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Farm Zero C Project

# Supporting Sustainable Innovation in Agriculture



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# Introduction

Diarmuid Donnellan, AIB's Head of Sustainability for Agri, Food and Fisheries provides an update on the progress to date on the Farm Zero C project. The project aims to make the farm climate neutral by 2027 and in the process develop and implement new technologies to support the Agri sector reduce its greenhouse gas emissions and increase the quality and quantity of farm biodiversity. AIB is the exclusive financial partner to the project. Sustainable communities is one of AIB's five strategic pillars and our Agri customers are at the heart of our sustainable communities. We recognise that innovation is required to support transition. Farm Zero C is just one of the ways in which we are supporting innovation.

The Farm Zero C project is a collaboration that aims to create a climate-neutral, economically viable dairy farm. Combining technologies and practices it reduces greenhouse gas emissions and enhances farm productivity and resilience. It adopts a holistic approach to reduce greenhouse gas emissions and increase the health and resilience of the farm. The aim of the project is to be a beacon for sustainable agriculture and provide a bright future for farmers and rural communities.

The collaboration involves AIB, Carbery, BiOrbic, Shinagh Estates, Teagasc, University College Dublin (UCD), Trinity College Dublin (TCD), University College Cork (UCC), Munster Technological University (MTU), Dairy Research Ireland (DRI), Science Foundation Ireland (SFI) who are the lead funder of the project and other partners.

The project involves research at Shinagh Farm, a working dairy farm milking 250 dairy cows on 102 hectares (ha). The farm operates under a joint programme between Teagasc and Carbery, and is owned by the four West Cork Co-ops (Drinagh, Bandon, Barryroe, and Lisavaird) who together make up the Carbery group.



**Diarmuid Donnellan**

AIB, Head of Sustainability for Agri, Food and Fisheries

## Project Goals and Objectives

The aim of the Farm Zero C project is to create an economically viable climate neutral dairy farm by undertaking a programme of work, targeting:

- Life Cycle Assessment - analysing the total environmental inputs and outputs on the farm to understand overall carbon emissions and to establish where savings can be made.
- Animal Emissions
- Breeding and Animal Health
- Soil and Grassland
- Biodiversity and Natural Capital Accounting
- Water and Air Quality
- Renewable energy
- Green Biorefinery and Anaerobic Digestion.

The project aims to demonstrate the latest best practice advice to support carbon mitigation on a large-scale grass-based dairy enterprise while providing insights into the profitability and sustainability of this type of farming system.

The project is supported by 10 monitor dairy farmers across the West Cork Carbery catchment. These farmers are early adopters of the technology piloted in Farm Zero C and are instrumental in supporting peer to peer learning across the farmer base. Allied to the goals of the Farm Zero C project these monitor farmers are seeking to reduce their carbon footprint, improve or maintain overall farm biodiversity and improve air and water quality on their holdings.

# Overview and Progress

## Farm Performance

In 2023, Shinagh Estates Farm milked 243 cows on 102 hectares. The herd ranks in the top 1% EBI (Economic Breeding Index) in Ireland, producing 458 kilograms of milk solids (kgsMS) per cow (milk solids, which, is a representation of kgs of protein and fat produced in a quantity of milk). Approximately 90% of calves are born within six weeks with the replacement heifers contract reared. All beef calves are raised on the Tipperary Dairy Calf to Beef Demonstration Farm, a joint initiative between Dawn Meats, Shinagh Estates and Teagasc. The farm uses sexed semen from high economic breeding index (EBI) bulls to breed it's replacements, while the rest of the herd uses semen from high value dairy beef index (DBI) bulls.

The farm manager Kevin Ahern (pictured below) has been a keen adopter of new technology and management practices to support the projects aims around carbon reduction.

There has been a marked increase in the level of environmentally friendly clover incorporated into the paddocks since the start of the project, with white clover included on the grazing ground and red clover on the silage ground.

“Initially, I was slightly nervous around the potential impact the reduction in chemical nitrogen application was going to have on our ability to maintain our grass growth. I have been pleasantly surprised with the impact the introduction of clover has had in supporting grass growth, reducing our chemical nitrogen usage, reducing input costs, and maintaining high levels of quality forage grown on the farm.”

