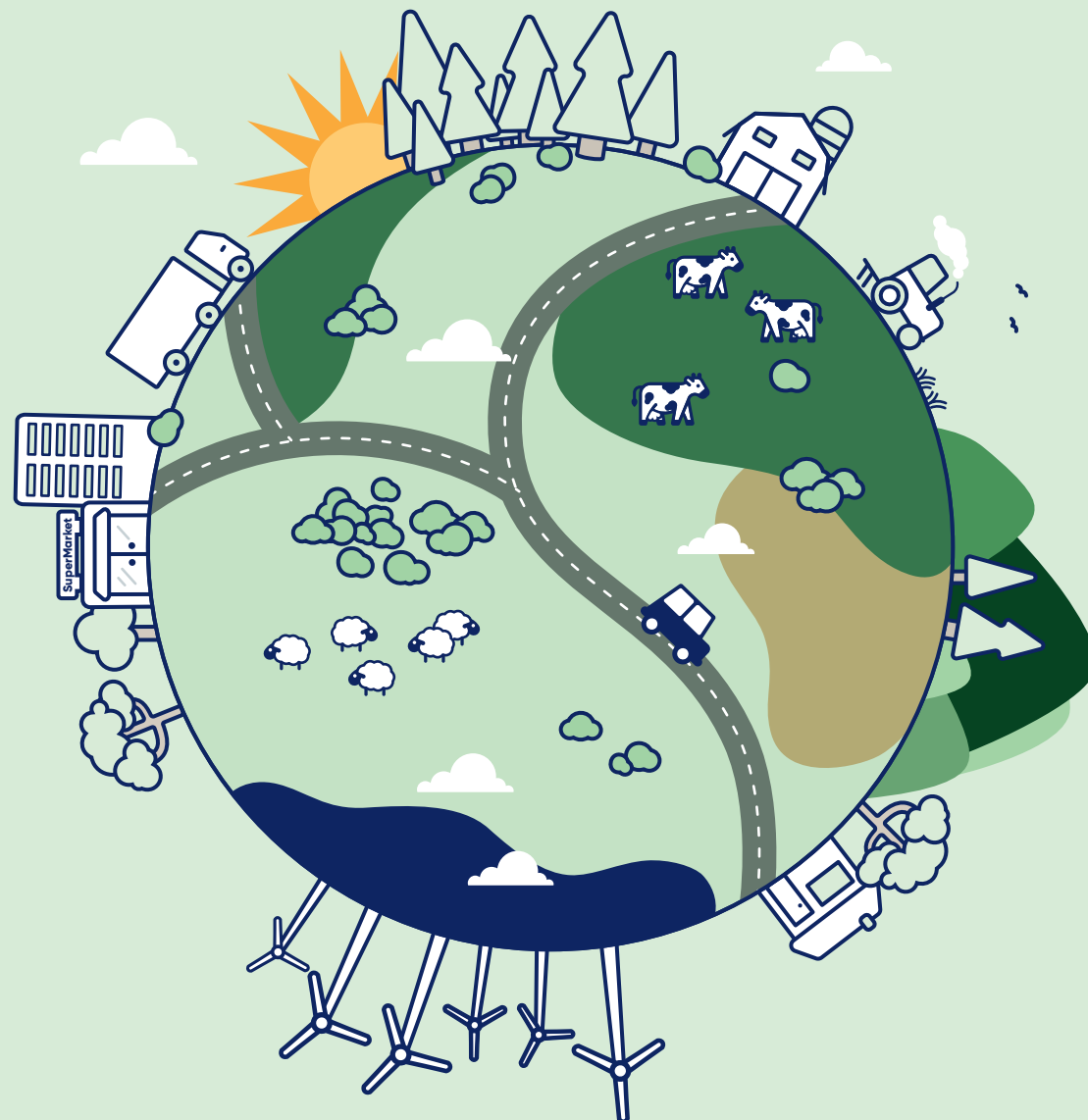
Farm to Fork will support climate focus in the CAP

Under the future Common Agricultural Policy for 2021-2027, incentives have been proposed for farmers to actively contribute to climate objectives, protect the environment and biodiversity. The Farm to Fork Strategy will complement and support these efforts to move towards more sustainable food systems.

Green Deal – Growth giving back more than it takes

"The European Green Deal is our new growth strategy – for a growth that gives back more than it takes away. It shows how to transform our way of living and working, of producing and consuming so that we live healthier and make our businesses innovative"

Ursula Von Der Leyen.





Chapter 1

The paths towards a sustainable European dairy sector

In this chapter we will present local cases of tackling biodiversity and sustainability across Europe. European dairy farmers have an important role in restoring and strengthening biodiversity in Europe and through a set of national cases we see how dairy farmers manage biodiversity actively on the farm. Furthermore, the chapter illustrates examples of industry-wide programs to monitor sustainability efforts, how changes to cow feed can improve farm sustainability and reduce methane emissions and how tech solutions create more sustainable farm management. Hence, the chapter illustrates how the European dairy farmers work dedicated with the sustainability goals set out in the European Green Deal, the EU farm to fork strategy and the EU biodiversity strategy.

Biodiversity and landscape

Dairy farming occupies its rightful place

Through their practices, dairy farmers participate in maintaining the ordinary biodiversity of our countryside. The meadows that breeders maintain to feed animals, and that are rich in agro-ecological elements such as hedges, embankments or ponds, do provide habitat and food resources for many species. With the cultivation plots, the breeding creates a landscape mosaic, while preserving the quality of the water. Grasslands, like forests, also have a key role in carbon storage.

Within these agricultural ecosystems, it is possible to directly observe the evolution of biodiversity, as was done in the context of the Indibio project¹³. Through Indibio, several animal species have been studied in connection with the practices of breeding farms. Scientists have thus chosen to study some species characteristic of their environments and of the services provided to agriculture: bumblebees, large endangered pollinators¹⁴, bats (very sensitive to changes in the environment) and birds, whose population has been declining for several years.

About Indibio

Indibio is a research project funded by Cniel (the French Dairy Association) and the French Ministry of Agriculture and implemented by Idele (breeding institute) with partners such as National Museum of Natural History France Nature Environment and INRA (French National Institute of Research for Agriculture). The main objective is studying the link between agricultural practices, landscape and biodiversity. In addition to that, Indibio project has developed and tested different indicators at farms. One of the results of INDIBIO was Biotex methodology based on indirect indicators.

13. Manneville V., Michel N., Amiaud B., 2016. Indibio: "Develop indicators relating to the effects of agricultural practices on biodiversity in livestock farming systems", *Agronomic Innovations* 49, 83-97 (hal.archives-ouvertes.fr/hal-01652935/document).

14. Pouvreau A., 1993. "Threatened pollinating bumblebees". *Inra Environmental Mail*, 19, 63-70 (hal.archives-ouvertes.fr/hal-01207324/fileC19Pouvreau.pdf).



Bumblebees are able to forage in cold, rainy or windy weather because they are better pollinators than bees and also more rustic.

In winter, the fertilized queen, the only survivor of the colony, hibernates in embankments or hedges. Meadow borders and wooded slopes are reserves of early-flowering for wildflowers (willow, cherry, etc.), which are necessary for the production of nectar in developing colonies in spring. Thereafter, the shifted blooming of the plants that are present in the meadows are representing a food reserve until the end of autumn. Maintaining dairy farms in the territories helps maintain these meadows and the slopes that are beneficial to bumblebees.



Bats which are insectivorous mammals, have a very important activity in the habitats in the edges of fields. At night, meadows, edges, forests, orchards, water points that are filled with insects, become their privileged hunting grounds. **The pasture of the meadow is favorable to them thanks to the provision of fresh organic matter (cow dung), necessary for the development of insects.** Predation of insects by bats limits the use of insecticides. They also consume mosquitoes that are vectors of diseases for animals and humans. Each night, they ingest nearly two-thirds of their weight in insects, or a consumption of 5 to 8 kg per year. The meadows and their maintenance through dairy activity, as well as the presence of cows participate in maintaining bat populations in the territories.



Some birds, especially passerines, are disappearing from our countryside, while others are more and more present, even too much like the great cormorant¹⁵. Birds can be grain-eaters/insect-eaters (sparrow, starling, rook), insectivorous (wagtail, swallow, sea-auger, etc.) or carnivorous (buzzard, falcon, etc.). Many of them are involved in the regulation of populations of insects, rodents and reptiles. **They also ensure the dissemination of plant species via the dispersal of seeds which are found in their faeces**¹⁶. Combined grasslands and crops are a privileged habitat for birds as they find food and refuge there. Some species nest on the ground in open fields or on the edge of the fields (skylark, wagtail, shepherd's

auger, common harrier, partridge), others in bushes (gray warbler), in trees (buzzard, rook, etc.) or in human habitats (swallow and sparrow). Grazed meadows are also an essential habitat for migratory species (woodcock, lapwing, thrush) during staging areas and for wintering.



Beyond these species, and in an anecdotal way, is a small ecosystem all by itself. About thirty Diptera (flies) and 130 species of dung beetles¹⁷ share at least this resource of providential food. The dozen dung produced by a cow per day also attracts snails, bees and even butterflies. **In addition to be a soil fertilizer, it is a place of food resources, a habitat and also a breeding ground.** Subsequently, insects and other invertebrates will attract badgers, foxes, moles which will eat snails or beetles.

These examples show to what extent breeding allows to preserve ordinary biodiversity. Cow dung plays an important role through the landscape mosaic, a mosaic that is useful for farm animals. Hedges protect cows from the sun and humidity. Grazing maintains the capacity of animals to move. The limited size of the plots in grass ensures management of the herd by batch which also induces, in grassland areas, a mosaic of practices. Grazing also preserves a unique floristic diversity.

The preservation of biodiversity is characterized by a set of interactions between species, taking into account the elements of the landscape and the actions of men. The farmer needs the services provided by biodiversity to produce sustainably. Conversely, the biodiversity richness of breeding areas is induced by breeders by maintaining semi-open spaces. The stake is important because it is a question of maintaining a balance, sometimes fragile, between species but that is beneficial for all.

15. Nothias JL 2009. "Why have Cormorants become a plague?", *Le Figaro Sciences* of 08/26/2009 (www.lefigaro.fr/sciences/2009/08/26/01008-20090826ARTFIG00318-why-cormorants-have-become-a-scourge-.php).

16. Fecal matter or excrement.

17. Giraud M., "Safari dans la bouse", *Insectes review* n° 149, 2008, pp 3-8 (podologueequine.files.wordpress.com/2013/04/1149-giraud.pdf).

Livestock farms, a favorable place to ordinary biodiversity

Meadows

Grasslands, whether permanent or temporary, are also important for the reception of wildlife. They provide a privileged habitat for these species. Incorporating temporary meadows into rotations is beneficial for the life of the soil. These meadows are also good levers for storing carbon.

Landscape mosaic

The diversity of in the occupation of the soil is favorable to the species resilience. A heterogeneous landscape mosaic will make it possible to limit the impact of aggressive agricultural practices on the fauna species housed in a plot, as they can more easily find refuge in the adjacent plots. Its main indicator is the diversity of crops and plots in a given agricultural territory.

Farmhouse and building

The farmhouse can also house wildlife species. It is possible for the breeder to adapt his buildings to better accommodate them. The health aspect is particularly well monitored so that the biodiversity present does not harm the farming activity.

Agro-ecological infrastructure

Hedges, trees, wood edges, ponds etc. are agro-ecological infrastructures that strongly contribute to biodiversity. Often maintained by the breeder in order to promote the flora and fauna that is present on his farm, they provide habitat and food for different species. Some elements, in particular the hedges, also make it possible to store carbon.

Animal husbandry practices and crop management

The farmer, through his choices and his farming strategy, has an impact on biodiversity, whether it is:

- Directly: through the choice of the species he cultivates and the breeds of cows he raises;
- Indirectly: through its breeding practices and the management of its crops.

