An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine

‘Ag-Climatise’

A Draft National Climate & Air Roadmap for the Agriculture Sector to 2030 and Beyond

Public Consultation

November 2019

Contents

1 Introduction

Under the Paris Agreement, Ireland has committed to reduce its greenhouse gas emissions by at least 30% by 2030, compared to those in 2005. The Government's Climate Action Plan, published in 2019, establishes demanding emissions reduction targets across sectors such as transport, residential, construction and waste management. The agri-food sector is also required to play its part, by reducing its emissions by between 10% and 15% in that period.

The agri-food sector, including forestry is Ireland's most important indigenous industry, playing a vital role in Ireland's economy. Our farmers are custodians of the land and producers of safe, traceable food which is globally recognised as sustainably sourced and produced. At the same time, agriculture has an impact on the environment which can be positive or negative depending on the actions taken.

Irish Food and Drink exported to over 180 markets in 2018

Irish Agri-Food Exports valued €13.7 billion in 2018

Sector employs 172,000 people, or 7.7% of total employment

Agri-Food Industry in 2018

The importance of addressing climate change and reducing greenhouse gas (GHG) emissions has been reflected in the recent publication of two important documents, which have clearly set out the ambition for Ireland:

(i) The All-of-Government Climate Action Plan 2019 To Tackle Climate Breakdown[1]
(ii) The Joint Oireachtas Committee on Climate Action Report[2]

Addressing climate change and protecting the environment is a very serious issue for our economy, society and the domestic and international consumers of Irish agri-food products. There are strong

[1] https://www.dccae.gov.ie/en-ie/climate-action/publications/Pages/Climate-Action-Plan.aspx

[2] https://data.oireachtas.ie/ie/oireachtas/committee/dail/32/joint_committee_on_climate_action/reports/2019/2019-03-28_report-climate-change-a-cross-party-consensus-for-action_en.pdf

synergies between improvements in environmental sustainability and economic performance, but equally, agriculture is expected to deliver food security, support rural economies and provide income for farmers and others along the food chain.

The agriculture, forestry and land-use sector must play its part in Ireland's decarbonising transition and it is in this context, that the Department of Agriculture, Food and the Marine (DAFM) is developing a National Climate & Air Roadmap for the agriculture sector. This roadmap will set out specific actions to ensure that the sector lives up to its climate commitments and enhances its green credentials.

We must also look at how best to lower our ammonia emissions, which impact human and ecosystem health though poor air quality. Like other EU Member States, Ireland must reduce its ammonia emissions between now and 2030 to meet annual ceilings. Activity to reduce ammonia emissions will go hand-in-hand with our efforts to reduce GHG emissions.

We have to act with a sense of urgency, in meeting our national and international obligations and playing our part in this global climate challenge. This consultation process is your chance to make a contribution to this process.

1.1 About this consultation

This consultation document sets out the unique climate and air challenges facing Irish agriculture, the opportunities that may arise from meeting our targets and ambitions, and how we are proposing to address the issues through this draft climate and air roadmap for the agriculture sector to 2030 and beyond.

The roadmap will also take account of the outcomes of recent public consultations on the

- National Air Pollution Control Programme[3]
- Code of Good Practice to Reduce Ammonia Emissions[4]
- The 2019 Nitrates Derogation Review[5]
- The Sectoral Adaptation Plan for Agriculture Forestry and Seafood[6]

Furthermore, this consultation aims to ensure agricultures climate targets are fully understood by all stakeholders with a view to better informing the development of our next agri-food strategy to 2030 and also the CAP strategic planning process; both of which have commenced.

[3] https://www.dccae.gov.ie/en-ie/environment/consultations/Pages/Public-Consultation-on-the-National-Air-Pollution-Control-Programme.aspx

[4] https://www.agriculture.gov.ie/media/migration/ruralenvironment/climatechange/CodeGoodAgriculturalPracticeReducingAmmoniaEmissions.pdf

[5] DAFM - 2019 Nitrates Derogation Review

[6] DAFM - Climate Change, Bioenergy & Biodiversity

To facilitate a structured response, questions are posed throughout the document, which range from high-level to specific. All submissions are welcome and will be considered as part of the development of this Roadmap.

For ease of submission all questions are presented through a survey at Ag-Climatise Survey and where applicable, there are opportunities to provide written comment. This survey will take approximately 25 minutes to complete.

The consultation is open until 10th January 2020.