The farm now has over 21% of the grazing platform sown under multispecies sward (perennial ryegrass, clover, plantain and chicory). Over 75% of the grazing platform has had clover incorporated into the sward with around 60% containing sufficient clover cover of 20% or greater.

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**Kevin Ahern**  
Shinagh Farm Manager

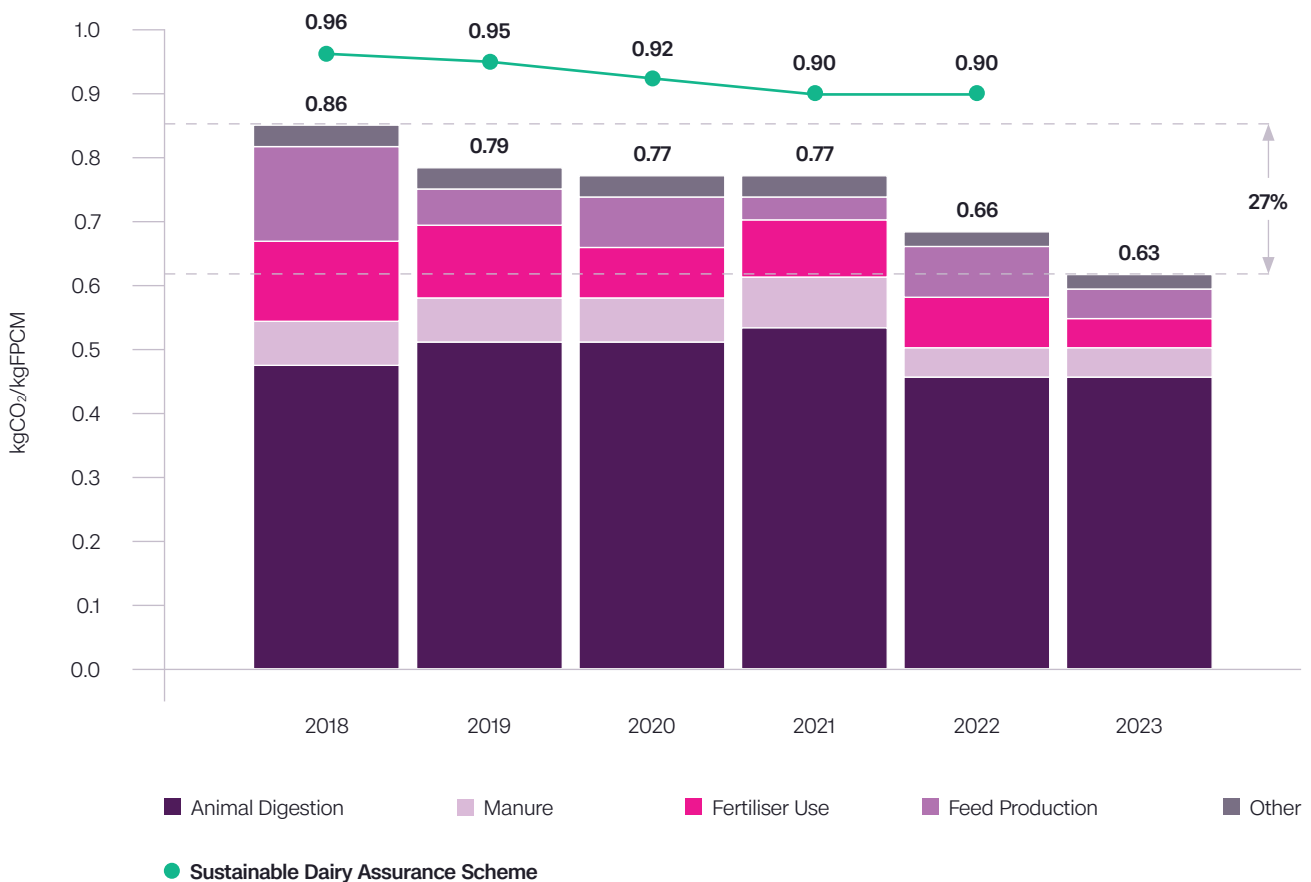
## Carbon Emissions Reduction

As a result, there has been a 27% reduction in the carbon footprint of Farm Zero C over six years (2018 to 2023).

