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Natural Capital Impact Group

Modelling better business:

Nestlé trials natural capital premium with UK dairy farmers

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For 800 years, the University of Cambridge has fostered leadership, ideas and innovations that have benefited and transformed societies. The University now has a critical role to play to help the world respond to a singular challenge: how to provide for as many as nine billion people by 2050 within a finite envelope of land, water and natural resources, whilst adapting to a warmer, less predictable climate.

The University of Cambridge Institute for Sustainability Leadership (CISL) empowers business and policy leaders to make the necessary adjustments to their organisations, industries and economic systems in light of this challenge. By bringing together multidisciplinary researchers with influential business and policy practitioners across the globe, we foster an exchange of ideas across traditional boundaries to generate new solutions-oriented thinking.

The Natural Capital Impact Group

The Natural Capital Impact Group is a global network of companies, working collaboratively to determine how business can sustain the natural world and its resources through its strategies and operating practices, convened by the University of Cambridge Institute for Sustainability Leadership.

The Group is composed of progressive companies, including market leaders and household names, with significant land footprints and dependencies upon natural capital. The group members co-develop, deploy and embed innovative and enterprising approaches to protecting soil, water and biodiversity in their businesses. In this way companies can enhance the natural environment and access new market opportunities, generate competitive differentiation, and manage risks.

Nestlé

Nestlé is the world's largest food and beverage company, with more than 2,000 brands and a presence in 191 countries. The company's purpose is enhancing quality of life and contributing to a healthier future. Three overarching ambitions for 2030 guide Nestlé's work and support the achievement of the UN Sustainable Development Goals. They are: help 50 million children live healthier lives; help to improve 30 million livelihoods in communities directly tied to Nestlé's business activities; strive for zero environmental impact in its operations.

Publication details

Disclaimer
The opinions expressed here are those of the authors and do not represent an official position of CISL, the University of Cambridge, or any of its individual business partners or clients.

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Modelling better business

This series of case studies, underpinned by sound research, provides examples of how large multinational companies are protecting natural capital on the ground, and the business and societal benefits this delivers.

Our goal is to create compelling commercial cases for action, in sectors reliant on natural capital, which companies may learn from and potentially replicate.

Natural Capital Impact Group

A global network of companies, working collaboratively to determine how business can evolve its strategies and operating practices to sustain the natural world and its resources, while creating new market opportunities and commercial benefits.

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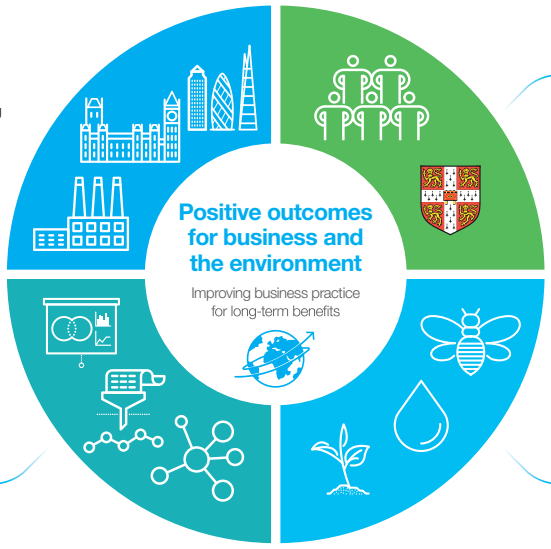