While we would encourage respondents to use the online survey questionnaire there is also opportunity to submit written comments by e-mail if possible, or in writing to:

E-mail: agclimatise@agriculture.gov.ie
Postal submissions:
Climate & Air Roadmap Consultation
Department of Agriculture, Food and the Marine,
Climate Change & Bioenergy Policy Division
Grattan Business Centre,
Dublin road,
Portlaoise,
Co. Laois
Ireland
R32 K857

When making your written submission please provide the name and contact details of the individual, firm or organisation making the submission and briefly describe the main activity and characteristics of the organisation making the submission.

Please note that by responding to this consultation through written submission, either by email, survey or by post, respondents consent to their name being published on our website and their submissions are subject to Freedom of Information. Confidential or commercially sensitive submissions should be clearly marked as such, as the Department will publish non-confidential responses to this consultation. In addition, all written comments submitted through the survey will be compiled in a composite paper, not attributed to any one individual, and will also be made available on the DAFM website and each respondent name and organisation will also be published.

The Department will redact personal addresses and personal email addresses prior to publication. We would draw attention to the Department's privacy statement:

Freedom of Information

All submissions and comments submitted to the Department for this purpose are subject to release under the Freedom of Information (FOI) Act 2014 and the European Communities (Access to Information on the Environment) Regulations 2007- 2014. Submissions are also subject to Data Protection legislation. Personal, confidential or commercially sensitive information should not be

included in your submission and it will be presumed that all information contained in your submission is releasable under the Freedom of Information Act 2014.

Data Protection

Please note that if you make a submission you are agreeing for it to be published in accordance with the EU General Data Protection Regulation (GDPR EU 2016/679), the Data Protection Acts 1988-2018, the Freedom of Information Act 2014 and the DPER Consultation Principles and Guidance.

Privacy Statement

The Department of Agriculture, Food and the Marine is committed to protecting and respecting your privacy and employs appropriate technical and organisational measures to protect your information from unauthorised access. The Department will not process your personal data for any purpose other than that for which they were collected. Personal data may be exchanged with other Government Departments, local authorities, agencies under the aegis of the Department, or other public bodies, in certain circumstances where this is provided for by law.

The Department will only retain your personal data for as long as it is necessary for the purposes for which they were collected and subsequently processed. When the business need to retain this information has expired, it will be examined with a view to destroying the personal data as soon as possible, and in line with Department policy. Further information on Data Protection can be found on our website at:
https://www.agriculture.gov.ie/dataprotection/informationondataprotection/

2 The Challenge & Our Obligations

2.1 Introduction

Globally and at EU level, we face a major challenge in reconciling the key objectives of increasing food production while meeting commitments to mitigate climate change and help farmers, fishermen and society generally to adapt to its impacts.

This challenge must be met against a backdrop where global population is growing, with a consequential increase in the requirement for food, and increasing demands on land, including as a source of feedstock for bioenergy. Furthermore, climate change is impacting productivity and has potential to impact the safety of our food production systems. Irish research by Dwyer (2012) illustrates that Ireland's climate is changing in line with global patterns. The Department of Agriculture, Food and the Marine recently published a sectoral adaptation plan. This document represents a first step by the Department in developing a climate change adaptation approach for the agriculture, forest and seafood sectors.

As part of the Paris Agreement, Ireland and other countries have committed to limit temperature rise to less than 2 degrees above pre industrial levels and pursue efforts to limit temperature rise to less than 1.5 degrees. Ireland's national policy position involves a transition to a low-carbon, climate resilient economy and society, including an approach to carbon neutrality by 2050.

As a member of the EU, Ireland's target to reduce emissions in line with the Paris Agreement goals is guided by the EU climate and energy framework, which specifically assigned Ireland a target to reduce emissions by 20% and 30% in 2020 and 2030 respectively.

The latest EPA figures indicate that total annual national emissions are 60.51 Mt CO_{2eq} and the agriculture sector contributes 20.6 Mt CO_{2eq} of this – in effect 34% of national emissions. Furthermore, EPA projections indicate that the total national emissions out to 2030 will increase by 6% unless we take steps to change the way we do things. This translates into a cumulative gap to the 2030 target of 101 Mt CO_{2eq} nationally.

The 'All-of-Government Climate Action Plan to Tackle Climate Breakdown' seeks to address the gap of 101 Mt CO_{2eq} and outlines the role that various sectors, including agriculture and forestry can play in bridging this gap.

In addition, the plan, published in 2019, for the first time establishes sectoral emissions reduction targets. The target for agriculture is to reduce emissions by 10-15% by 2030. The plan, contains a total of thirty-four actions for the agriculture, forestry and land use sector, incorporating many of the JOC recommendations and ancillary actions, to ensure a time bound delivery of actions.