This is represented as an emission intensity factor in terms of kilograms (kgs) of CO<sub>2</sub>eq per kg of fat and protein corrected milk. (kg/CO<sub>2</sub>/kgFPCM). In 2018, Farm Zero C had a carbon footprint of 0.86kg/CO<sub>2</sub>/kgFPCM and the average across the sustainable dairy assurance scheme nationally was 0.96kg/CO<sub>2</sub>/kgFPCM. Now, it has reduced by 27% from 0.86kg/CO<sub>2</sub>/kgFPCM to 0.63kg/CO<sub>2</sub>/kgFPCM (see graph below).



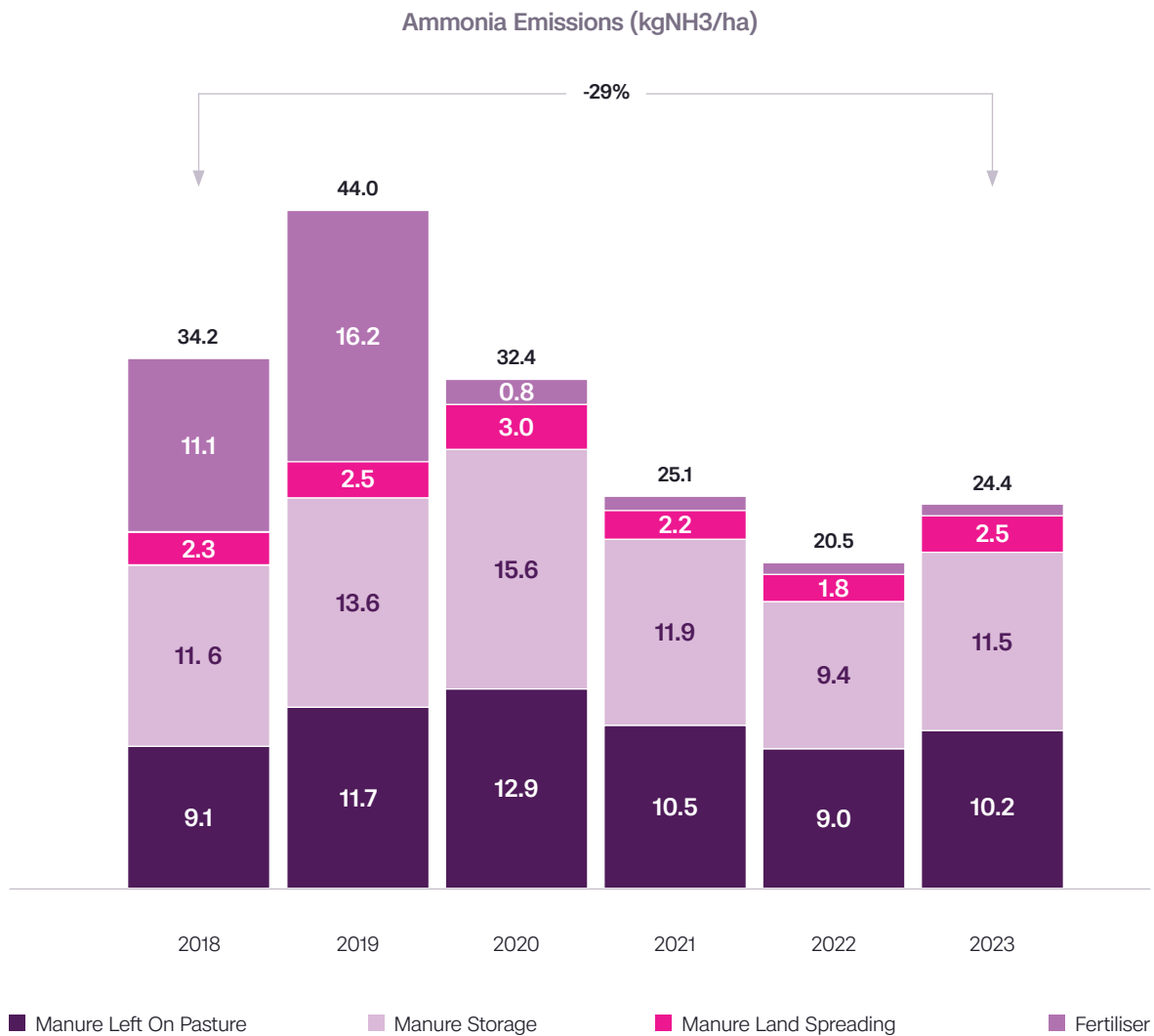
Shinagh Carbon Footprint (kgCO<sub>2</sub>/kgFPCM)