Depending on the farmer's practices, the impacts on natural resources of the farm and the territory are different.

Species present on breeding farms

- On average, around 40 to 70 different bird species could be counted on breeding farms
- Of the 20 species of bumblebees present in France, 13 have been identified on breeding farms
- Between 150 and 300 species/m2 live in a breeding meadow
- Out of the 29 species of bats present in France, on average 13 species are present on breeding farms

Source: Indibio research program.

Soil life

The grazing and the addition of manure on the plots are beneficial for the fertility of the soils and therefore the food-producing for cows. It is a true virtuous circle: cow droppings allow organic matter to return to the soil, which is degraded by soil microorganisms. These microorganisms are invisible but very important for the agronomic functioning of the farm.

Agricultural and wild biodiversity

There are three types of biodiversity on farms:

- Cultivated biodiversity, with different crops: cereals, corn, alfalfa etc.
- Biodiversity of breeding with cows
- Wild biodiversity with the non-domesticated flora and fauna present on the farm: poppies, hares, deer etc.

Assessment tool

brings farmers attention to biodiversity

A high variety of plants, animals, and microorganisms is the goal when working with biodiversity, which is key to sustainable dairy farming. A new tool, Biotex, developed by French experts helps the dairy farmers assess their own impact on biodiversity. The system is tested in multiple European countries and on more than 300 French farms.

But what is the dairy farmer's role in preserving biodiversity and how great is the potential of Biotex? We asked Vincent Manneville, Environmental Assessment Project Manager at the Livestock Institute (Idele) in Paris, who took part in the development of Biotex.

1. What is biodiversity in the context of the European landscape?

"Biodiversity is linked to the heterogeneity and the complexity formed by the density of agro-ecological element structures. In other words, it is shown in the mosaic of the landscape. The landscape decides the diversity of natural habitats, the connexion for species mobility, and

the food resources available to the whole species. The characteristics of the landscape are very important, because they explain more than 30 percent of the specific richness of species like bumblebees, bats and birds."

"Also, agricultural practices have an impact on biodiversity. For instance, the use of chemical insecticides damages a lot of insects' resources with a direct impact on birds. On the positive side, most of the permanent grasslands are favourable to biodiversity. Furthermore, organic matter is essential to biological activities within the soil. Dairy systems preserve the health of their soil by spraying manure. Therefore, it is important that farmers are attentive to crop management, to the use and rate of organic matter, and the effect of rotational crop."

2. How can the European dairy farmers promote the preservation of biodiversity?

"The farms are often located in diverse areas and terrains with

ponds, banks and woods. And many livestock farms have smaller plots, surrounded by hedges to protect animals from the weather and provide shade. The preservation of these areas and corridors allows wild animals to move around to reproduce, hunt, and nest. Grazing livestock also help to naturally regulate and maintain the permanent grasslands, fertilizing the soil, and give life to a variety of different insects, plants and micro-organisms."

3. How can farmers know if their practices protect biodiversity?

"Some dairy farmers are well aware of the issue and observe their environment a lot. To support these farmers, the tool Biotex was created under the auspices of the Indibio project and tested in seven European countries and on nearly 300 French farms in collaboration with farmers."

"Biotex is based on the agro-ecological elements of the landscape on the scale of the territory, the farm and the plot, in order to assess whether the farm promotes or damages biodiversity."

Vincent Manneville.

"The use of the Biotex tool is quick and requires only a day's work. However, one must always keep in mind that the different spatial scales – the territory, the farm, and the plot – and the maintenance of biodiversity is not the work of an individual. Preservation of biodiversity requires collective impact."

4. Have you noticed a progress due to the implementation of Biotex?

"Biotex has encouraged discussions on biodiversity. A Biotex appraisal prepares the farmers engagement in biodiversity discussions and promote the measures taken to preserve biodiversity and to maintain ecological services."

Vincent Manneville.

"The tool has made some farmers more comfortable with the discussion on biodiversity and made the debate with other defenders of nature more productive."

Main elements in Biotex

The Biotex tool is based on the evaluation of 23 sub-indicators aggregated in 7 indicators audited by a consultant:

- Territory land use
- Farm land use
- Agroecological structure spatial organization at farm landscape level
- Agroecological structure spatial organization at farm plot level
- Agroecological structure management
- Crop management
- Permanent grassland management
- Soil fertility

All farmers receive feedback after the audit with the purpose of raising awareness on biodiversity, highlighting the impact on biodiversity of certain farming practices.

"As a result of including Biotex in the discussion, we have seen examples of certain Trade-Unions that have arranged workshops to discuss the assessment of biodiversity. Other stakeholders have been invited to debate and to find compromises on future actions. Finally, the Biotex tool has also shown to be a tool to help make decision makers."

5. How do we promote the interest in biodiversity even further?

"Like Biotex does, we need to point to the effects of biodiversity in the farmer's practices making the value of preservation ecological services clear. We need to show what the actions are to improve the link between production and nature because a healthy nature is a condition for sustainable farming."



Private photo.

About Vincent Manneville

Vincent Manneville is an Environmental Assessment Project Manager at the Livestock Institute (Idele) in Paris and one of the developers of Biotex.



EU Biodiversity strategy

In May 2020, the EU Commission released a new EU-wide strategy to strengthen and preserve biodiversity. The biodiversity strategy sets high ambitions for restoring biodiversity in Europe, and is a part of the EU Green Deal, highly interlinked with other main strategies such as the 'farm to fork' strategy.

The ambitions of the EU biodiversity strategy are to:

Establish protected areas for at least **30%** of land and sea in Europe

Restore degraded ecosystems at land and sea across the whole of Europe by:

- Increasing organic farming and biodiversity-rich landscape features on agricultural land

- Restoring at least **25 000 km of EU rivers** to a free-flowing state

- Put the EU in a leading position in the world in addressing the global biodiversity crisis. The Commission will mobilise all tools of external action and international partnerships for an ambitious new UN Global Biodiversity Framework at the Conference of the Parties to the Convention on Biological Diversity in 2021

- Reducing the use and risk of pesticides by

50%
by 2030

- Halting and reversing the decline of pollinators

- Planting **3 Billion** trees by 2030

- Unlock **€20 billion** per year for biodiversity through various sources, including EU funds and national and private funding. Natural capital and biodiversity considerations will be integrated into business practices

Give life to more species and reinforce the wild

Nature Check

increases biodiversity at the farm

A mosaic of fields, forests, lakes and buzzing bees is part of our image of a rich Danish nature and it must also be part of a sustainable dairy production. Therefore, SEGES has developed a number of tools for Danish farmers with the goal of securing nature and increasing biodiversity.

It requires knowledge to care for the Danish nature and SEGES and Andrea Oddershede, biologist and nature consultant at SEGES, want to disseminate this knowledge. That's the reason why she and her colleagues have developed the tool 'Nature Check' for the Danish farms.

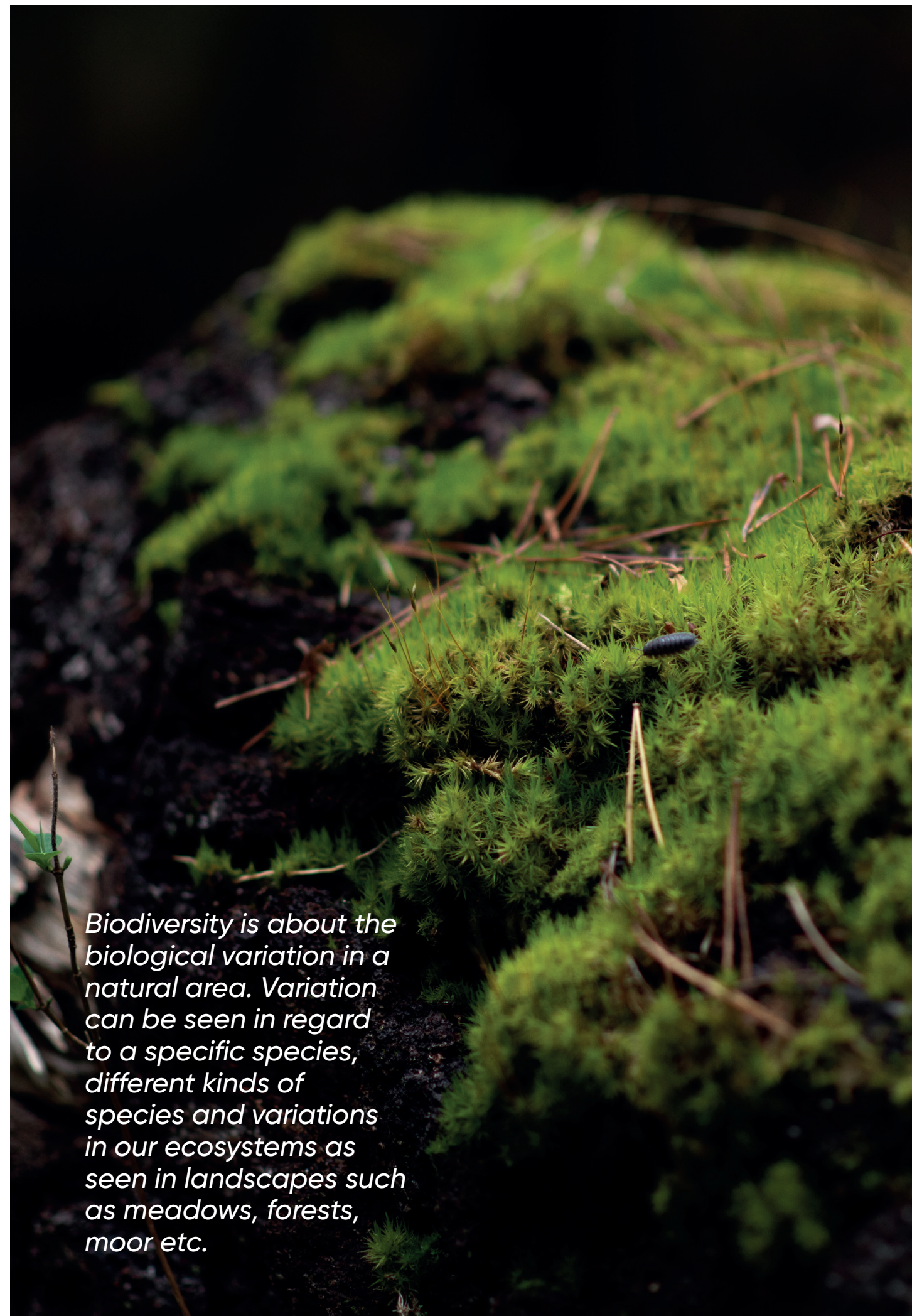
"At a 'Nature Check' we visit the farms and offer one-on-one guidance for the farmers. We help the farmers choose 5 to 10 special focus areas at the farm that either need to be carefully looked after or have to be managed in another way," Andrea Oddershede explains.

'Nature Check' is a project that was started two years ago and SEGES is now experiencing an increasing demand from farmers who wish to get a professional opinion of biodiversity at the farm.

"Basically, we work to give farmers the opportunity to see the benefits of the procedures they are initiating. I think this can make an apparent difference in relation to the motivation behind improving biodiversity"

Andrea Oddershede.

"Both small and large businesses order 'Nature Check' because everyone can do something. On the individual farm it is the little strokes that make a noticeable difference, and on a larger scale we can create a smarter arrangement of the landscape so that wild land can be connected in larger components," Andrea Oddershede explains.



Biodiversity is about the biological variation in a natural area. Variation can be seen in regard to a specific species, different kinds of species and variations in our ecosystems as seen in landscapes such as meadows, forests, moor etc.

"Often the most effective initiative that the farmer can do for biodiversity is to ensure that areas on the farm are wholeheartedly allocated to nature. This is where the otherwise distressed biodiversity can be allowed to unfold its full potential."