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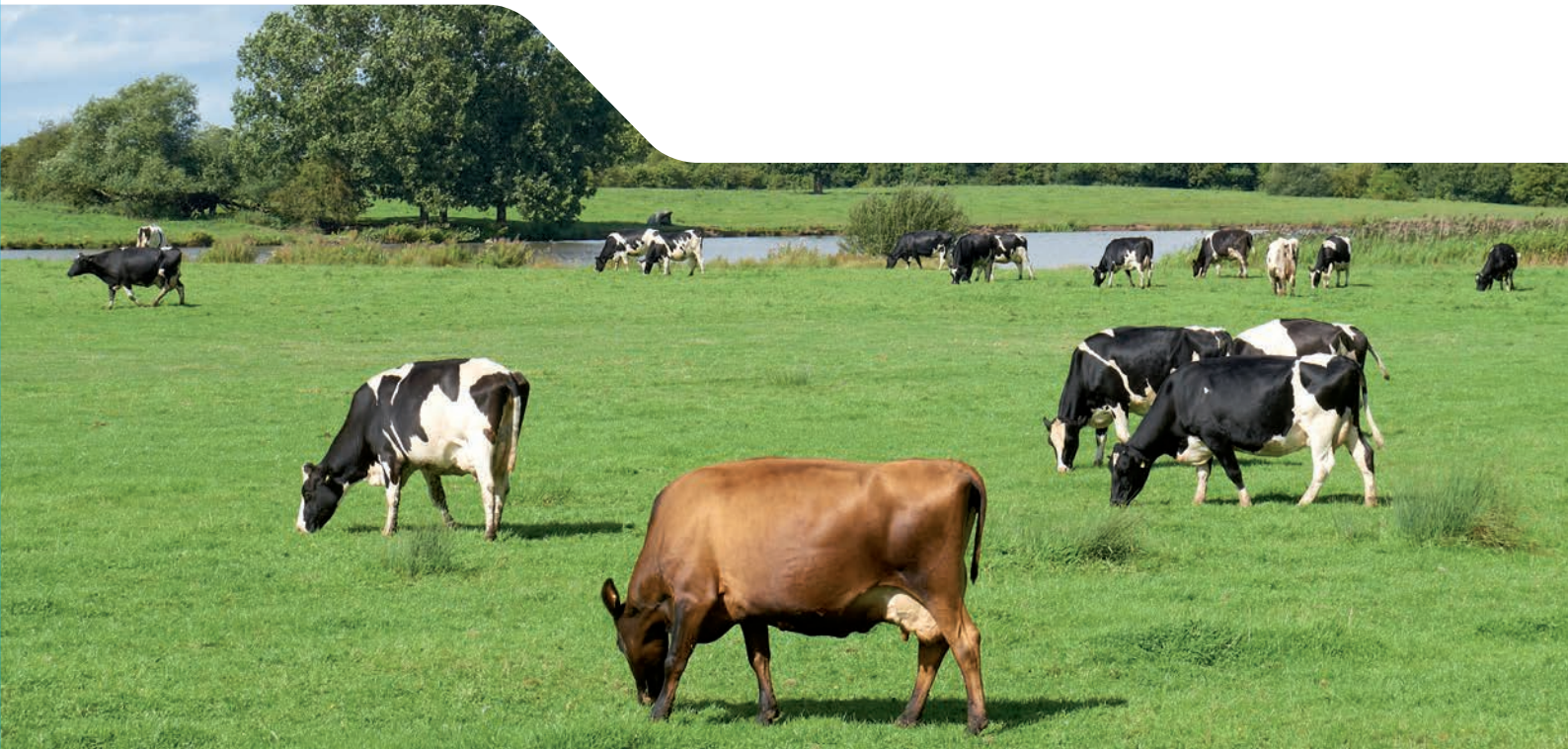


Modelling better business: Nestlé and its dairy farmers

Paul Barrow, his father and uncle spent mid December planting wildlife-attracting hedgerows on their 265-acre dairy and sheep farm in Cumbria's Eden Valley. In return, they would start the new year with a sustainability bonus from food giant Nestlé, which buys 90 per cent of the farm's milk supply.

"It's a win–win all round," says Barrow, a third-generation farmer whose land already boasts red squirrels, and a river designated a Site of Special Scientific Interest (SSSI) as a habitat for rare white clawed crayfish. "The sustainability bonus covers the investment we make in planting new hedgerows, and they protect against sediment run-off into our stream and potential disease spread as well as attracting all kinds of wildlife and nesting birds." Paul and the other Nestlé farmers are members of dairy co-operative First Milk, who are a strategic partner of Nestlé UK.

The scheme, which includes 99 farmers in Cumbria and Ayrshire, is an innovative response by the world's largest food company to growing pressures on the natural capital which underpins its business. All Nestlé's UK dairy farm suppliers, producing 1 per cent of the nation's milk, are involved, receiving per-litre price premiums for taking practical measures that enhance biodiversity and protect watercourses.

Against a backdrop of topsoil erosion and species decline across UK farmland, Nestlé is making the investment to protect its milk supply, which supports popular products including KitKat and Nescafé prepackaged drinks for domestic and overseas markets.

Each farmer chooses from a range of practical interventions, which Nestlé identified with the Game & Wildlife Conservation Trust and benchmarked against a 'top ten' list of sustainable dairy practices from the University of Cambridge Institute for Sustainability Leadership's (CISL) Natural Capital Impact Group (NCIG). "As a member of the NCIG, we were in prime position to draw on their research for our farmer programme," says Andy Griffiths, Head of Environmental Sustainability, Nestlé UK and Ireland. "Given the risks and challenges to our supply chain from the depletion of natural capital, the opportunity was too good to pass by."

Launched in 2017, Nestlé's UK trial is a first for the global dairy industry. It's an innovation the company hopes to build on elsewhere as it scales efforts to reduce its environmental risks and impacts and promote natural capital partnerships across sectors. For CISL and its corporate partners, the scheme offers an exciting testing ground for action-driven research that could help usher in a new era of sustainable UK dairy farming.

The global context

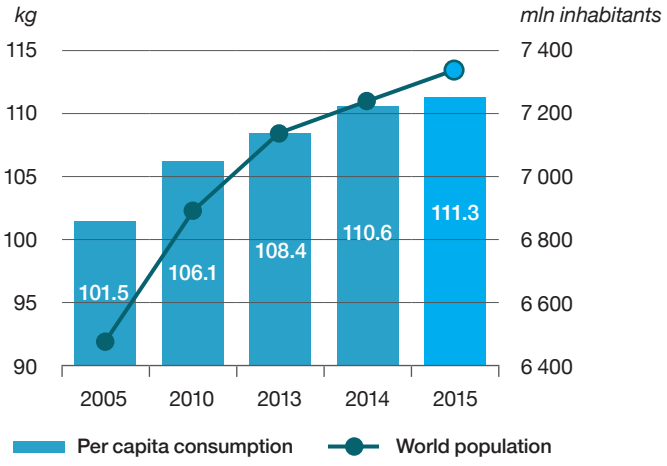
Dairy farming is a global industry that provides nourishment for almost every person on Earth. Most countries have a domestic dairy industry, and the global market in which Nestlé is a leading player is worth more than $330 billion[1].