One of the actions common to both reports and identified to be most impactful, is the development of a roadmap to ensure that the future development of the agriculture and land use (including forest) sector will be built upon environmental sustainability and contribute fairly to Ireland's climate, air and energy targets, ensuring alignment with the Paris agreement. The 10% to 15% emissions reduction target for agriculture in The All-of-Government Climate Action plan, translates to a reduction in emissions from 20.2 Mt CO_2eq in 2017 to between 17.5 and 19 Mt CO2eq by 2030. Furthermore, this plan also requires agriculture to enhance CO_2 removals from the landscape by at least 26.8 Mt CO_{2eq}

and contribute to the development of sustainable decarbonised energy systems. These obligations require full implementation of the actions set out in the Teagasc report 'An Analysis of Abatement Potential of Greenhouse Gas Emissions in Irish Agriculture 2021-2030'[7] (also known as the 'MACC curve').

Meeting the targets laid down in the Plan will involve significant changes in the way we do things across society. Agriculture is no exception. This means that all actors within the sector will need to work in partnership in order to achieve those targets, while also ensuring that the agri-food sector continues to support a vibrant rural economy and society.

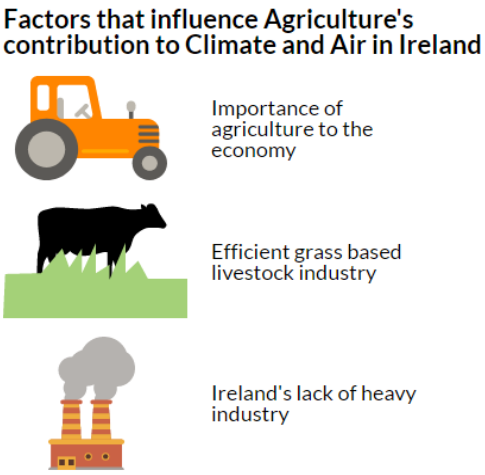
There are 5 key things that we need to do while maintaining viable farm incomes in the sector.

1. Reduce GHG emissions from the sector
2. Increase the carbon sequestration potential of our land and forests
3. Meet our ammonia ceilings targets
4. Build resilient food production and land use systems that meet these climate and air obligations, while also meeting market expectations
5. Transparently communicate our progress

Agriculture has a social, economic and environmental value to Ireland. It is therefore important that we find a balance between these multiple objectives placed on agriculture and land use to ensure it continues supporting vibrant rural and coastal economies and communities. The farmer will remain at the heart of this transition. We need to achieve our goals, while at the same time protecting the economic viability of our primary producers. The next CAP rural development programme will play a key role in this regard.