## Ammonia: Air quality

Ammonia is an air pollutant gas and affects overall air quality. Ammonia (NH<sub>3</sub>) comes mainly from management of animal manures (housing, slurry storage and land spreading) but also from grazing animals, and finally from spreading of chemical fertiliser. There are a number of technologies being undertaken on Farm Zero C to reduce the ammonia impact of the farm. Almost all of the chemical nitrogen fertiliser spread on the farm (96.5% in 2023) is now protected urea (46% N).

This supports a reduction in ammonia emissions by over 70%, it has also proven cost effective per kg of chemical nitrogen applied with equivalent amounts of grass grown. All slurry on the farm is spread using LESS technology - (low emission slurry spreading) through a trailing shoe which has been proven to cut ammonia emissions by half while also improving the nutrient use and plant uptake of the slurry.



## Methane (CH<sub>4</sub>)

Methane from enteric fermentation is the largest contributor to the farm's carbon footprint. When microbes decompose and ferment food and fibres in the digestive tract of the ruminant animals, they produce energy and nutrients for the animal, and release methane from digestible energy loss. This digestive process is known as enteric fermentation and is one of the important sources of methane from livestock. It is estimated that 90–95% of enteric methane is expelled from the rumen in the breath of the animal (eructation) with the remainder a product of flatulence.

To address this, feed additives like Bovaer (3NOP) have shown a reduction in methane emissions during housing. The goal is to identify a year-round feed additive that can mitigate methane emissions effectively. Methane emissions from stored slurry constitute about 7% of the farm's carbon footprint. An automated dosing system using GasAbate by Glasport Bio has been implemented to enhance the effectiveness of slurry, reducing both methane and ammonia emissions.