The sector contributes to the resilience and economic viability of farmers and rural communities worldwide, with around 150 million small-scale dairy households, equivalent to 750 million people, engaged in milk production. In East Africa and the Near East alone, the UN Food and Agriculture Organization (FAO) estimates that for every 100 litres of milk produced locally, up to five jobs are created in related industries[2].

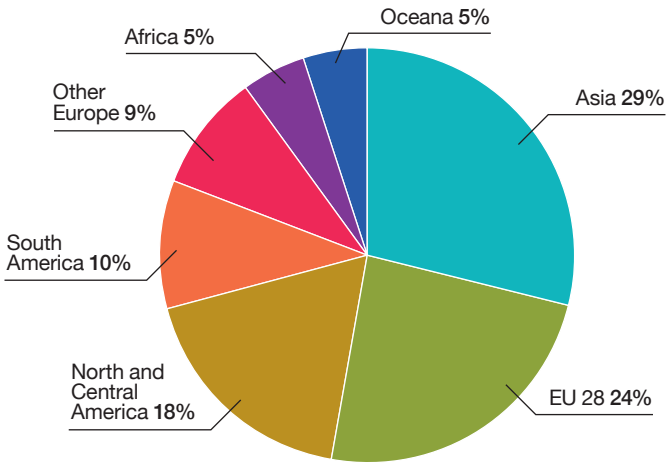
However, while many of the world's dairy farmers are small-scale producers, like the Barrows, industrial production and conglomeration is on the rise along with intensified farm methods. Consumer demand for milk, butter and cheese is surging, driven by population growth, urbanisation and the westernisation of diets in emerging countries[3].

Between 2005 and 2015, global milk consumption per person rose 10 per cent, to 111.3kg a year (see graph), and the Organisation for Economic Co-operation and Development (OECD) and FAO expect 12.5 per cent more growth by 2025[4]. The industry underpins food security worldwide, with 96 per cent of adults getting essential nutrients from protein-rich dairy products[5]. Demand is rising fastest in emerging markets such as those in Asia (see graph), providing an opportunity to influence more sustainable farming practices as domestic dairy industries grow.

Per capita milk consumption and population



Cow's milk production (share per region)



Source: World Dairy Situation, 2016, International Dairy Federation

Natural capital and the dairy industry

Dairy/livestock farming natural capital impacts: by the numbers[7]

- **26%:** of ice-free land on Earth used for livestock grazing
- **33%:** of cropland used for livestock feed production
- **988 million:** approximate global cattle population
- **270 million:** approximate global dairy cow herd
- **818 million tonnes:** global milk production in 2015
- **2.5 billion tonnes:** dry feed dairy cow consumption per year, 77% of which is grass and straw
- **10 million:** hectares of arable land eroded or degraded every year

To meet this rising consumer demand, the dairy sector depends on vast amounts of natural capital, including land, healthy soils and plentiful, clean water supplies.

Already, according to the FAO, livestock farming is one of the biggest drivers of land use change around the world. Thirteen billion hectares of forest alone are converted every year into pasture or to grow food crops and livestock feed. This leads to a domino effect of detrimental impacts – on regional water availability, soil fertility, biodiversity and climate change[6].

The implications for maintaining and improving food production to meet the world's needs are ominous. Perhaps most alarming for the future of agriculture, unsustainable farming methods are stripping topsoil of nutrients at ten to 40 times the rate they can be replenished by nature. Intensive dairy herds also compact soil, affecting its quality, and livestock feed production depletes both soil quality and biodiversity. Dairy cows and their manure also produce greenhouse gas emissions, and poor management of manure and fertilisers can degrade local water resources. The box above provides a snapshot of the natural capital impact both from the global livestock herd, including sheep, beef and dairy cattle, and goats, and specifically from the dairy industry.

While the dairy industry is only one among many drivers eroding Earth's natural capital at an unprecedented pace, its future depends on maintaining healthy ecosystems for its farmer suppliers. Recognising this, the sector's leading players are exploring how to secure a long-term milk supply and meet growing consumer demand while managing their natural capital risks through more sustainable farming practices and models.

Launched in 2014, the Dairy Sustainability Framework enables member companies representing "a large percentage" of globally traded milk volume to align their sustainability efforts and agenda. Implementing members, including Nestlé, commit to programmes and targets prioritised from among 11 sustainability criteria, including greenhouse gas (GHG) mitigation, improved soil and water management and safeguarding biodiversity.

The UK context

The UK is well placed to address the imperative for more sustainable dairy farming. As the third largest milk producer in the EU and tenth largest in the world, its dairy industry has huge potential to influence natural capital domestically and pilot initiatives that its counterparts elsewhere could adopt. And the need to improve farming models is urgent. The UK faces a natural capital crisis, using resources at five times their sustainable rate, with topsoil eroding by 2.2 million tonnes a year and species declining by 50 per cent over the past 40 years[8].