Many farmers own several different types of land: From lakes to forests and wild areas and in that way there are plenty of opportunities to let nature run free."

Andrea Oddershede.

A focus on the effect of initiatives that support nature

With the 'Nature Check' initiative farmers get an individual evaluation of the level of diversity in the surrounding nature at the farm, and they receive a catalogue with ideas on how to increase biodiversity. In the process of 'Nature Check' the farmer is also able to have the effect of already implemented initiatives evaluated through a revisit, but the next step is to create a digital database which will be able to document the progress on the farms.

"It is complicated to calculate on biodiversity. A relatable example is

trees. It is not enough to just count the trees. There is quite a difference between whether the tree has just been planted, or whether it is an old tree with a dense trunk and myriads of habitats for smaller and larger animals, moss and fungus," Andrea Oddershede says.

SEGES has therefore begun to investigate how the effect of the farmers' initiatives can be evaluated more precisely.

"We do not lack knowledge or data on the instruments we recommend. We are missing a set-up that allow us to monitor the improvement on

the individual farm. Therefore we are in the process of investigating how we can create a method to document the effect, so that the farmer can keep track of both the state and progress of biodiversity on the farm," Andrea Oddershede says.

Biodiversity is a complex matter that is difficult to put into equation. However, according to Andrea Oddershede, there may be a particular advantage in the improvement of tracking the impact of the farmers' efforts.



About Andrea Oddershede

Andrea Oddershede is a biologist with a PhD in biology. She is a nature consultant at SEGES, which is a department that focuses on knowledge and innovation in the Danish business organisation Agriculture & Food. SEGES specializes in topics within agricultural management and Andrea Oddershede is affiliated with SEGES 'Environment and Land'.



The importance of biodiversity

Shane Fitzgerald is a young, third generation, dairy farmer milking 210 cows alongside his family in Portlaw, Co. Waterford, Ireland. Shane discusses the importance of biodiversity and the actions he and his family take to allow room for nature on their 90-hectare farm.

"A biodiversity baseline assessment was recently carried out on our farm as part of a study conducted by Teagasc. This baseline identified the biodiversity features present on the farming platform and the management practices associated with them.

The biodiversity features on this farm account for 18% of the farming platform area:

- **The hedgerows** on our farm are networks for nature that provide nesting sites and song posts for birds, cover for small mammals and birds, and space for native plants to grow which in turn provide various food sources for pollinators and birds.
- **The watercourses** that flow through the farm provide further connections for biodiversity and space for flora and fauna to thrive along the banks and waterbed, and in the water.

- **The woodland grove** and the low-input pasture are both spaces on the farm which support a range of insects, birds, mammals, plants and trees.
- **The Whooper Swans** that arrive each winter to feed on our green pastures are a unique feature of

our farm. The paddocks that these large, migratory birds feed on make up almost 10% of the farming platform. Whooper swans have been identified on the amber list for birds of conservation concern in Ireland and we welcome their arrival each year.

"Improving the value of biodiversity on our farm is important to us. When I think about improving biodiversity, I always start with the habitats that are already in place on the farm and how these can be maintained and enhanced to increase their value for biodiversity. It is only after this that I consider creating new habitats where suitable"

Shane Fitzgerald.

Biodiversity Management Practices

We maintain the high level of biodiversity on our farm by keeping best management practices in mind and applying some simple yet effective measures:

- When it comes to hedgerow management, we cut our hedges in rotation and from a dense base up to a point to give them a triangular profile. This ensures that hedge-nesting birds have enough cover above and below their nests to protect from predators. We also allow thorn trees, like whitethorn and blackthorn, to grow and mature along the hedges. This provides for the pollinators and the birds as these trees produce flowers and fruit right throughout the year.
- All watercourses are fenced off with 1.5 metre-wide margins and animals are not permitted to drink directly from any watercourse. These practices allow vegetation to grow along the bank and avoids damage and pollution to the waterbed, protecting the instream biodiversity habitat.
- Currently, we have 1 metre wide field margins along all hedgerows and grass banks. These field margins are not cultivated and only spot spraying of noxious weeds is practiced. We plan to increase the width of these margins over time.



- Low input pasture is managed with lower rates of fertiliser, no pesticide usage and light grazing. This has created a more diverse sward with a greater variety of plants and wildlife.
- We use LESS slurry spreading equipment and protected urea to reduce ammonia losses, protecting plant and animal species diversity. A 5-metre and a 2-metre buffer zone are maintained along permanent boundaries when applying slurry and fertiliser respectively, to protect biodiversity features.

A Plan for Biodiversity

We have also developed a unique Biodiversity Management Plan that complements our farm plan and increases the sustainability of our enterprise. In addition to the continuation of positive practices already in place on our farm, our plan also involves:

- Creating a pollinator patch and bee scape in the farm yard. This includes native Irish wildflowers that provide an added food source for pollinators and an exposed southerly facing earth bank that offers shelter for mining solitary bees.
- Planting a new native hedgerow which will extend the connections and corridors for nature throughout the farming platform and reduce the average field size from 7 hectare to 6.5 hectare on our farm.

A biodiversity plan provides us with services that benefit both environmental and social aspects of our farm. The management of biodiversity fits into our farm system. The actions we take around the farm to protect and improve biodiversity involve minimum effort, time and cost but are hugely beneficial to nature and contribute greatly to the sustainability of our farm."

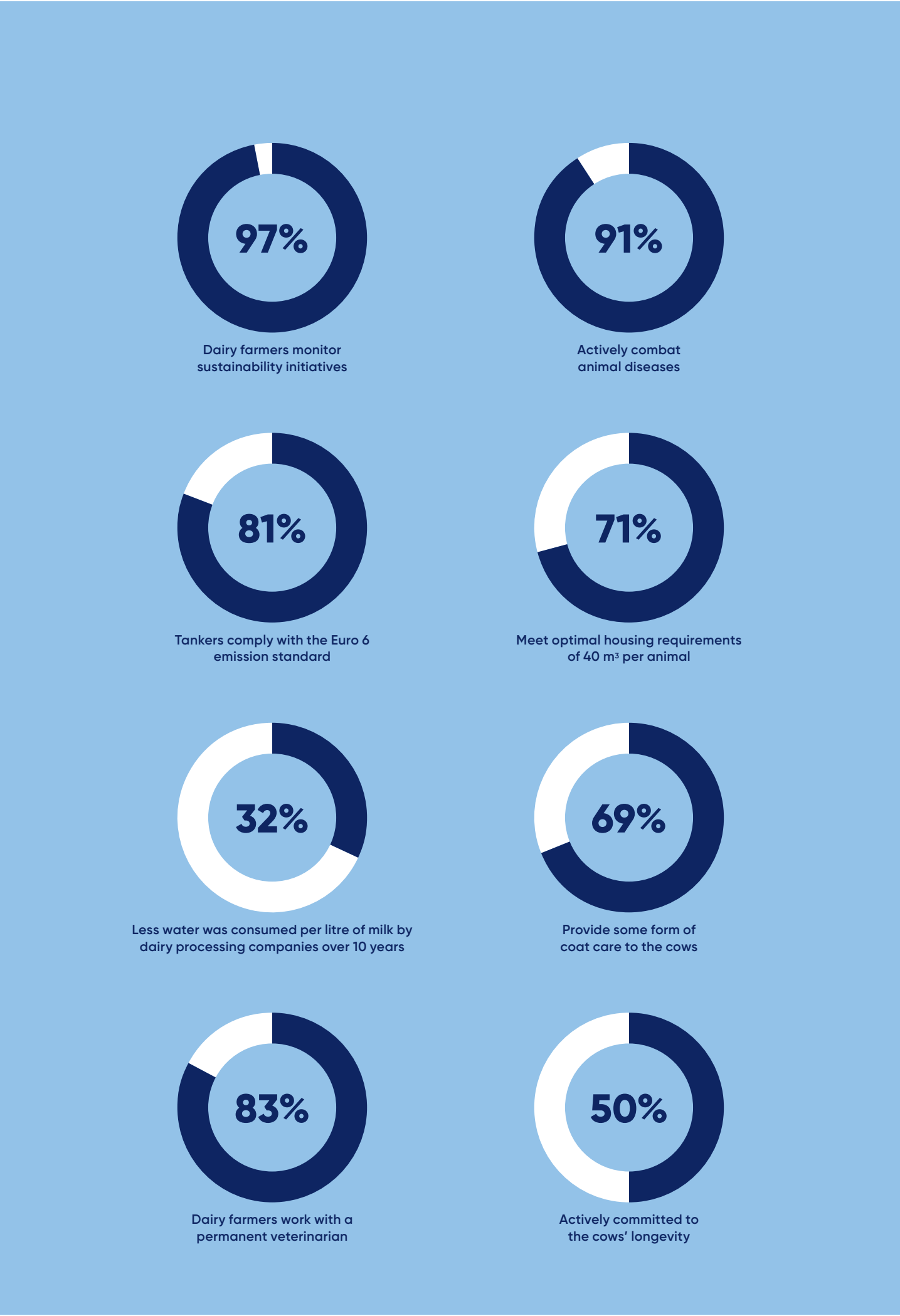
Results from sustainability monitor

How sustainable is the dairy industry? In order to document the many efforts that are being made, an industry-wide sustainability programme has been rolled out throughout the Belgian dairy chain since 2014. The programme allows dairy farmers to monitor their sustainability efforts and make comparisons with the rest of the industry. This encourages dairy farmers to make even more progress in terms of sustainability. Animal welfare and animal health are important pillars in this regard.

The industry-wide sustainability programme, which is managed by the dairy sector's trade association MilkBE, aims to have an impact on three levels. This helps each link in the chain to contribute towards a more sustainable dairy industry:

- 35 sustainability initiatives are monitored on the farm. 97% of all dairy farmers actively participate in this type of monitoring. On average, they implemented 16.5 out of 35 initiatives in 2019. Independent auditors visit the dairy farms every three years. The initiatives exceed the statutory requirements. Not all companies can apply the criteria, as they are sometimes company-specific.

- Sustainability is also monitored and measured during transport. This has been done since 2006 based on the annual data from eight dairies representing 82% of the national milk supply. These figures show how the transport industry is evolving in terms of mileage, total fuel consumption, the environmental friendliness of milk tankers and the efficiency per milk tanker.
- Finally, the sustainability of dairy processing has been surveyed annually at dairy processing companies since 2005. In 2018, 12 sites participated. They accounted for more than 90% of the milk that is processed on a national level. They provided figures on the annual production and processing of milk, energy and water consumption, water recycling, waste water, CO₂ emissions, waste processing and the production of green electricity.



Climate, energy and environment in the sustainability monitor

Of the 35 monitored sustainability initiatives, 18 deal with climate, energy, environment and water and soil. Some important initiatives are:



1. Reuse of water

44% use alternative sources such as rainwater and surface water.



2. Eco-friendly waste disposal

55% of dairy farmers are committed to a well-maintained business environment and environmentally friendly waste processing.



3. Environmentally friendly pest control

39% of dairy farmers engage in selective and environmentally friendly control of insects, mites and parasites.



4. Biodiversity management

27% invest in farmland bird management, hamster protection, local livestock breeds, field margin management or management of small landscape elements.



5. Use of by-products

61% of dairy farmers use by-products from the food industry, such as pulp, draff and potato by-products.



6. Green energy

37% of the dairy farmers produce their own sustainable energy that amounts to at least 4,000 kWh of the company's electricity consumption. This is done, for example, via solar panels, a windmill or biogas equipment.



Tech solutions for more sustainable farm management and animal welfare

The Belgian dairy sector invests in numerous research projects, often very technological. One of the goals is to be able to intervene as soon as possible if health problems were to arise in the dairy cows. Because healthy

cows not only produce more and better milk, they also do so in a more sustainable way. Promoting the health of dairy cows contributes to reducing the ecological footprint of the sector.