## Nitrous Oxide (N<sub>2</sub>O)

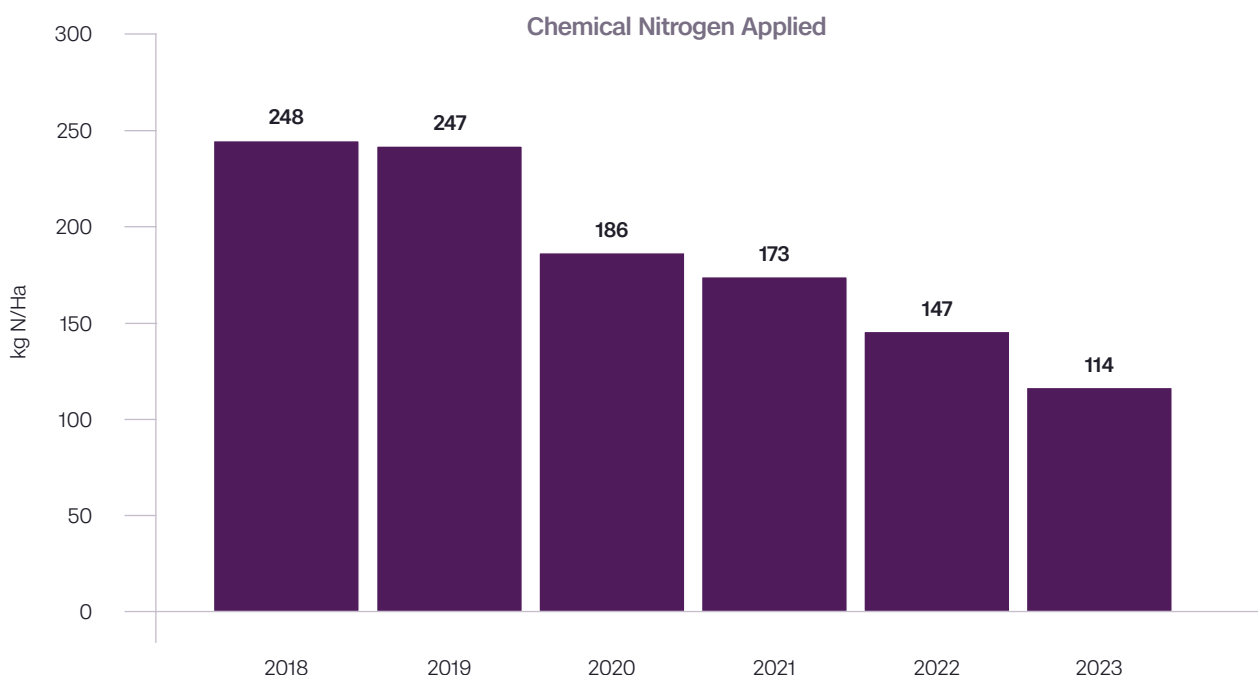
Nitrous oxide (N<sub>2</sub>O) is a powerful greenhouse gas (GHG) and agriculture produces 90% of N<sub>2</sub>O emissions in Ireland. The main contributions are:

- through the application of chemical fertilisers on pastures (38%)
- the deposition of animal excreta during grazing (23%)
- manure management, slurry storage & spreading (14%).

Nitrous oxide (N<sub>2</sub>O) is also produced in the soil through microbial processes which utilize nitrogen (N) from the above agricultural practices. The rate of nitrogen lost from grassland largely depends on the environmental conditions which favour microbial activity

such as wet soil conditions, major rainfall events, high soil temperatures/drought conditions.

The farm has significantly reduced chemical nitrogen use from 248 kg/ha in 2018 to 114 kg/ha in 2023, a 54% reduction. However, the farm did have to buy in some silage in 2023 to supplement winter feed. The farm aims to spread under 150kg of chemical N/ha annually. This reduction has been achieved by incorporating clover into grassland, with 75% of the grazing platform now consisting of grass-clover swards. Additionally, 97% of the chemical fertiliser used is protected urea, which reduces nitrogen losses and is more cost-effective than other forms of nitrogen such as Calcium Ammonium Nitrate (CAN).



# Initiatives and Future Plans

## Carbon Dioxide (CO<sub>2</sub>)

Efforts to reduce CO<sub>2</sub> emissions focus on minimising fossil fuel use and reducing the environmental impact of farm inputs. The farm uses native Irish ingredients for concentrate feed. The use of native grain combined with the use of renewables has resulted in a 60% reduction in overall energy usage from the grid due to energy efficient equipment and use of renewable energy sources like wind, solar PV (photovoltaic panels) and battery storage on the farm.

## Biodiversity

Shinagh Farm (Farm Zero C) has increased its biodiversity area from 7% to over 10% of the farm, which is 25 acres of natural habitats, hosting a variety of habitats and species. A 2023 biodiversity survey recorded 128 plant species, 48 pollinator species and 29 bird species, including 3 species of conservation concern. Biodiversity mapping technology is used to monitor and improve habitat quality. Improving the biodiversity and quality of the habitats on the farm will be a major focus of the next phase of the project.

## Water Quality

The farm monitors groundwater nitrate levels to assess the effect of different sward types on leaching. Data gathered helps to improve water quality practices on the farm. Preventing nitrogen loss to groundwater is a major focus of the project, this in turn informs the management practices carried out on the farm. The overall reduction in chemical nitrogen applied across the holding is supported by the increased use of clover and multi-species swards which reduces the chemical nitrogen loading on the farm, sustains high levels of dry matter production and reduces risk of nitrogen escaping to groundwater.