While milk accounted for 17.8 per cent of UK agricultural output in 2014, with a market value of £4.6 billion[9], dairy farming has been hard-hit by low prices and dwindling profit margins. With the UK government's release of a 25 Year Environment Plan to improve the environment within a generation, the dairy industry has a prime opportunity to partner with government and other stakeholders to reinvent its future.

As both the global and UK dairy industries work to implement more sustainable practices, this NCIG case study highlights practical, farm-based solutions that make commercial sense while helping reverse declines in natural capital.

Changing the paradigm: toward sustainable dairy farming

Sustainable dairy farming is in everyone's interests – consumers, farmers and the broader dairy supply chain including food companies and supermarkets.

By working with farmers, businesses throughout the dairy value chain can support interventions that protect milk yields and reduce their supply chain risks from natural capital depletion. And by paying farmers not just to produce raw materials but also to act as stewards of natural capital, they can protect agricultural assets vital to their companies' performance and long-term future.

So what kind of farming practices can support this shift, enabling dairy farming's often negative impacts on soil, water and biodiversity to become net positive impacts, measurable as natural capital benefits? In the UK, the University of Cambridge Institute for Sustainability Leadership (CISL) and its Natural Capital Impact Group (NCIG) business partners sought to answer this question with action-oriented research.

While the domestic dairy industry has committed to sustainable farming practices through initiatives like Dairy 2020, these generally lack practical guidance for farmers on how to combat loss of natural capital. To plug this gap, six companies—Nestlé, Anglian Water, Glanbia, Lactalis McLelland, Volac and Yara—joined CISL in a Dairy Action Research Collaboratory to identify the most effective on-farm interventions.

After reviewing more than 90 management practices around the world, the companies chose ten to evaluate in detail for positive impacts on waterways, biodiversity and soil quality on dairy farms. The resulting blueprint for farmers, Commercial Gains from Addressing Natural Capital Challenges in the Dairy Sector, was launched at the House of Lords in 2016.

> "We are practically testing interventions with our dairy farmers in order to understand the multi-factoral impact across soil, water and biodiversity as well as the likely benefits and beneficiaries of these types of intervention, beyond just the agri-food sector. This is a crucial enabling step to developing a broader shared interest model."
>
> **Andy Griffiths, Head of Environmental Sustainability, Nestlé UK and Ireland**

Top ten interventions for dairy farmers

Each of the ten tested interventions assessed by the NCIG, and listed below, were evaluated by their implementation costs and impact on milk yield as well as environmental effectiveness. The measures range from complex and costly practices such as housing and feeding cattle indoors year-round to simple, low-technology solutions such as fencing in waterways to reduce cattle manure and sediment loads in rivers. (See Appendix for more detail.)

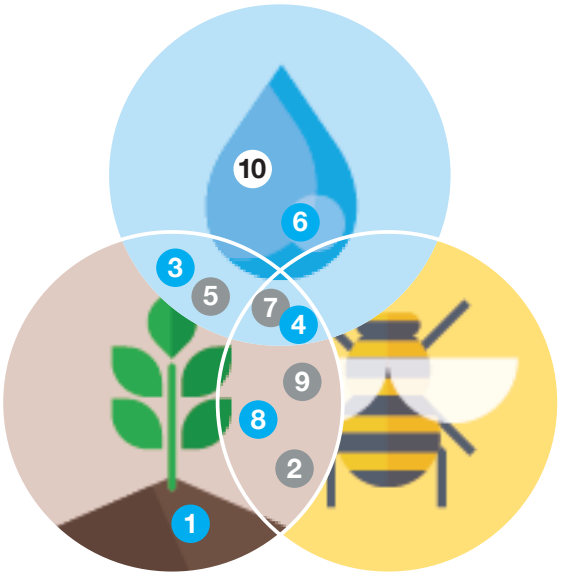
By presenting these best practices, in usable form, to dairy businesses, investors and policymakers, CISL and NCIG seek to mobilise much-needed investment to rejuvenate the industry and, over time, take sustainable dairy farming to scale. The suitability of options will vary by farm and depend on factors including physical conditions, cost–benefits and incentives.

In 2017, Nestlé became the first dairy industry player and NCIG member to test the menu of interventions on the ground, with its 99 farmer suppliers in Ayrshire and Cumbria. The company's ultimate goal is to develop and test a 'shared interest model' where businesses from a range of affected sectors can jointly support such natural capital interventions, reaping benefits in the form of cost efficiency or risk reduction.