2.2 Agriculture's influence on climate & air

2.2.1 Climate

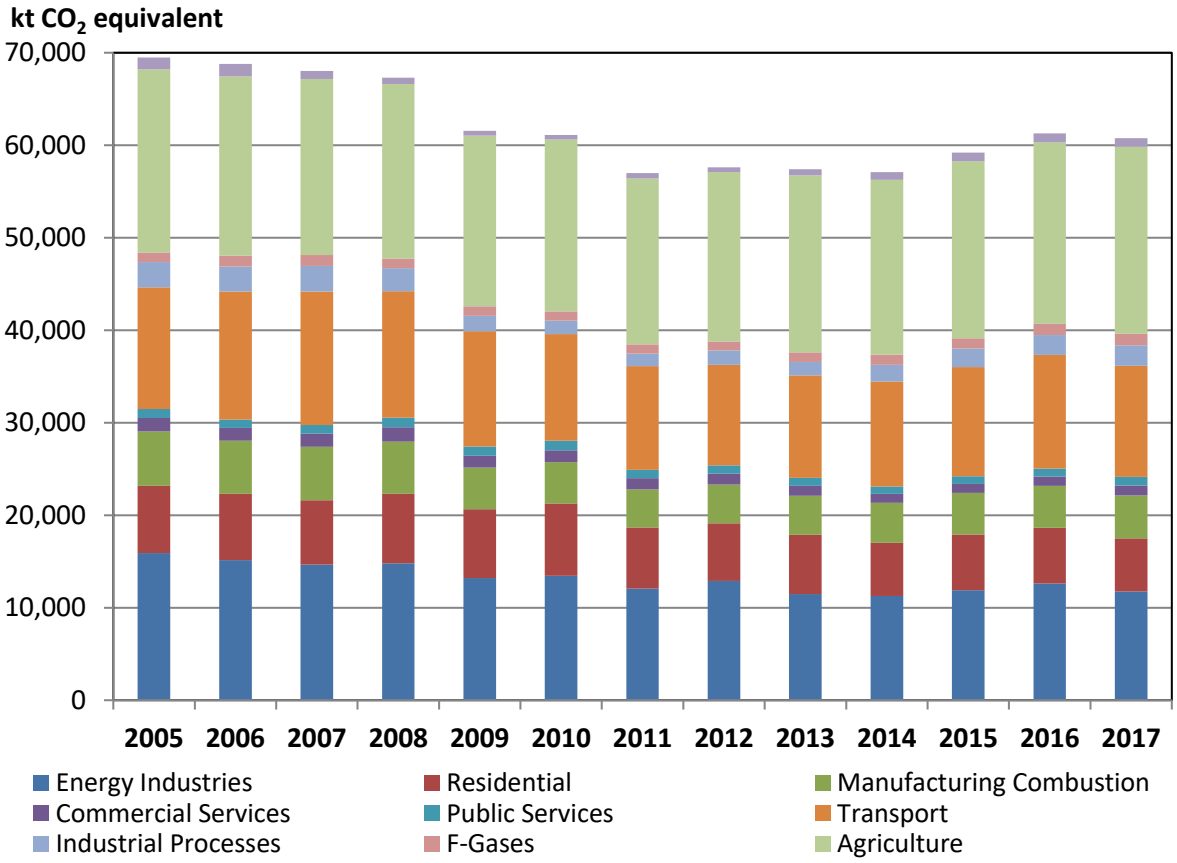


Agriculture remains the single largest contributor to overall emissions in Ireland accounting for 34% of the total (see figure below). This is uniquely high in a European context where the average is 10%, although our emissions intensity per unit of output is among the lowest in EU. Therefore, this high percentage is not a result of environmental inefficiency, but rather reflects the importance of agriculture to the Irish economy, the biological nature of agricultural emissions and Ireland's lack of heavy industry.

[7] https://www.teagasc.ie/publications/2018/an-analysis-of-abatement-potential-of-greenhouse-gas-emissions-in-irish-agriculture-2021-2030.php

While agriculture emissions have increased approximately 12.7% in the period 2011 – 2017, they remain marginally below 1990 levels and marginally above the long-term average since 1990 – see Figure 1 below.

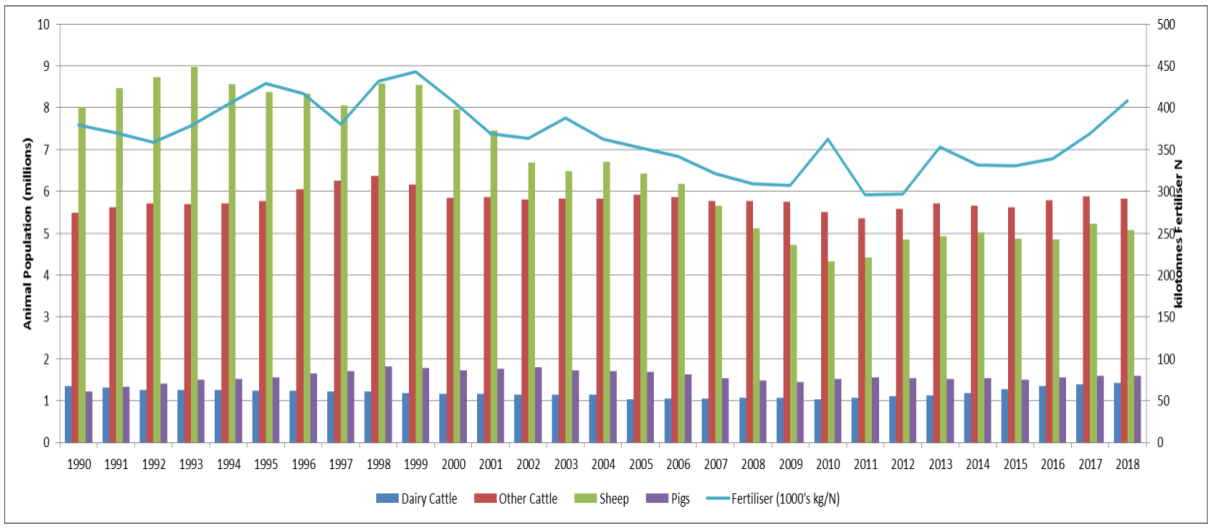
Figure 1: Ireland's CO_2 Emissions Inventories, 2005-17



Much of Ireland's climate and landscape, particularly in the western half of the country, is not suited to forms of food production other than those involving livestock. The suckler beef and sheep sectors are strongly embedded in local economies and play an important role in supporting rural employment, managing the natural environment and maintaining the social fabric of rural areas. Profitability on many of these farms is low, but surveys indicate that 85% of farmers in these sectors intend to continue farming.