ClawCare

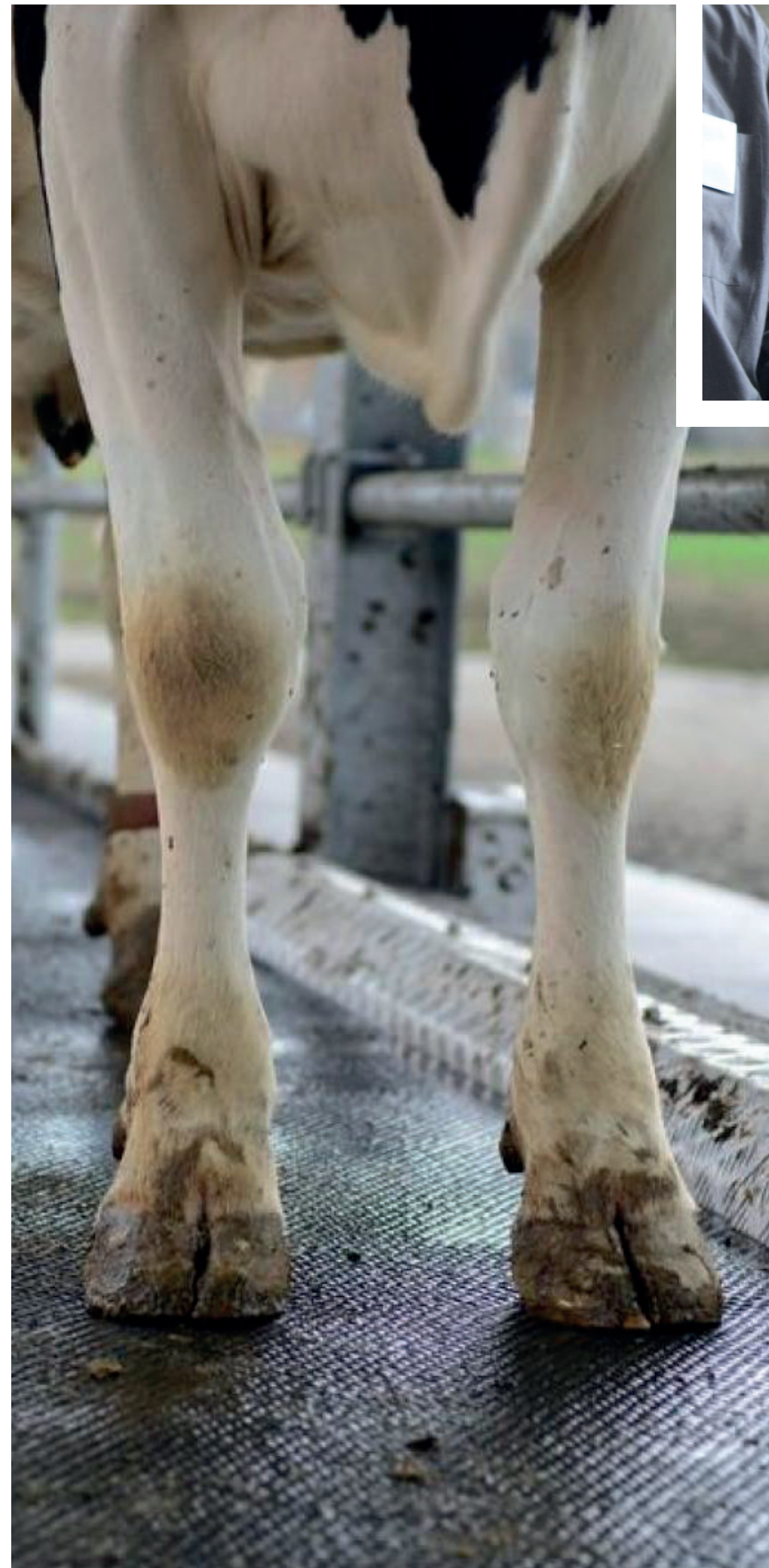
Using a heat camera to detect claw problems

Claw problems can lead to lame and unhealthy cows. This year the ClawCare project was launched to detect claw problems in time and offer better treatment. The project is developing an affordable smartphone app to make the detection of claw problems easier.

Mobile heat cameras and a self-learning image processing algorithm will make it possible to detect deeper injuries that are not yet visible to the naked eye. This will allow the

farmer and hoof carer to start the right care more quickly. The algorithm uses a database to eventually learn where problems are likely to occur. In a final phase, a software tool will be developed to determine exactly how to take care of the claw.

ClawCare is a collaboration between UGent, Hooibeekhoeve, ILVO, Inagro and HoGent. The project will run until 2023.



MoniCow

Cattle farming monitoring

The MoniCow project is developing a smarter, more integrated, user-friendly and energy-efficient prototype tool for dairy farmers. The system uses a limited number of sensors and a chip in the cow's ear tag or collar to send real-time updates on various monitored health and fertility parameters. The cow is not hindered in any way. This type of data management benefits animal welfare: it detects any diseases and problems more quickly, so that they can be dealt with in a better way. The system can detect when a cow is eating less, is restless, is suddenly taking fewer steps or is lying down less than usual. It also tracks the cow's location in the barn with an accuracy of up to 30 cm, documenting its behaviour in great detail.

The system is also economically interesting for dairy farmers. It is time efficient and will reduce veterinary costs. The researchers estimate that this type of monitoring system could save farmers an average 200 euros per cow per year: a win-win for the animals' welfare and the farmer's bottom line. The MoniCow all-in-one solution for cattle farming monitoring was created by various partners, such as ILVO, IMEC-UGent, KULeuven and various technology companies. The follow-up project FWO will focus on the prototype's further optimisation from 2020 to 2022.

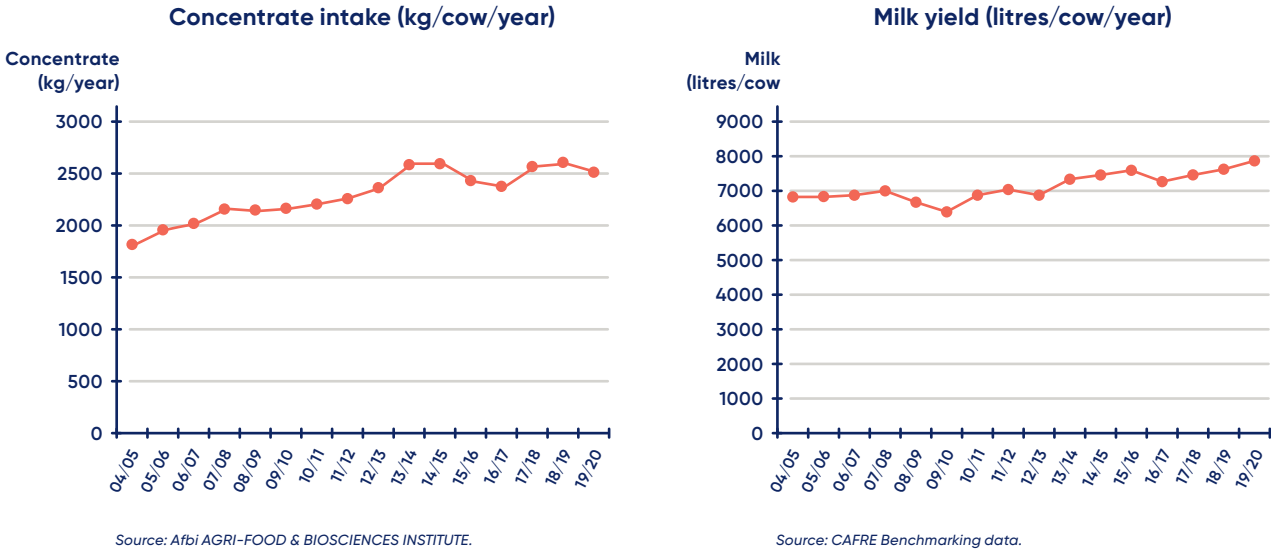
Improving farm sustainability through efficient concentrate use

Purchased concentrate feed costs currently represent approximately 70% of variable costs on Northern Ireland dairy farms and future fluctuations in climate and trade are likely to increase volatility in the cost and availability of this resource. CAFRE Benchmarking data indicates increasing reliance

on concentrate feedstuffs in recent years with an average concentrate input per cow on benchmarked dairy farms within Northern Ireland increased from 1.1 tonnes/year in 1997/1998, to 2.6 tonnes/year in 2017/2018, with wide variation between individual farms.



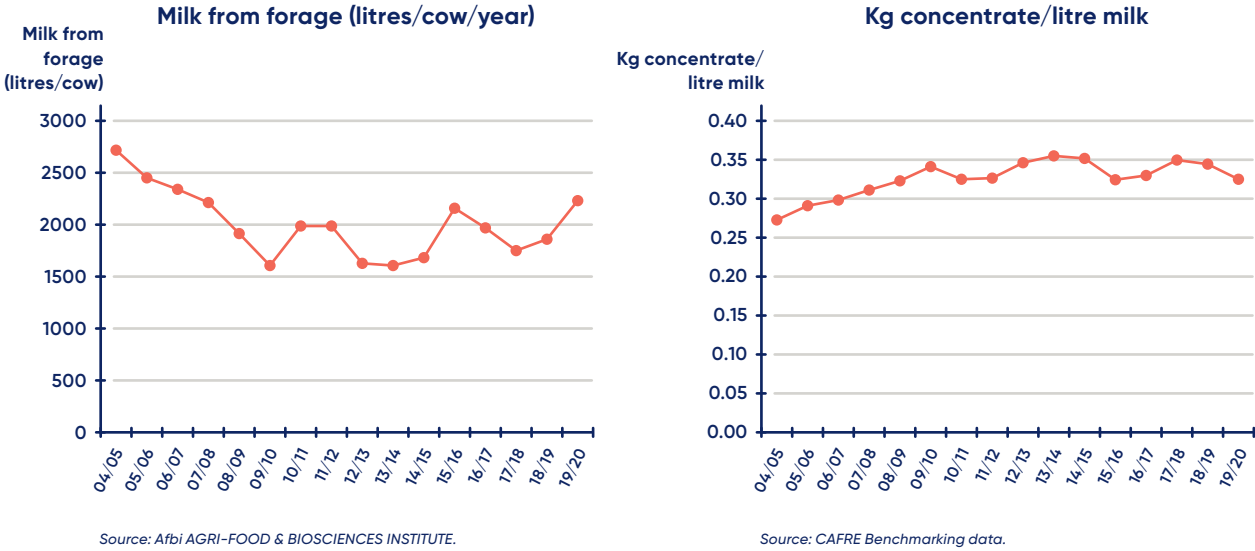
Trends in c oncentrate use and milk yields in Northern Ireland



Concentrate usage has increased for a number of reasons, but is primarily linked to a significant increase in the genetic merit of the Northern Ireland dairy herd during the last two decades and consequently a corresponding increase in milk output per cow. These higher genetic merit animals are unable to consume enough energy in forage alone to meet their energy requirements placing greater

importance on concentrate feedstuffs. Although the provision of concentrates provide a mechanism to better meet the nutritional demands of high yield dairy cows, inefficient use of purchased feedstuffs can result in negative animal health effects and, higher nutrient surpluses on-farm, increasing the risk of nutrient loss to the environment.

Efficiency of concentrate use Northern Ireland



To address this challenge, AFBI have been working in partnership with CAFRE and industry to conduct a range of trial work to improve concentrate use efficiency on commercial farms in N.I. These studies have included:

- **Delayed concentrate build-up strategies in early lactation**

Milk yield increases rapidly in the weeks following calving, and in many cases higher yielding cows are unable to consume enough feed to meet their nutrient requirements resulting in negative health effects. In an attempt to keep pace with this rapid increase in milk production in early lactation, the quantity of concentrate offered may increase rapidly following calving however this may further drive milk production and result in a greater negative energy balance. A series of studies investigated the impact of delayed and slow build up concentrate strategies in early lactation to negate these issues. Results show that cows on the delayed strategy had a higher forage intake in early lactation and lower incidence of rumen health problems than those on higher concentrate feed rates. In addition, there was no negative effect on lactation performance. Adopting a delayed build-up strategy can result in savings in concentrates of approximately 100 – 150 kg/cow. These results also became apparent when trialled on 5 commercial farms in N.I. with similar responses found.