> "The challenge for companies across the dairy value chain is to put our collective efforts behind a handful of evidence-based on-farm practices that will lower costs, increase productivity and protect the natural assets upon which dairy depends. This is the only way that we can guarantee a commercially viable dairy industry for the future."
>
> **Andy Richardson, Head of Corporate Affairs, Volac**

Summary of dairy farm practices to support natural capital[10]

1. Loosening of compacted grassland soils
2. Cereal-based whole-crop silage
3. Nitrification & urease inhibitors on pasture
4. Fencing waterways
5. Year-round housed dairy system
6. Anaerobic digestion of on-farm dairy wastes
7. Precision agriculture on pastures
8. Controlled traffic farming
9. Tree shelterbelts
10. Fertilising pasture with selenium



The ten analysed dairy farming interventions are grouped by their positive impacts on natural capital. Numbers in grey indicate limited evidence for one or more of water, biodiversity or soil. Numbers in white indicated that trials found no evidence that it degrades natural capital, but no evidence that it improves it either (ie neutral)

The company context

The Nestlé Group is the world's largest food and beverage company, purchasing nearly 1 per cent of global agricultural production. By sales value, it is also the largest milk company, sourcing more than 12 million tonnes of fresh milk equivalents annually, from 600,000 mostly small-scale farmers in more than 30 countries[11].

As population growth fuels food demand, the company faces the challenge of finding ways to meet global calorie needs, predicted to be 69 per cent higher by 2050 than in 2006 from increasingly degraded natural resources. In response, its leadership has increasingly linked sustainability to corporate purpose, committing to strive for zero environmental impacts from its operations by 2030. Across the Group, all social and environmental initiatives must support the company's purpose "to enhance quality of life and contribute to a healthier future" by making a positive impact for individuals and families, for Nestlé's communities and/or for the planet.

For the past decade, Nestlé has cultivated direct relationships with its farmer suppliers, linking business benefits to social impact and sustainable agriculture through its Creating Shared Value approach. Responsible stewardship of natural resources is a cornerstone of this strategy. The company's Commitment on Natural Capital, which dates from 2013, specifies "providing guidance to farmers on sustainable agricultural practices to manage and conserve water and soil [and] conserve and restore biodiversity[12]."

Nestlé UK and sustainable dairy sourcing

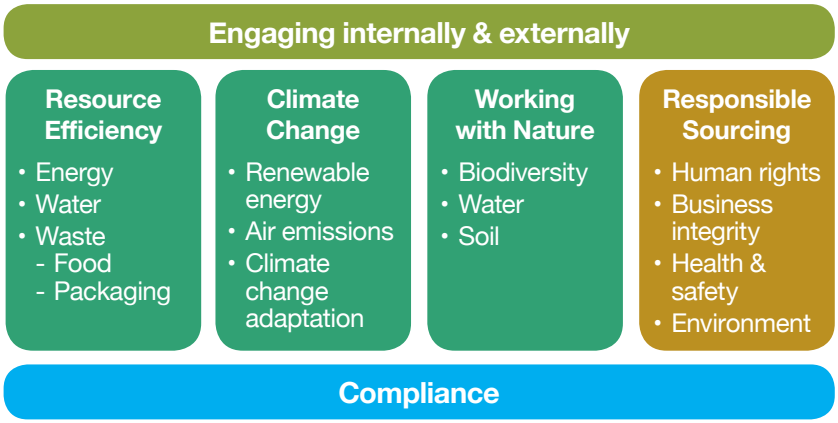
Nestlé UK and Ireland's sustainability vision and approach, shown below, adapts this global framework to UK circumstances. The company seeks to provide food sector leadership through collaboration with industry, government and NGO partners.

In his role as Head of Environmental Sustainability, Andy Griffiths has pursued resource stewardship activities that help secure the pipeline for Nestlé UK's product sourcing priorities – including dairy, cereals, sugar, meat and eggs. These "Working with Nature" programmes (see graphic) aim to improve farmers' management of biodiversity, water and soil with support from Nestlé and expert partners. They also align with Nestlé UK's Milk Plan Vision to develop long-term relationships with the 99 farmers who provide essential ingredients for two key brands, KitKat and Nescafé.

Under this plan, which builds on its work with NCIG, the company is enlisting other partners to train its milk suppliers in lean farming methods, environmental sustainability and animal welfare. Key partners in this collaborative approach are the Game & Wildlife Conservation Trust, a national leader in wildlife management techniques, which co-ordinates all the farmer engagement, and the First Milk dairy co-operative which helped develop the programme and engage member farmers. Dairy consultancy EFFP also helped structure the company's UK Milk Plan. The goal of all this effort and co-ordination is to improve UK dairy farmers' livelihoods and deliver top-quality milk using sustainable farming practices.

In 2017, Griffiths and his colleagues expanded the existing training programme by offering farmers the option of also receiving a 'sustainability bonus' in return for trying out natural capital interventions identified by the NCIG's dairy research. The idea took root, Robin Sundaram, Nestlé UK's Sustainable Sourcing Lead explains, because it aligned well with existing UK activities and partnerships while supporting the company's global sustainability purpose and goals. "We structured the initiative to try and create solutions to UK farming's specific challenges and needs but also to inform our company's global sustainability strategy and programmes."

Vision : Establish Nestlé as a sustainable, low carbon business, providing industry leadership through collaboration



Testing the approach

In late 2016, Nestlé approached its dairy suppliers, who collectively own around 14,778 hectares of land and 14,822 dairy cattle, with the concept of a price premium for investing in practices that improved their soil, water and biodiversity.