Dairy farming is more profitable. Higher dairy cow numbers (see Figure 2 below) and increased fertiliser use are significant drivers of increased emissions in recent years. Since 2010, dairy cow numbers have increased by 350,000 with a corresponding milk production increase of 2.09 billion litres. In 2017, there were also increased CO_2eq emissions from synthetic fertiliser application on agricultural soils (+10.3%).

Figure 2: Trends in livestock numbers and fertiliser use in Ireland (1990-2018) – source EPA 2018

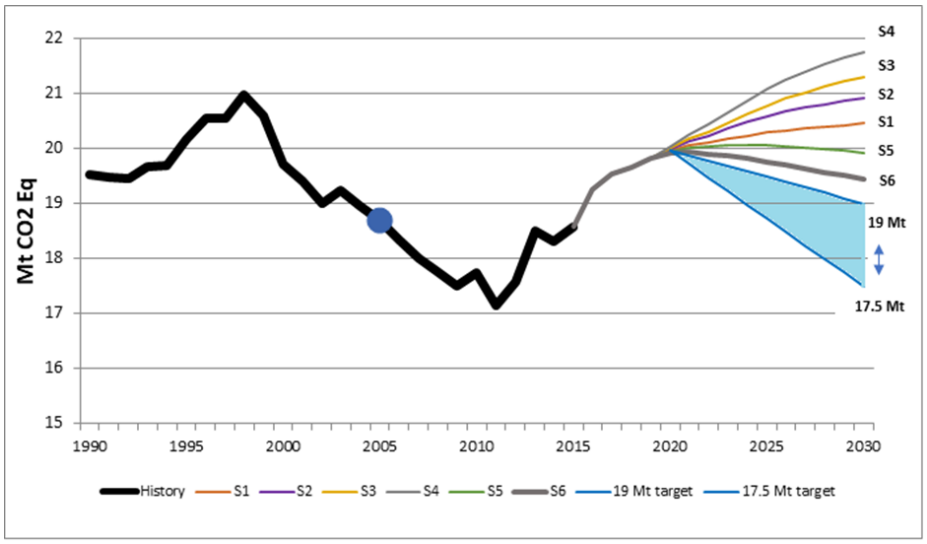


Against the background of these livestock numbers, reducing absolute GHG and ammonia emissions will require significant improvements in emissions intensity. It is clear that the ambition for the development of these sectors will requires a greater focus on efficiency over simply increasing additional animal numbers. Improvement in the efficiency of the national herd such as reducing the age at first calving, replacement rates and other indications are critical to delivery of a reduced carbon footprint. We must do this while not negatively impacting on animal welfare.

Figure 3 illustrates the distance to target between a range of 6 scenarios[8] reflecting a range of possible livestock herd trends and their impacts on emissions. Included also is the target range of between 17.5 $MtCO_2eq$ and 19 Mt CO_2eq as per the All-of-Government Climate Action Plan. Against all scenarios, significant action must be taken if we are to achieve our target.

[8] http://www.teagasc.ie/media/website/publications/2018/GHGscenarios2030final.pdf

Figure 3: Contrast of Teagasc Scenarios 1-6 reflecting various herd sizes against the 2030 required emissions target range for 2030.



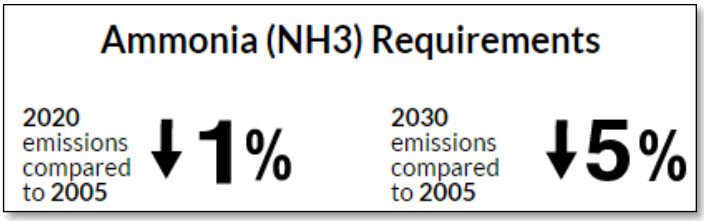
The Teagasc GHG MACC suggests that achievement of our target is possible whilst maintaining a stable herd. In practice this means taking all possible actions whilst stabilising overall methane emissions. If the actions are not adopted quickly and effectively, then it will not be possible to deliver our commitment without more radical action, especially from the sectors which are experiencing growth.

Agricultural GHGs

Methane (CH_4) and nitrous oxide (N_2O) make up the majority of Irish agriculture greenhouse gas emissions, mainly due to the dominance of cattle and sheep livestock production. Methane is the most significant greenhouse gas emitted from agricultural activity in Ireland, accounting for 65% of total agricultural emissions. Enteric fermentation, which is a natural process in the digestive system of ruminant animals that results in the emission of methane, accounts for 90% of agricultural methane emissions. The remaining agricultural methane is associated with the storage and management of animal manures which may present opportunities, albeit limited, for methane recovery through the future deployment of anaerobic digestion technologies.