- **Concentrate feeding during the dry period**

The period around calving (the transition period) is one of the most important periods in relation to overall cow productivity. This period can be highly stressful for the dairy cow given the stress of calving, an increased risk of injury and uterine infection and large changes in diet. In addition, the cow's immune system becomes suppressed at this time making her more susceptible to infection. Nutritional and management strategies during the dry period should be targeted at preparing the dairy cow to achieve high milk yields and high fertility levels during the following lactation, whilst minimising the risk of metabolic and infectious diseases. While concentrate feeding during the dry period is often recommended as a strategy to

improve body condition of cows prior to calving and to 'prepare the rumen' to better cope with concentrate rich diets offered in early lactation, the scientific evidence to support this is limited. In a series of studies the effect of concentrate feeding during the dry period has been examined. Results from research trials and on-farm studies from 9 commercial farms indicate that when cows have a condition score of 2.5 or above at drying off, and are offered good quality silage together with a high quality dry cow mineral supplement, offering concentrates during the dry period is unlikely to result in milk yield, health or fertility benefits. Again this allows savings to be made in concentrate usage.

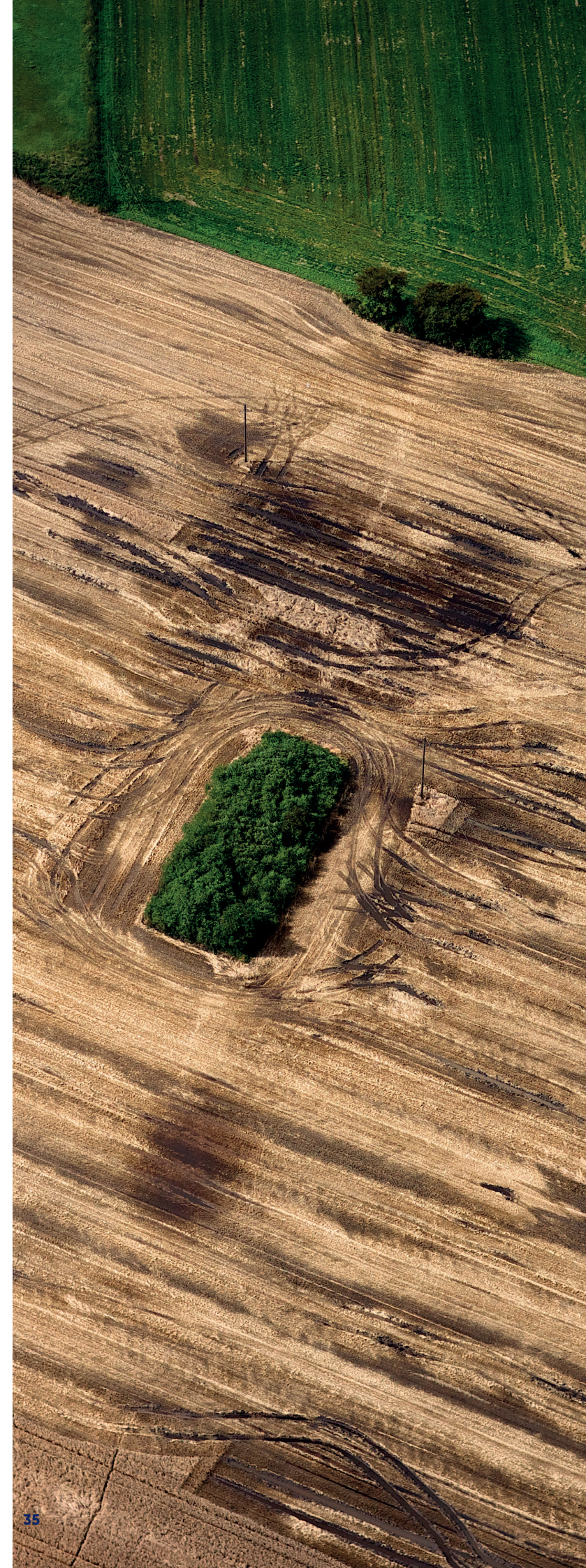
- **Precision feeding:**

The adoption of feeding systems in which concentrates are offered to individual cows according to their milk yield is now common place. The approach most often adopted on local farms involves offering a 'basal diet' of silage and concentrates, which is designed to support the energy requirements of the cow for maintenance, plus a certain milk yield (often referred to as the Maintenance plus, or M+ value). Additional concentrates are then offered to individual cows to support milk yields above those supported by the basal diet. In reality a range of feed rates are adopted on farm hence studies were undertaken to identify the optimum feed rate for lactating dairy cows. Results from feeding three different feed rates (0.35, 0.45 and 0.55kg per litre of milk) indicated that reducing feed rates to 0.35kg per litre of milk had no significant impact on cow performance but reduced overall concentrate consumption by 22.5% and increased margin over feed costs per cow.

- **Replacing purchased protein with field beans**

As the UK livestock sector has expanded and intensified, the demand for concentrate feeds has increased. This increase in concentrate use has led to an increased demand for quality 'protein' ingredients such as soya-bean meal. However, many protein ingredients are imported from countries outside the European Union (EU), and this has left the dairy sector

vulnerable to instability of supply, price volatility, and the limited availability of non-genetically modified protein sources. For these reasons there is increasing interest in the use of locally-grown protein crops. Field bean (*Vicia Faba*) is a grain legume of particular interest locally, with yields of 5.5 – 8.5 t/ha reported in Ireland. While the crude protein content of field beans is lower (30% DM basis) than that of soya-bean meal (55% DM basis), field beans have a much higher starch content, 40% of DM compared to 5-7% of DM for soya. However, there is limited information on the animal performance responses when different levels of field beans are included in dairy cow diets. In addition, the use of field beans in dairy cow rations is often restricted due to concerns about 'anti-nutritional factors' which can reduce intakes and performance. A series of studies have examined the use of locally grown field beans in dairy cow diets. Results show that field beans can partially replace soya bean meal and rape seed meal in dairy cow diets with no adverse impacts up to 3.5 – 4.0kg/day. Furthermore, the means of processing field beans either by propionic acid treatment or by drying and coarsely rolling or finely milling is not a critical factor, as feeding beans from all three methods have been capable of supporting the same animal performance.





Drew and Val McConnell Farm, Carrigans, Omagh, Northern Ireland

Efficient concentrate use

— case study

Drew and Val McConnell milk 160 cows on a 300 acre farm at Carrigans, just outside Omagh. Drew is the third generation to farm at Carrigans, and in addition to taking responsibility for the calves, Val also owns sheep and suckler cows.

One of the many research programmes the farm has been involved in explored how to improve farm efficiencies by altering the diet being fed to the cows.

Farm objectives

The farm business is focussed on breeding high producing animals that are efficient and will produce high quality milk for a long number of years. By targeting efficient animals with a long lifespan they achieve a better financial margin but a lower carbon footprint due to the lower number of both milking cows and young-stock required to maintain overall farm production.

Farm details

Area farmed	300 acres
Cropping	0
Stock	160
Altitude	350-700 ft
Soil type	Heavy clay
Rainfall	50-60 inches every year

Farm average physical performance (year ending June 2020)

Milk yield	9,500-10,000 litres
Concentrate fed	3.02 t/cow
Feed rate	0.31 kg/l
Milk from forage (grass and silage)	2,983 litres
Replacement rate	<20%
Calving interval	13.7 months

Taking part in research trials to help improve young-stock rearing for long lifespan animals has been key to achieving the farms environmental footprint.

Improving farm sustainability through efficient concentrate use

The modern dairy cow has the genetic potential to produce high volumes of milk in early lactation. However, to do this a cow has a huge daily energy requirement. To meet this energy demand a cow may have to break down body fat reserves.

Working in partnership with Thompson's and AFBI, the farm investigated the impact of feeding a lower protein

diet to dairy cows as part of a two year research trial with the aim of reducing the negative energy balance.

The protein element of the diet was reduced down to 15%.

This lower protein ration limited milk production in the first 40 days after calving, thus reducing the overall energy demand being placed on the cow at this important time.

Although milk volume was reduced in those early days, the farm recorded no negative impact on overall milk performance because the cows maintained their peak for longer so over 305 days there was minimal difference

in milk yield. There were also improvements in animal health and fertility.

Importantly, lowering protein in the diet has also helped improve the farm's environmental footprint by lowering enteric emissions and overheads have been reduced because protein is the most expensive part of the diet.

During the research programme they also achieved marginal benefits in milk quality.

Nutrient management

Soil testing is carried out every 2-3 years allowing nutrient application to be tailored to meet the needs of the farm. This has reduced the nitrogen applied on the farm which has an environmental and financial benefit to the business.

The utilisation of dribble bar technology has reduced the fertiliser use by 25% and 10-15% of the land is reseeded each year.



"This lower protein ration limited milk production in the first 40 days after calving, thus reducing the overall energy demand being placed on the cow at this important time"

xxx.

Lime is applied after reseeding and depending on the soil analysis, it can be applied in subsequent years to optimize pH levels.

Grassland management

The grasses selected for the farm contain a lot of sugar and provide a higher nutritional value for the cow to ensure the cow achieves maximum benefit from the forage provided. Silage is harvested during the summer months.

The farm also utilises a borewell for water and energy efficient LED lighting has been installed in the parlour and sheds.



Additives for cows' feed can boost climate efforts

In just one year we can expect to have a feed additive on the market that can reduce cows' methane emissions by more than a third. At Aarhus University research is running at full speed and the expectations are high since the feed additive can be crucial for the future of agriculture.

The name is 3NOP and it is currently the feed additive that looks the most promising according to Professor Mette Olaf Nielsen, who is a researcher at the Department of Animal Science at Aarhus University.

"3NOP is clearly the safest card. In the experiments that have been done with the additive, there is a reduction potential of up to 39 percent, and there are no adverse effects on either cows, humans or milk. In fact, there is a tendency for milk production to increase," Mette Olaf Nielsen explains.

It is the Dutch company DSM Nutritional Products that has developed 3NOP, which they expect to put into production as soon as it is approved by the EU. All required tests of the substance are conducted, and it is now only awaiting the approval by the EFSA (European Food Safety Authority).

The substance X makes it possible to reduce even more

Although 3NOP has a great potential, Mette Olaf Nielsen and her colleagues are still researching other solutions that can reduce the emission of methane significantly, among these the currently confidential substance X.

Facts: Methane

According to the UN Climate Panel methane makes up only 20 percent of global greenhouse gases while CO₂ makes up about 75 percent. In return the greenhouse effect of methane is 25 times higher than the effect of CO₂ emissions, and it is therefore of great importance to the climate.

"We have been testing a new substance and in our laboratory experiments at the University of Copenhagen it shows a reduction of almost 100 percent. In a smaller pilot experiment at Aarhus University, it could reduce methane emissions from dairy cows by 33-50 percent. We hope to develop a product that is as effective as 3NOP."

Mette Olaf Nielsen.

The very special thing about substance X is that it is not in itself new but actually a rather known substance that has been used in the food industry for years. And that is quite an advantage in terms of getting the substance approved as a feed additive.

"The substance is already allowed and does not have an upper limit value for residues in food. In comparison 3NOP was a completely new laboratory-produced substance, which had to go through a very long process of tests and approval to ensure that it did not affect humans, cows or milk in an unfortunate way," Mette Olaf Nielsen explains.