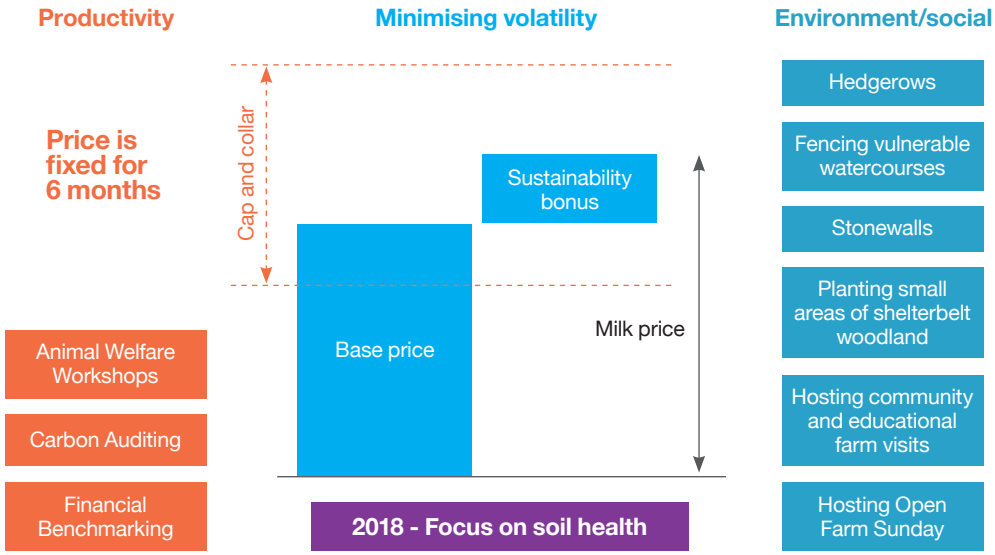
All 99 farms are members of the First Milk co-operative, which supplies the Nestlé milk processing factories at Girvan in Ayrshire and Dalston, Cumbria. Nestlé proposed replacing the varying milk price it negotiated monthly with First Milk with a base price, with the option of earning an additional sustainability bonus or price premium per litre. To gain the bonus, farmers would earn points awarded, up to a cap, for a range of natural capital interventions they could choose from.

At the same time, the company introduced a premium for productivity, with farmers taking part in carbon auditing and financial benchmarks to inform operational efficiencies.

Farmers receive carbon auditing elements of the bonus after they complete a greenhouse gas emissions calculator tool and attend a workshop run by agricultural and environmental consultancy ADAS on how reduce on-site emissions. They are eligible for separate bonus elements after they carry out financial benchmarking with the Agriculture and Horticulture Development Board (AHDB), actively participate in benchmarking groups, and attend animal welfare and antibiotics courses run by Edinburgh Vets.

This holistic approach to sustainability interventions is illustrated below.

Sustainability price premium: Nestlé's approach



In devising the nuts and bolts of the sustainability premium scheme, Nestlé consulted closely with Natural England, the Environment Agency and Defra, as well as its farmers, whose buy-in was critical to success. After many meetings between the company, their dairy suppliers and the Game & Wildlife Conservation Trust, it was agreed to focus mainly on habitat and biodiversity interventions during 2017. NCIG's dairy research findings helped inform the choice of interventions as well as the points allocation for the different management activities.

Farmers could opt to choose from among options including repairing or top wiring dry stone walls, planting hedgerows or woodland, and fencing watercourses to prevent cattle manure pollution and bankside erosion. "It was the farmers' choice whether to take part and every one joined up," says Sundaram. "We weren't surprised because we'd consulted them closely in planning the programme, but we were certainly very pleased."

Securing natural capital in action

The nonprofit Game & Wildlife Conservation Trust, a national leader in wildlife management techniques, manages the programme and day-to-day farmer liaison on Nestlé's behalf. As a first step farmers reported existing coverage of hedgerows, stone walls, watercourses, ponds and woodland on their land. The Game & Wildlife Conservation Trust also mapped key habitats and species in the two regions, to inform the choice of interventions.

Each farmer then agreed an intervention plan, and sustainability bonus points total, which would build effectively on existing features and investments and be completed by year's end. The most popular options (see table above) included hedge planting or gap filling and fencing of restored hedges. Farmers cited multiple benefits to both wildlife and their livelihoods, including habitat for birds, mammals and invertebrates and feeding routes for bats as well as shelter for livestock and boundary protection against disease transmission.

Dairy farmer natural capital commitments 2017

Option	Amount
Hedge planting & gapping up (m)	14,952
Hedgelaying (m)	2,472
Top binding laid hedges	0
Stone wall repair (m)	1,341
Stone wall top wiring	2,602
Watercourse fencing (m)	19,521
Fencing restored hedges (m)	10,271
Fencing woodland (m)	0
Woodland planting (ha)	20
School / community visits	3

Farmers make the upfront financial investments in labour and materials themselves or negotiate loans from local banks. The price premium, per litre of milk supplied to Nestlé, is paid twice yearly in July and January. This was a fairer and more practical approach, according to Sundaram, than attempting to evaluate the actual natural capital impacts of each farm's activity. "At a farm level it is very difficult to measure direct impacts on a sustained basis, so we opted for payment for implementation," he explains. "All the farmers need to do is take photos before, during and after the work. There is a lot of trust involved, but we are confident these interventions by farmers will have a sustained positive impact on the sustainability areas we are looking to address."