Nitrous oxide (N_2O) emissions arise from bacteria breaking down nitrogen in soils. N_2O emissions are increased by the application of nitrogen-based fertiliser and animal slurries to agricultural soils. Nitrous oxide contributes up to 35% of Ireland's agricultural greenhouse gas emissions.

2.2.2 Air



In relation to ammonia (NH_3), the agriculture sector accounts for virtually all (99.1%) of ammonia emissions in Ireland. Recent increases in cattle numbers and fertiliser use have seen NH_3 emissions increase for the last five years. Ammonia emissions are compliant with the 2010 National emission ceiling directive (NECD) for the years 2010 to 2016. However, Ireland exceeded the ammonia emission ceiling in 2016 and 2017. Again, the increases in dairy cow numbers and nitrogen fertiliser use over the period 2012 to 2017 were the most significant drivers of increased ammonia

emissions[9]. Furthermore, there is a requirement for a 1% reduction on emissions compared to 2005 levels by 2020 onwards and 5% reduction in emissions compared to 2005 levels by 2030 onwards.

It is clear from Table 1 below that without mitigation options Ireland will not be compliant with ammonia emission levels for either 2020 or 2030. Again, action is required early through measures such as use of low emissions slurry equipment. DAFM has issued a Code of Good Agricultural Practice for reducing Ammonia Emissions from Agriculture[10] informing our direction of travel and highlighted the types of actions at farm level that need to be addressed.

Table 1: Projected ammonia emissions without abatement for 2020 and 2030

Year	2020	2030
Projected ammonia emissions (kt NH_3)	121.743	128.112
Ammonia ceiling (kt $NH_{3)}$	112.077	107.549

Furthermore, from a regulatory perspective DAFM has been working to enhance the framework for nitrogen management through the Nitrates Action Programme and has recently completed a Nitrates Derogation review. This review will require farmers benefitting from a Nitrates derogation to take actions to enhance nitrogen use efficiency.

2.3 Market Drivers

According to the Bord Bia / PwC Global Sustainability Survey 2018, where over 8,500 consumers across 13 countries were surveyed, consumers associate 'sustainability' with 'protecting the environment' while they associate 'food sustainability' with being 'better for the planet'. In Western markets, particularly European markets, the sustainability agenda is being driven by trade customers; leading retail customers are ever more demanding on the topic. In other markets (Asia, Middle East), it is the end consumer who is driving food sustainability as a product differential. In addition, it is also becoming apparent that customers and consumers increasingly compare the merits of various protein alternatives, including their carbon footprint.

Origin Green is Ireland's food and drink sustainability programme, bringing the food industry of our country together with the common goal of sustainable food production, thus responding to the market drivers around climate change and sustainability. In April 2018, Bord Bia welcomed over five

[8]https://www.epa.ie/pubs/reports/air/airemissions/irelandsairpollutantemissions2017/Irelands%20Air%20Pollutant%20Emissions%202017.pdf

[10]DAFM - Climate Change, Bioenergy & Biodiversity

hundred international buyers to 'Marketplace International' in Dublin to meet almost 180 Origin Green verified members for the first ever sustainable global sourcing event. Bord Bia reported that the resounding consensus from the trade customers in attendance was the value they place on the level and extent of data that is being collected via the Origin Green programme.

Ireland's food and drink sustainability programme

The Origin Green sustainability development programme, which operates on a national scale, unites government, the private sector and food producers in a common vision to improve the environmental performance of individual farms and food producers. Further details are available at the following link: http://www.origingreen.ie

Origin Green is committed to further changes and developments across all levels of the supply chain to facilitate the continuous improvement of the programme. Over 210,000 farm assessments have been conducted to date and Bord Bia continues to work with stakeholders to communicate and highlight the benefits of sustainable farming practices.

At company level, over 340 CEOs have signed up the sustainability agenda and their companies are fully verified members of the programme, with 10 at Retail and Foodservice level.

Meanwhile, competitor countries which also supply some of our main export markets, are forging ahead with ambitious climate action plans. The Danish Agriculture and Food Council have announced their ambition to have a food industry that is climate-neutral by 2050. The Netherlands has declared that its agriculture, nature and food sector will be a leader in circular agriculture by 2030. Meanwhile the UK has set net zero emissions by 2050 as their target with some agricultural leaders calling for emissions in that sector alone to reach net zero by 2040. New Zealand have also declared high ambition with the intention of reducing emissions of biogenic methane by 24-47% by 2050 (compared to 2017) and by 10% by 2030. It is essential that Ireland is recognised as a leader in sustainable food production in the markets where we compete with countries such as these and the roadmap set out in this document will prove crucial in this regard.