The name of the substance X is still withheld because it is being evaluated whether a file for patent is



Facts: Methane emissions from Danish agriculture

In Denmark 20 percent of the greenhouse gases come from agriculture of which methane makes up 55 percent. This part primarily originates from ruminants such as cows and sheep.⁸

possible in regard to using the substance as a feed additive. While the fact that the substance is already approved for use in the food industry may speed up the process, it will probably still take a couple of years before we see it on the market.

Seaweed has great potential in organic farming

Both 3NOP and the substance X are chemically produced substances that are unlikely to get an approval for organic farming. Fortunately,

seaweed can be an option for organic farmers.

"Seaweed can be used in feed for both organic and conventional herds. This is because certain seaweed species contain bioactive substances that can inhibit the formation of methane in the stomach of ruminants. These bioactive substances are presumably evolved by the seaweed plant as a defence mechanism against microorganisms to avoid rotting due to the

depletion of oxygen in their environment. Some of these substances happen to inhibit the formation of methane in the cow's rumen," Mette Olaf Nielsen explains.

Research is being done at full speed in New Zealand, Australia and the USA, and it shows that a unique seaweed species, the red algae *Asparagopsis taxiformis*, has been able to reduce the formation of methane in the cow's rumen by more than 90 percent. Unfortunately, the substances that the *Asparagopsis* algae forms are unhealthy for humans, and therefore it might very well take a long time before the EU conducts an approval, Mette Olaf Nielsen estimates but adds:

"There is reason to continue the research in seaweed. For instance, in Denmark we are taking a closer look at seaweed species that are able to grow in the northern latitudes. They may be less effective – that is, the active substances might be different. But we are looking for harmless substances that can be concentrated and such extracts could have great potential," she says.

Seaweed also benefits the climate since it absorbs carbon dioxide from the air just like soil plants.

"At the moment it is not part of the equation, but it is not difficult to imagine that the cultivation of seaweed can have a positive impact on the climate because it is able to store CO₂. However, there is still some way to go before we can talk about seaweed forests as a counterweight to deforestation of the Amazon,"

Mette Olaf Nielsen.

May have a huge impact on agriculture

If the research succeeds in creating feed additives that reduce or completely eliminate the cow's methane emissions, we will look at a

completely new reality for the future of agriculture and our perception of meat and dairy products.

"It will be incredible! This will mean that we can shift focus to the beneficial value of the cows. As ruminants the cows have a huge potential to convert by-products that have no nutritional value for humans," Mette Olaf Nielsen says.

However, she can't say when or whether we will reach a reduction of 100 percent. For that there are too many unknown factors. On the other hand, she believes that it will be possible to approach climate-neutrality by 2050.

"Researchers are also looking into ventilation systems for stables that can burn the methane produced by the cows, and in the long-term perspective it may be possible to breed cows that emit less methane. If we can combine several of the solutions the potential is much greater and becomes an important contribution to making agriculture climate-neutral," Mette Olaf Nielsen concludes.

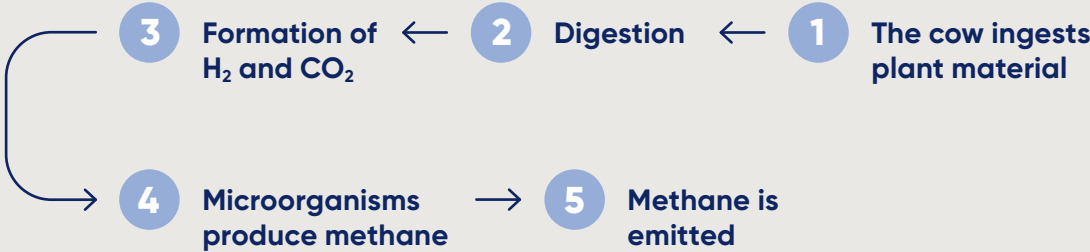
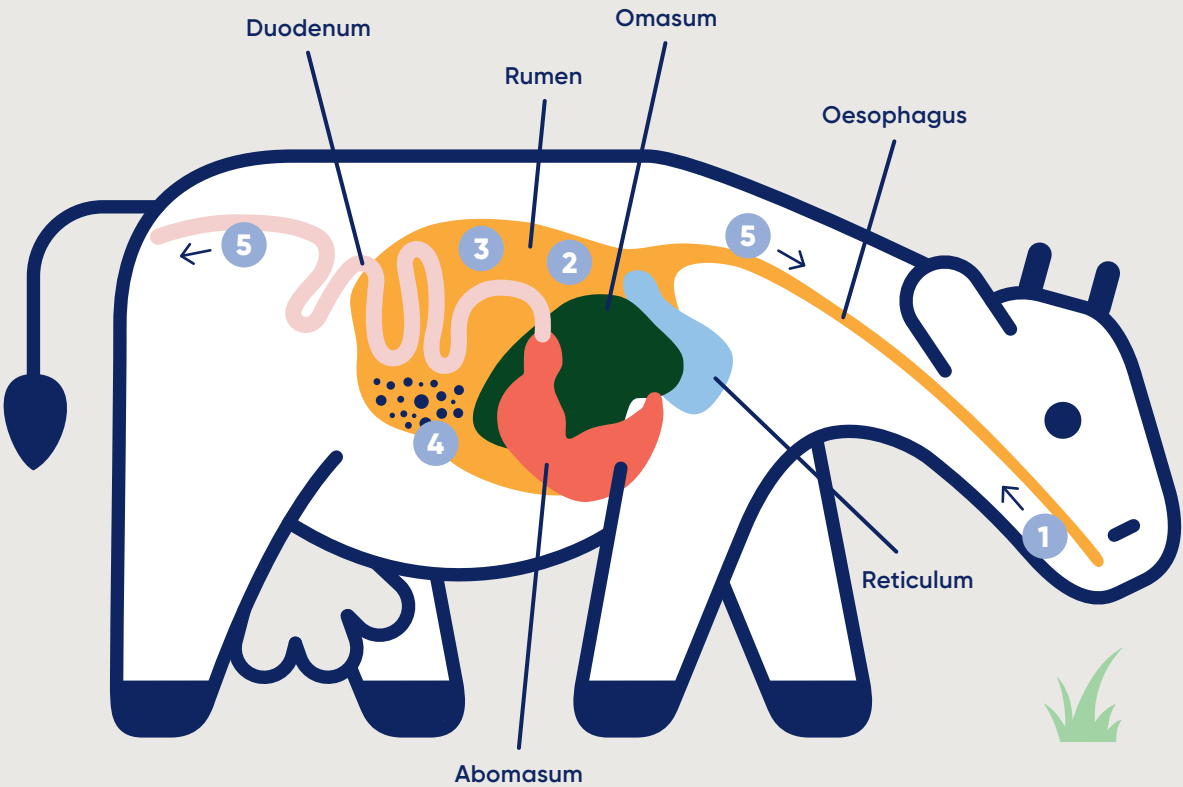


About Mette Olaf Nielsen

Professor at the Department of Animal Science at Aarhus University where she studies the matter of sustainable feed, including methane-neutralizing feed additives and sustainable protein as feed for livestock.

How does the cow form methane?

Methane is released when the cows burp or produce gas. Methane is formed by some special microorganisms in the cow's rumen, called archaea, that converts carbon dioxide and hydrogen into methane. Carbon dioxide and hydrogen are formed as a by-product from a fermentation process in the absence of oxygen in the rumen when the cow degrades the feed it has ingested. When researchers look at substances that can reduce methane emissions, they are looking for substances that can block or inhibit this process.



An influencer among COWS

Heleen Lansink calls her own motto "The farmer's strength lies in its visibility to the citizen". As a city girl with an educational background, she not only fell in love with her husband Rogier, but also with farm life. She is now one of the figureheads of Dutch dairy farming. With lectures, dialogue meetings and media appearances, Heleen knows better than anyone else does how to bring the story of the farmer these days into the limelight. Earlier this year, Heleen received the You Go Girl Award 2019, an 'encouragement prize' for visible women in the media, and was awarded the Nuffield Scholarship to engage in dialogue with innovative colleagues around the world. "I am the influencer of the agricultural sector," she often says with a wink.

"This time demands adjustments from all of us"

Heleen Lansink.

At the Lansink family's home in Haaksbergen it is rarely quiet. While her husband is working in the stables, Heleen suddenly rushes up from the kitchen table to turn on the radio. "There will be an interview with me in a moment. Still grumbling about the reporter who came up with all the clichés about complaining farmers, she reads the first reactions that come in via WhatsApp immediately after the item.

Her eldest daughter is still bored with some sandwiches – at home from school because the teacher is waiting for the results of a COVID-19 test – while Heleen keeps an eye on the youngest son, who is already better able to ride a (mini)shovel than she does herself. "I'm still not a hero on such a thing."

Farmers leader

In spite of her status as a 'farmer's leader', she never forgets what it was like to have to conquer a place in a rural community that saw her as an import. "In the beginning I kept aloof from farming, but at a certain point this changed and I became more and more curious. I started asking questions about the how and why and that made Rogier think as well. It is so easy to continue doing the same thing forever. We try to learn something new every day, by following courses and experimenting with other techniques, for example about the influence of fertilization on soil conditions".

Transition

"This time demands adjustments from all of us," says Heleen, who calls herself a 'farmer in transition'. The outside world may see her primarily as someone who stands up for farmers and the harsh conditions many of her colleagues have to cope with. Farmers deserve more appreciation, she constantly repeats, also because of a higher price for their products in the supermarket. Yet she can



get just as fierce about farmers who think that everything can stay the same. "I think that farmers need to have a realistic perspective in order to continue to run their farms in a healthy way. On the other hand, farmers cannot ignore society. All too often, now you see the weakest link blocking any change and then we will not get any further. That is why I have sympathy for the protests we have seen recently, but I remain critical and independent. You won't see me waving flags of a farmers' movement, although I am regularly asked to join a board".

Nature park

Also through her experiences abroad, she has become increasingly convinced that the future lies with 'regenerative agriculture', better known in the Netherlands as cycle thinking, in which biodiversity is leading. This truly calls for different choices, in which, for example, we can no longer fill up the entire meadow with the same type of grass and fertilize it endlessly. "Today's agricultural land is tomorrow's natural park, in which agricultural use is just one of the functions and ideally promotes biodiversity rather than pushing it away. This also calls for diversification of the revenue model of the farmer of the future. For a dairy farmer, income from milk will account for little more than 50 or 60% of total turnover. He will have to earn the rest in a different way".

Portfolio

A diversified revenue model is already a reality for the company of Heleen and Rogier Lansink. Heleen discovered that people are not curious about her vision of agricultural entrepreneurship only, but also would like to invest in it. That is why lectures, chairman activities and company visits are part of the company's 'portfolio'. As with the Milk Tapping Farm, which she started in 2017 and has since become the name of the farm, the approach remains the same: making connections between the people of the city and the world of farmers.

"Bringing farmers and citizens together has now become my business"

Heleen Lansink.



Chapter 2

Experts on climate change and sustainability

In the European dairy sector, we build our actions, initiatives and programs on sound scientific research and insights. In this chapter, we introduce some of the leading experts within the field of climate, agriculture and nutrition to present the latest research on sustainable and climate reducing diets and life cycle assessment measurements

Metrics matter in sustainable diet

To meet the challenges of climate change, we need to change our food patterns to become more sustainable. But if we want to encourage people to eat sustainably, we need to have insight in the impact of food on people and society. This means, we must take a closer look at the metrics of a sustainable diet.

But what is a sustainable diet, and what are we trying to measure? According to FAO, UN's Food and Agriculture Organisation, sustainable food is produced with respect to our environment; it is healthy to our bodies; acceptable to society, and affordable.

To Dr. Adam Drewnowski, professor of epidemiology at University of Washington, there is little food that can match all criteria at once. This is why, it is imperative that we use the right metrics to calculate food's impact and worth and before we can conclude the most responsible trade-offs between environment, health, society and affordability.