One farmer's experience

Paul Barrow, who milks 180 pedigree Holstein cattle alongside 250 Lleyn sheep at Helm Farm in Ormside, was an enthusiastic adopter of Nestlé's innovative programme. The family farm already works with local Wildlife Trusts to protect the rare species within its grounds, with riverbank fencing of its SSSI beck and by limiting grazing in the woodland frequented by red squirrels. The price premium offered a means to scale up their existing efforts to protect biodiversity while improving the farm's resilience to natural capital risks.

The Barrows signed up to plant an additional 218 metres of hedgerow, including hawthorn and blackthorn, with trees planted every 25 metres. "There was a field boundary we wanted to secure to prevent potential disease spread and provide some shelter for the lambs," Barrow explains. "It's also by a stream, and hedgerows help limit sediment run off. So there were a lot of benefits for the farm, as well as for biodiversity."

While the specifics of the price markup farmers receive is proprietary, Barrow described it as a worthwhile economic benefit that he expects all the farmers will continue to take advantage of as the scheme rolls out over time. "Nestlé has been very conscientious about serving local needs and understands how each farm is different," he says. "Some farmers wanted to award more points to some of the activities, so they altered the weighting. The programme is in its infancy and we are all feeling our way together."

Scaling the programme

In 2018, Nestlé plans to offer farmers points for soil and water-specific interventions, developed with the Rivers Trust and the Game & Wildlife Conservation Trust. Over time, Sundaram expects farmer activity to cover "all or most of the ten NCIG evaluated practices to secure natural capital". A lot of the activities, he points out, are multi-impact, and will boost soil and water quality at the same time as likely improving animal health.

For Barrow, it's an exciting prospect.

> With Brexit coming, which means losing the EU Basic Payment Scheme, I think any future payments to UK farmers will more than likely be based on environmental work.
> **Paul Barrow, third-generation farmer**

Paul Barrow and his pedigree Holstein cattle, Helm Farm, Ormside.

What works and next steps

What Nestlé learned

A model that works
The price premium model works. One year in, says Griffiths, Nestlé views the natural capital pilot as a clear success. As the programme rolls out to cover soil management, the company will support soil testing that it expects will lead to improved nutritional planning and better milk yields and quality, more clearly linking environmental and commercial benefits. Turning the NCIG report's recommendations into action, says Griffiths, has shown them to be both practicable and popular with farmers. However, he acknowledged that the milk price premium that made the scheme attractive to Nestlé's farmers, "might be a financial challenge for some businesses" looking to replicate the model.

Scaling natural capital actions
As Nestlé continues to reform its "Working with Nature" model its goal is to scale natural capital conservation at a regional or watershed level.

To support this ambition, Griffiths and his team are using the experience gained with dairy farmers to lay the groundwork for a larger strategy that supports sustainable farming partnerships at a regional level. "We're using the premium price model as a short- to medium-term approach to deliver interventions that improve sustainable farming," he explains. "This is working very well on a one-to-one basis with our dairy farmers. But we also see it as an enabling phase for developing a shared interest system to support all types of agriculture. Our goal is to work with local governments and regional networks of businesses to protect our common interest in the health and performance of the landscapes in which we operate and source vital raw materials."

Together with partners including sustainability consultancy 3Keel, the Game & Wildlife Conservation Trust, the Rivers Trust and Catchment Sensitive Farming, Nestlé is developing a pilot for a catchment-based approach in Cumbria. Known as Landscape Enterprise Networks (LENS), this innovative approach is being designed by 3Keel and builds on NCIG's work with a range of partners.

Local and national governments' role
The pilot envisages public funds being provided for conservation interventions that provide public goods (such as flood prevention) along with top-up funding from other regional beneficiaries, including water utility companies, insurers and housing developers. For Griffiths, LENS offers the prospect of reversing natural capital decline nationwide over time. "It's the end goal of our work with dairy farmers in Cumbria and Ayrshire today."

What the Natural Capital Impact Group achieved

The UK dairy sector research enabled NCIG companies to collate the best available information on sustainable farming practices and present it to influential businesses, investors and policymakers. CISL shared the findings and approach with policymakers at a 2017 NCIG summit exploring post-Brexit agri-environment policy. It has also been leveraged to help shape Nestlé's "Working with Nature" model, along with input from important stakeholders including 3Keel, the Game & Wildlife Conservation Trust, the Rivers Trust and Catchment Sensitive Farming.

Given the uncertainties surrounding Brexit and the future of farming subsidies, such a collaborative approach is much needed to support UK agriculture and to inform the implementation of the government's 25-year plan. "By co-designing actionable research and relating it to company supply chains, the NCIG aims to mobilise the much needed investment and leadership to take these best practices to scale," says Gemma Cranston, Director, Natural Capital at CISL.