3 The Opportunity

3.1 Introduction

While the agriculture sector is undoubtedly a big contributor to climate and air issues, and decarbonising the sector is challenging, it should also be borne in mind that the sector is part of the solution in terms of reducing emissions, storing carbon and supplying sustainable energy. The results of the Teagasc Sustainability Survey show that the top performing third of cattle farms emitted, on average, 9.6 kg CO_2 equivalent per kg beef, compared with 14.9 kg CO_2 for the bottom performing third of cattle farms. Reducing this variability presents a real opportunity to make progress in reducing emissions from cattle production in Ireland. The approaches to realise this also offer many co-benefits with other environmental ambitions such as biodiversity, water quality, and can improve overall farm performance and efficiency. Furthermore, less than 10% of our grasslands are on peat rich soils which result in significant CO_2 emissions and adopting reduced management intensity of these peat rich soils offers a significant opportunity to reduce CO_2 emissions while at the same time contributing to biodiversity and water protection goals. Therefore, with the appropriate actions, the sector can be part of the climate change solution while also delivering on the multiple objectives of agriculture as part of a vibrant rural economy and society.

3.2 Market opportunities

As outlined above, environmental sustainability and evidence to prove this is a key market driver for the food and drinks industry as a competitive advantage and product differential. This was set out in the Food Wise 2025 strategy which stated, "*a key fundamental underpinning the sector's ability to access and grow exports in international markets is Ireland's reputation for producing sustainable, safe and high-quality food*". Origin Green is the primary vehicle for proving Ireland's sustainability credentials and ensuring access to international customers who place huge significance on this attribute when choosing where and who they purchase from.

Furthermore, changing consumer lifestyle trends around healthy eating, locally produced food and climate change is increasingly shaping consumer decisions. This provides the potential within the sector for greater import substitution through increased production of certain crops to meet increased consumption for Irish fruit and vegetables.

3.3 What we have achieved to date

We are not starting from a point of inaction. There are already a range of measures and actions that are contributing positively to reducing GHG emissions and these we need to build on. To date, productivity gains and efficiencies have lowered the emissions intensity of agricultural output and have also contributed to limiting the potential increases in absolute agricultural emissions.

These productivity improvements have been supported by CAP RDP (Rural Development Programme) which is worth almost €4 billion over 7 years and is strongly targeted towards environmental benefits.

Over 50% of expenditure in 2017 was on climate-related measures such as GLAS, BDGP, ANC and TAMS 2. Important actions in the current GLAS programme involving almost 50,000 farmers include, for example, initiatives such as the provision of support for 4,500 farmers to use low emission slurry equipment (LESS), 1,200 km of new hedgerows planted, and 270,000 Ha of low input pasture land supported. The Beef Data and Genomics Programme (BDGP) is directly targeted at reducing the GHG emissions of 24,000 beef farmers. The Targeted Agricultural Modernisation Schemes (TAMS) supports investment in low emissions slurry spreading equipment, farm nutrient storage and renewable energy and energy efficiency.

The current Nitrates Action Programme (NAP) takes account of pressures on water quality and contains new strengthened water protection measures to break nutrient and transport pathways and provides a facility for the Minister to specify the type of fertiliser to be used to aid reduction of emissions. The NAP also has a new collaborative approach for improved implementation and a focus on improving soil fertility for better nutrient use efficiency. Opportunities for large savings on farms through better grassland management have also been included. Furthermore, the recent review of the N derogation provides a legal basis to drive use of LESS and clover in pasture reseeds hence reducing requirements for chemical N.

It is also worth noting that farmers have planted over 300,000 ha since the 1990s and these forests have the potential to sequester up to 20 million tonnes of CO_2 during the period 2021-2030 which will contribute to meeting our climate change commitments.

3.4 The Bioeconomy

The National Policy Statement on the Bioeconomy[11] published in 2018 outlined that the bioeconomy can play a part in lowering greenhouse gas emissions through, for example, the development of innovative practices and processes that can improve the efficiency and circularity in agriculture and forestry production systems. In this respect, the bioeconomy will promote circularity through solutions and innovations that reuse and recycle materials that would otherwise be treated as waste products.

The bioeconomy can replace high embedded carbon products such as fertilizers, plastics concrete and steel, with biobased alternatives and produce new products aiding the transition to a carbon neutral economy.

Our farmers, fishermen and foresters will in the future not only be partners with food companies, but also potentially with chemical, textile and construction industries. The agri-food sector has strong innovation potential to support Ireland's transition to a more integrated sustainable, circular, low carbon economy, with economic, social and environmental benefits for rural Ireland.