## Soil Carbon

Soil carbon sequestration is a key strategy for offsetting the farm's carbon footprint. Extensive soil sampling has established a robust baseline for carbon stocks, and an Eddy covariance flux tower measures atmospheric gas concentrations to monitor sequestration accurately. The intention is to carry out soil sampling on the farm every three years, using 2023 as a baseline for soil carbon and measuring it again at the same location in three year's time to evaluate and measure if management practices have contributed to increasing the amount of carbon sequestered in the soil. There is a 'geo tag' established which is, a digital reference of where each individual soil sample was taken saved remotely, this will ensure consistency of results across treatments and evaluation.

## Renewable Energy

**Farm Zero C has received €3 million from the Department of Agriculture, Food, and the Marine for an Integrated Anaerobic Digestion (AD) & Grass Biorefinery Demonstration Initiative. This project, in collaboration with partners like MTU and UCD, aims to develop new business models and support farmer diversification into the circular bioeconomy.**



## Plans and Targets

The farm aims to keep its chemical nitrogen use below 150kg of chemical N/ha. The farm is also committed to spreading its nitrogen in the form of protected urea, improve the quality of natural habitats and continue to further reduce its carbon footprint. Long-term goals include quantifying soil carbon sequestration, enhancing water quality monitoring, identifying a methane reducing feed supplement for a grass based system, trialing different soil health technologies and developing the biorefinery and AD unit.

Farm Zero C represents a significant step towards sustainable and climate-neutral dairy farming. Through innovative practices, collaboration, and a commitment to sustainability, the project aims to set a benchmark for future farming initiatives.

## Challenges and Solutions

The project faces challenges such as quantifying carbon sequestration and storage. Solutions include ongoing research and development, collaboration with industry partners, and adopting best practices in sustainability.



### Above – Listed Left to Right:

AIB is the exclusive financial partner of Carbery Groups Farm Zero C project. Present at the launch are Carbery Chairman Cormac O'Keeffe, Minister for Finance Michael McGrath and AIB Chief Executive Colin Hunt.

## Knowledge Transfer

Carbery has incentivised its suppliers to take on additional sustainability measures by way of introduction of its sustainable farm scheme ‘Futureproof’ offering farmers a 1 cent per litre bonus if they met specific sustainability criteria, such as milk recording, meeting EBI thresholds, conducting water assessments, and using protected urea. In its first year, 935 farmers participated.

The projects 10 monitor farmers offer peer-to-peer learning to fellow farmers on the various aspects of the technology adoption from the farm Zero C project, such as, establishment of clover, dealing with risk of bloat, timing of chemical nitrogen application on grass/clover swards.

This helps to extend the reach of the project to farmers within the Carbery catchment. There is also bi-annual open day events on Farm Zero C with an open day taking place this year on Wednesday the 4<sup>th</sup> of September. Farm Zero C regularly holds farm tours by the project team for industry stakeholders, secondary school students and academia. Almost 50 groups visited Farm Zero C last year, with the same number expected through the gates this year. AIB’s partnership with the project seeks to further enhance the reach of the pioneering research carried out at farm Zero C across the Agri industry in support of the sector’s ambitions to reduce GHG’s, increase biodiversity and improve water and air quality.



**Above:** AIB’s Chief Strategy and Sustainability Officer Mary Whitelaw alongside Timmy McCarthy (Farm Sustainability Lead, Carbery Group), Donal Whelton (AIB Head of Agriculture, Food and Fisheries) and members of Marys’ senior management team on a recent visit to farm Zero C.

## Project Partners



# AIB Agri Team

We have a dedicated Agri Advisor Team based around the country who support the needs of our farming customers. We are from farming backgrounds ourselves, so we have a practical understanding of the sector and bring a wealth of experience when looking at farm finance. Our team provide strong, objective farm financial and technical analysis on individual farm cases as needed.



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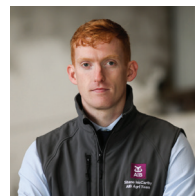
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