Next steps for the dairy industry

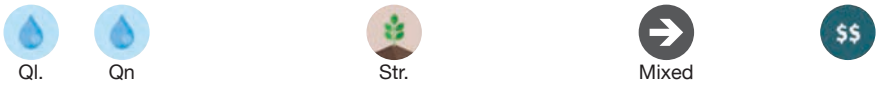
This case study represents the first insights into how a large, multinational company is using the NCIG-recommended interventions to the benefit of its supply chain and natural capital dependencies. The findings from the NCIG dairy project are available online for other companies in the dairy supply chain to test and scale in the UK. A summary graphic of the purpose, benefits and costs of each intervention is provided in the Appendix below. NCIG hopes others along the dairy industry value chain will take the research and this case study as an opportunity to develop their own approaches to support farmers, their business supply chains and natural capital.

For further information or advice on our work in this area, please contact Dr Gemma Cranston at Gemma.Cranston@cisl.cam.ac.uk.

Appendix

Appendix: The Natural Capital Impact Group's top ten dairy interventions by cost and impact[10]

1. Loosening of compacted grassland soils

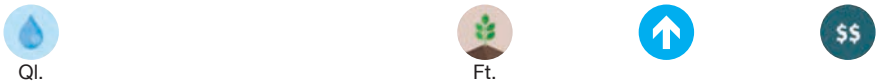


Definition: Compacted soil layers within pastures are mechanically broken up using aeration, subsoiling or ripping tools.
Purpose: Increase rainwater infiltration and percolation, root growth and faster incorporation of surface-applied nutrients. Reduced water logging of soils can also help lower nitrous oxide emissions.

2. Cereal-based whole-crop silage

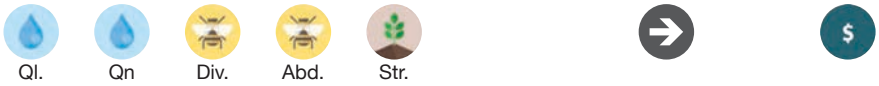
Definition: Cereals such as wheat or barley are grown for silage instead of grass or maize.
Purpose: Provide food and habitat resources for increasingly scarce farmland birds.

3. Nitrification & urease inhibitors on pasture



Definition: Chemical inhibitors are applied to pasture by broadcast application or incorporation into fertiliser treatment.
Purpose: Reduce greenhouse gas emissions and nitrate leaching, whilst increasing fertiliser efficiency and yields.

4. Fencing waterways

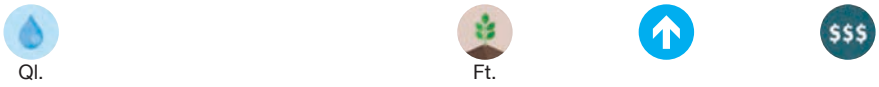


Definition: Fencing is constructed alongside waterways to reduce access by cattle.
Purpose: Reduce faecal deposition of pollutants into streams and reduce erosion of banks, which increases sediment loads.

5. Year-round housed dairy system

Definition: Farming system is converted to one in which cows tend to be housed year-round, do not graze outside and require high nutrient and energy inputs.
Purpose: Increase milk yields and operational efficiency, whilst controlling emissions/leaching from slurry captured indoors.

6. Anaerobic digestion of on-farm dairy wastes



Definition: Organic matter in dairy slurries and effluents is broken down by bacteria to generate methane and digestate.
Purpose: Produce biogas for electricity or heat and digestate for use as a fertiliser whilst reducing odours, wastewater treatment costs and greenhouse gas emissions.

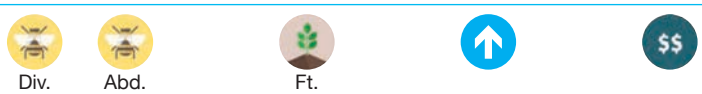
7. Precision agriculture on pastures

Definition: Farming practices are adopted that increase the scale of resolution at which the needs of crop units are met by, for example, measuring and responding to soil fertiliser needs at sub-field scales.
Purpose: Increase the efficiency with which fertilisers are used to increase productivity, reduce variable costs and reduce unnecessary losses of agrochemicals to the environment.

8. Controlled traffic farming

Definition: Traffic is concentrated onto permanent wheel lanes and separated from the zones in which crops are grown.
Purpose: Reduce over compaction of soils and direct damage to the grass sward.

9. Tree shelterbelts



Definition: Establishing a narrow strip of trees that provide a sheltered area in the lee of the wind.
Purpose: Reduce ammonia emissions when used around livestock housing or slurry pits or to provide leeward shelter to livestock when used around pastures.

10. Fertilising pasture with selenium

Definition: Application of the selenium, an essential nutrient, directly to pastures for uptake in cow diets.
Purpose: Increase the amount of selenium in pasture, which is beneficial for both animal and human health through improved immune system response, inhibition of prostaglandins, reduced tumour growth rates, and increased fertility.

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Head Office
1 Trumpington Street
Cambridge, CB2 1QA
United Kingdom
T: +44 (0)1223 768850
E: info@cisl.cam.ac.uk

EU Office
The Periclès Building
Rue de la Science 23
B-1040 Brussels, Belgium
T: +32 (0) 2 894 93 19
E: info.eu@cisl.cam.ac.uk

South Africa
PO Box 313
Cape Town 8000
South Africa
T: +27 (0)82 829 6852
E: info.sa@cisl.cam.ac.uk

Design: adrenalinecreative.co.uk