Adam Drewnowski point to the fact, that we are already able to assess the environmental

impact by using e.g. the Life Cycle Assessment or measure water use or land use, but we don't have accurate metrics to assess the relative value of food, when it comes to society and economy.

"A mistake that has been made in many years, is measuring food in kilo grams or litres. This is misleading, because a kilo gram of cheese is very different than that of wheat. Dairy might be more costly to produce, but it is a very different component," Drewnowski argues and continues with another example.

"Looking at calories per energy cost. Take sugar for example. Sugar has the highest calories, low cost and the lowest environmental impact. By this metric, if you want to

eat food with low greenhouse emission, eat sugar!"

Instead, Drewnowski argues, we should be looking at nutrient profiling. "More specifically, we need to look at the cost per precious nutrient. I'd say the most meaningful way is to look at cost per 100 grams of protein, as this would provide us with the worth of quality nutrition," Dr. Drewnowski conclude.

Still, nutrient profiling can't tell us everything

Dr. Adam Drewnowski sees a slow but steady movement towards a more accurate metric system for assessing sustainable food. But even when there's agreement of the metrics, a sustainable diet will never be a matter of simple calculation.

Because when it comes to the consumer, nutrients are not the only thing. There should always be a high regard for societal acceptance.

"The food might be nutritious, but if it's not eaten, it's not doing anybody any good. The most expensive and unsustainable food you'll encounter, is food sitting on the shelf."

Adam Drewnowski explain.



Life cycle assessment

Life cycle assessment (LCA) is a method to calculate the environmental impact of a product through all its stages. For dairy products this means calculating the impact from raw milk production to milk processing, transportation and even waste treatment.

Thus, when we want to encourage people to eat sustainably, we need to assess the environmental impact, the foods health qualities and the economic cost – but if social acceptance is left out of the equation there is little chance that a diet will be adopted by the people.

"That's part of the reason, I consider dairy to be a part of sustainable diet. It is high quality food that is relatively cheap and has a lower environmental impact than other protein sources. And it is socially accepted by most," Dr. Drewnowski says and concludes, that a sustainable diet will always need to be a compromise, and this should be voiced in the debate.

About Dr. Adam Drewnowski

Dr. Adam Drewnowski is professor of epidemiology and Director of the Center for Public Health Nutrition at the University of Washington. He has a MA degree in biochemistry from Oxford University, and PhD in psychology at The Rockefeller University. Drewnowski has developed Nutrient Rich Foods Index (NRF), a nutrient profiling model that measures nutrient density of individual foods, meals and composite food patterns. Dr. Drewnowski advises governments, foundations, and the private sector on issues related to diets and health.

LCA: An attempt to define environmental impact

Life cycle assessment (LCA) is a method to calculate the environmental impact of a product through all its stages. For dairy products this means calculating the impact from raw milk production to milk processing, transportation and even waste treatment. LCA does not only consider carbon footprint but also environmental performance of water consumption, land use and more. It seeks to be as complete as possible.

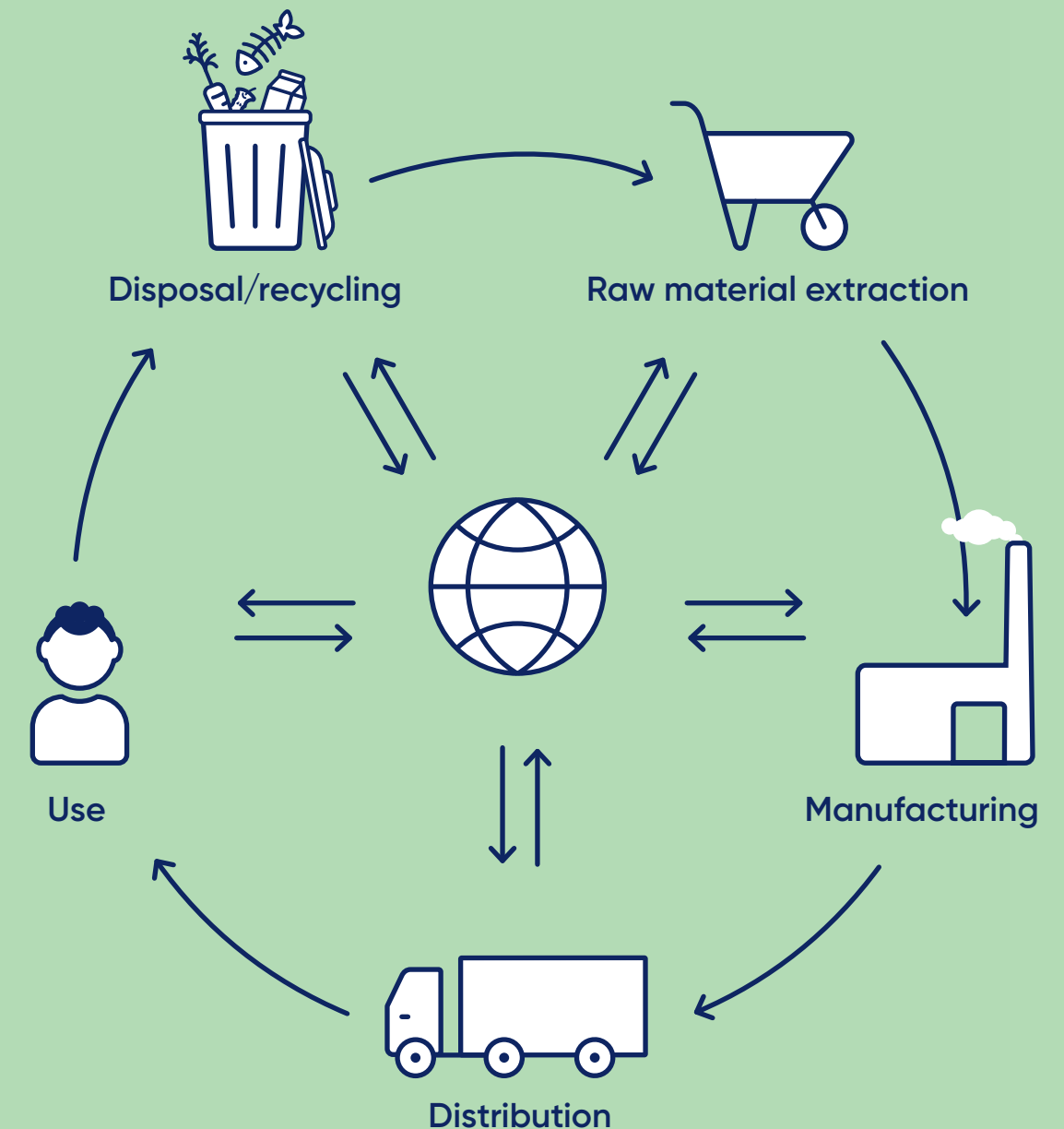
Dr Brad Ridoutt, Principal Research Scientist at the Commonwealth Scientific and Industrial Research Organisation in Australia (CSIRO), explains: "Food production systems differ in different regions and so do the local environmental concerns. For example, some dairy farms use irrigation, others not. Some are in water scarce regions, other in regions where water scarcity is less of an environmental concern. These differences are most important to consider."

These aspects of the life cycle perspective are essential as they help to identify where the major environmental gains are possible.

In 2017, the international standard for LCA (ISO14044) was amended to cover footprint indicators. An important development, according to Dr Ridoutt: "It is important that environmental footprints are calculated consistently and reported transparently to avoid misleading and confusing environmental claims. The amendment of the international standard was therefore imperative for industry and for consumers," he explains.

But even though the LCA approach is valuable, Dr Ridoutt reminds us that the method has limitations and should be handled with care.

"Supply chains can be very complex, with inputs sourced from many places as the various sectors of the economy are highly inter-connected. As such, life cycle assessments can become complex, seeking to incorporate a wide range of different types of impacts in different locations. However, an LCA study cannot include a detailed local environmental impact assessment at each and every place of production," he clarifies.





Sustainable diet is a delicate balance

A sustainable diet must be healthy, acceptable and affordable for all. This makes composing a sustainable diet a delicate balance. A switch of a few food items can affect nutritional value and footprint significantly. Modelling tools such as the Dutch developed Optimeal® help understand the impact of food choices on the environment, health and food prices.

Sometimes replacing certain foods leads to contra-intuitive results. For instance, replacing animal-based foods with plant-based foods does not necessarily lower the diet's carbon footprint.

These effects are shown in the modelling tool Optimeal® developed by the Netherlands Nutrition Centre and Blonk Consultants (Netherlands) using the data from life-cycle assessment methodology to calculate the environmental impact of the food we consume.

The Optimeal model calculates nutritional, environmental and price impact when a category of food is omitted or replaced. The reference diet being the recommended daily intake of nutrients and consumption

of food products advised by the Dutch Health Council and the Netherlands Nutrition Centre.

"Essentially, Optimeal® calculates what food products you need to consume in order to replace the nutrients you exclude when omitting certain foods. Of course, it is a standardized model, but it gives insights for composing both more healthy and sustainable diets," says Dr Stephan Peters.

"The nutrients from dairy have to be compensated for by other food products and not individual nutrients"

Stephan Peters.

"This means that not only protein needs to be replaced, but also calcium, vitamin A, B12, B6 and more," he explains.

"For this reason, you have to consume large amounts of mainly beans, pulses and vegetables. Surprisingly so, the CO₂-footprint of the alternative diet is approximately the same as diets with dairy," Dr. Peters continues.

Healthy and sustainable – and affordable and acceptable too

Besides following the recommended diets and nutritional intake, Optimeal® has adopted the four dimensions of sustainable diet as it is defined by FAO, the UN's Food and Agriculture Organization – namely health, sustainability, affordability

and cultural acceptability. Therefore, the model is designed to propose diets as close to the recommended diet as possible with respect to these four dimensions

Dr. Peters elaborates: "A diet could easily have a low emission but at the same time be unhealthy, expensive or unfamiliar. For instance, a very large amount of vegetables is more costly. Or candy and snacks are cheap, but definitely unhealthy. That is why we strive to follow the recommendations of the Dutch food-based dietary guidelines."

Restrain fast conclusions

According to Dr. Stephan Peters, the full potential of the modelling tool is yet to be fulfilled:

"We want to be able to give more nuances to the model. Expanding the food groups, we include and expanding the dimensions of the environmental impact to water use and land use"

Stephan Peters.



About Stephan Peters

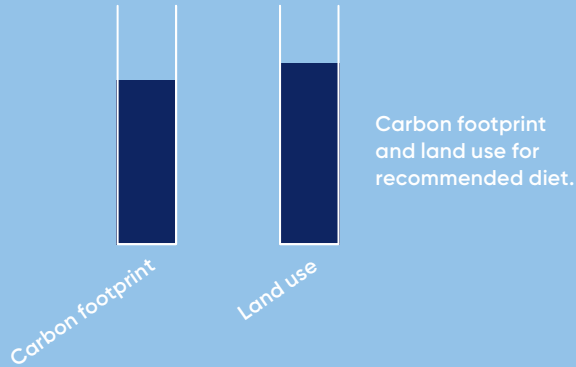
Dr. Stephan Peters is manager nutrition and health at the Dutch dairy association since 2015 and is specialised in the role of dairy in healthy and sustainable diets and food systems. Dr. Peters has previously worked on the development of Dutch food-based dietary guidelines and was product developer of clinical nutrition for cancer patients. Dr. Peters has a MSc in nutrition and toxicology and a PhD in clinical nutrition in cancer patients.

Until now, Optimeal® has been widely recognised in the European science community. But according to Dr Peters, it has the potential of greater impact outside academia.

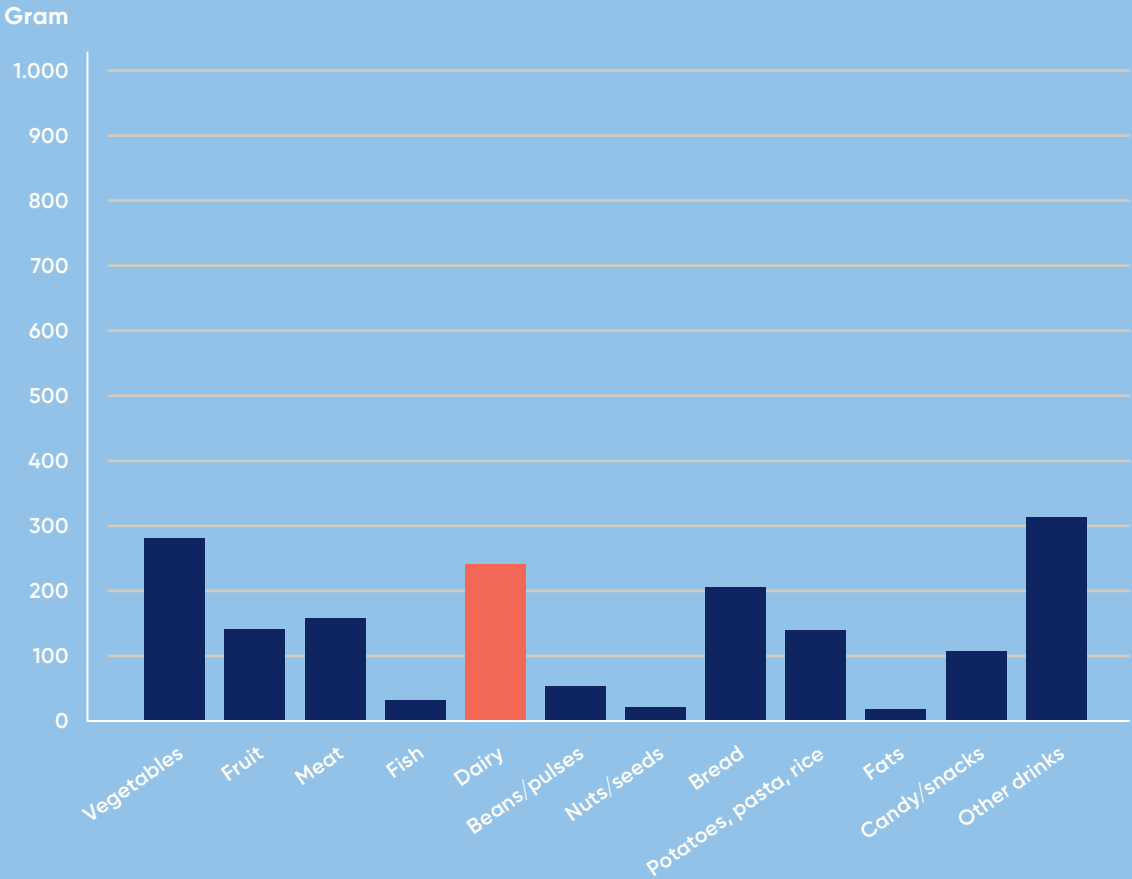
"Optimeal® and related linear programming tools could qualify the public debate. The common notion that animal-based foods always have a higher environmental impact than plant-based sometimes become too simplified. There are more consequences than what is usually presented by policy makers for instance. We need more nuances," he says.

Therefore, to Dr Peters, it is important that we treat the debate on sustainable food with respect and restrain from fast conclusions. We will have to keep the good things of a healthy, nourishing, affordable food pattern within the need to create an even more sustainable production.

"When you change diet patterns, it sometimes comes with totally unexpected consequences. It is a delicate balance between economic, cultural, ecological and health aspects. When you want to change the food system or consumption, you should take into account all these four factors. When one is ignored, you are doomed to fail. In addition, you must monitor the consequences critically. We tend to forget this," Dr. Stephan Peters concludes.



Standard food groups reorganised dairy combined



Optimeal takes reference in the average Dutch diets based on the Dutch National Food Consumption Survey and from September 2020, EU data is a part of the reference data. The model has so far included a life-cycle assessment of 208 products across food groups.

The model makes it possible to adjust the intake of varies food groups like bread, fish, fruit, vegetables, dairy and so on.



Dairy is part of most low emission diets, according to new research

Research study from the Commonwealth Scientific and Industrial Research Organisation in Australia (CSIRO) shows that nearly all Australian lower greenhouse gas emission diets include dairy. This indicates that dairy plays an important role in a healthy and sustainable diet says Dr. Brad Ridoutt, Principal Research Scientist at CSIRO.

The study recently published in European Journal of Nutrition examines a group of 1732 Australian adult diets with above average diet quality score and markedly lower GHG emissions (43 percent below the average).

"Analysing these diets, we found that 90 percent of the low emission diets contained dairy. This clearly demonstrates that you don't need to exclude dairy to have a diet with a lower impact," Dr Ridoutt explains.

In addition, the study showed that dairy foods are an important source of nutrients. Among these lower GHG emissions diets, those with higher levels of dairy intake were more likely to achieve

recommended intakes of a broad range of nutrients.

"The evidence points to dairy avoiders as missing out on nutrients. And this is not only because dairy foods are nutrient rich. We assessed the complete diet and a higher consumption of dairy foods seems to be associated with a more nutrient dense dietary pattern," Dr Ridoutt elaborates.

"These findings refute the argument that dairy must be excluded from low-emission diets"

Brad Ridoutt.

CSIRO

The CSIRO research study 'The role of dairy foods in lower greenhouse gas emission and higher diet quality dietary patterns' by Ridoutt, B.G., Baird, D. & Hendrie, G.A was published in European Journal of Nutrition April 10th, 2020.

"There are a lot of suggestions going around about lower GHG emission diets. Often, certain foods are excluded. The problem is that many of these diets are linked to poor nutritional and health indicators."

There is no such thing as the perfect diet

Dr Brad Ridoutt argues that all food items should be seen in the context of the complete diet. To argue any individual food product is sustainable or not is too simplified.

According to Dr Ridoutt this is the strength of the study – the investigation of actual diets and the enormous variation that exists.

"We looked at what real people eat. We didn't look at a fixed, categorized diets or a single food product. That would have no practical value. In reality, there is no perfect diet. A perfect diet is purely an academic concept."

Asked if you should include dairy in the diet if you strive to eat sustainably, Dr Brad Ridoutt replies: "There are many ways to eat a healthy and sustainable diet, and there needs to be flexibility and room for individual preferences. Eating healthy and sustainable does not demand excluding milk, cheese and yogurt. On the contrary these foods can be a critical source of nutrients in a sustainable diet."

Supporting data on results

When diets met the recommended intake of dairy foods described in the Australian Dietary Guidelines, 94% met the recommended intake of calcium, 97% met the recommended intake for protein and a similar percentage met the recommended intake of vitamin B12. When these diets contained low levels of dairy foods, only 5% met the recommended intake for calcium, 72% for protein and 47% for vitamin B12.



About Dr. Brad Ridoutt

Dr. Brad Ridoutt is a Principal Research Scientist with Australia's national science agency – The Commonwealth Scientific and Industrial Research Organisation (CSIRO). His expertise is in life cycle sustainability assessment in the agriculture and food sectors. Dr Ridoutt is engaged in a range of international processes relating to the standardization of sustainability assessment and environmental labelling.



Chapter 3

Facts of the European dairy sector

The European dairy sector

Facts

France

54 000 dairy farms

762 processing sites

63 dairy cows/farm on average

24.6 billion liters

Ireland

18 000 dairy farms

30 processing sites

76 dairy cows/farm on average

7.5 billion liters

Denmark

4 100 dairy farms

61 processing sites

127 dairy cows/farm on average

4.7 billion liters

Northern Ireland

3 311 dairy farms

12 processing sites

95 dairy cows/herd

2.4 billion liters

Belgium

6 756 dairy farms

45 processing sites

80 dairy cows/farm on average

4.6 billion liters

Netherlands

16 500 dairy farms

53 processing sites

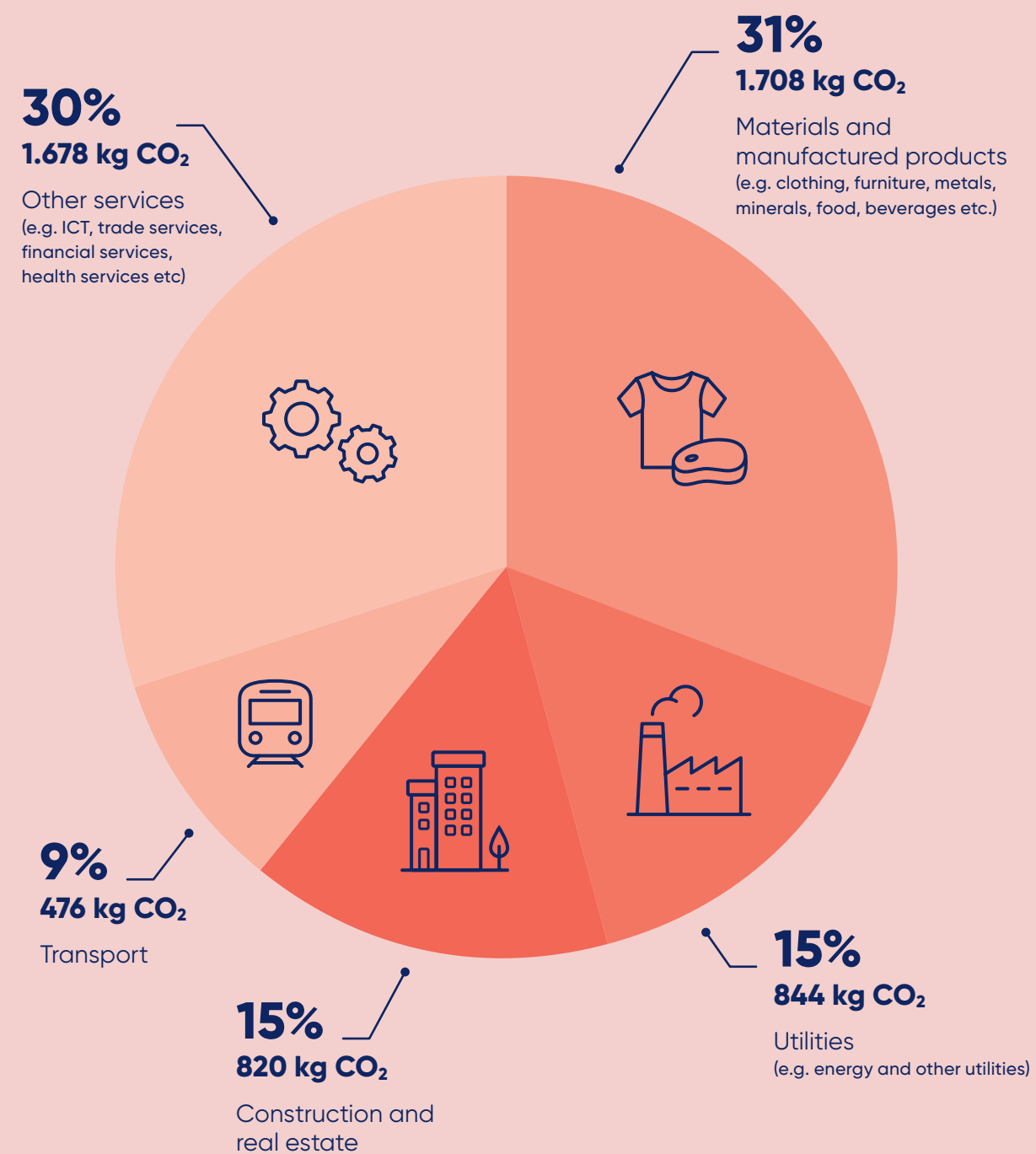
97 dairy cows/farm on average

13.9 billion liters

Emissions from european sectors



The carbon footprint of the average European citizen



Materials and manufactured products