[11] https://www.dccae.gov.ie/documents/20180312-Bioeconomy%20-%20National%20Policy%20Statement.pdf

Additionally, the call for a climate-neutral Europe by 2050 highlighted that the systemic adoption of a circular bioeconomy approach at governmental, agri-food and industrial level provides the opportunity to address the multifaceted challenges posed by climate change and land use [12] [13].

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN

[13] https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf

Small-scale, farmer-led green biorefineries

Biorefinery Glas is a European Innovation Partnership (EIP) Operational Group funded by Department of Agriculture, Food and the Marine under the Rural Development Programme 2014-2020. The initiative is led by the Institute of Technology, Tralee, with a total of 5 partners including the Barryroe Co-operative, the Carbery Group, GRASSA B.V. and University College Dublin.

Biorefinery Glas aims to improve the sustainability, value and resource efficiency of Ireland's livestock sector through farmer diversification into the bioeconomy. Protein rich green biomass is converted into high value products.

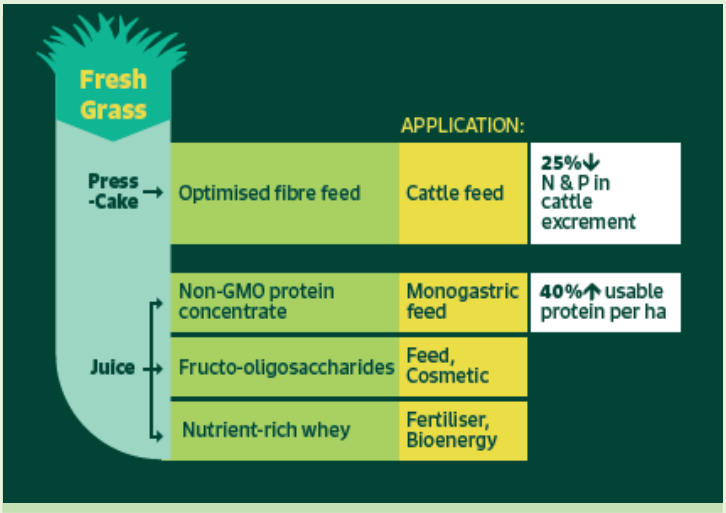


Figure 1 Bioeconomy Glas Process

The biorefinery process converts freshly harvested grass supplied by local farmers into a range of products, including; an optimised cattle feed fibre, a non-GMO protein concentrate feed for monogastrics, a high-value sugar stream of fructo-oligosaccharides and a grass whey for fertiliser or bioenergy applications. The project targets a 40% increase in usable protein per hectare and expects to achieve a 25% reduction in nitrogen emissions in cattle excrement, with additional emissions savings through displacement of soybean feed imports with a grass-based monogastric feed. The project also demonstrates and evaluates an innovative business model for farm diversification into the circular economy and supports farmers with a range of knowledge exchange and dissemination

4 What We Are Proposing

The agricultural sector needs to respond to the challenges outlined above in order to play its part in the transition to a low carbon, climate resilient economy and society for the future, while also taking advantage of the opportunities that have been set out in the previous section.

In order to respond to the challenge in a coherent and coordinated manner, and bearing in mind the All of Government Climate Action Plan 2019 to Tackle Climate Breakdown, and the Report of the Joint Committee on Climate Action, we are proposing a roadmap for the agriculture and land use sector to ensure that its future development will be built on environmental sustainability and climate resilience, and contribute fairly to Ireland's climate, air and energy targets. This draft roadmap is composed of three elements:

i. **Implementing Changes Now**: to ensure the actions necessary to protect the environment and address climate change are carried through to operational reality for farmers on the ground now;

ii. **Acting in Partnership:** To succeed in the effort outlined in this roadmap, all stakeholders right along the food chain, from farm to fork, will have to contribute in a spirit of partnership.

iii. **Preparing for the Future:** using best available science to inform policy development and to help stakeholders make strategic choices about the future;

4.1 A DRAFT CLIMATE AND AIR ROADMAP FOR THE IRISH AGRICULTURAL SECTOR

For Public Consultation

Part 1: Implementing Changes Now

I. Reduce agriculture emissions to 19Mt CO_2eq or lower by 2030
II. Enhance the development of sustainable land management practices so that 26.8 Mt CO_2eq $_{in}$ in abatement can be delivered through Land Use, Land Use Change and Forestry actions over the period 2021 to 2030
III. Contribute to sustainable energy and decarbonisation of energy systems

Introduction

The pathway to ensuring that the sector achieves its climate ambitions is based on setting targets against which we can make sure we are travelling in the right direction. Actions outlined in this roadmap are mainly guided by the GHG MACC. However, translating a number of MACC actions into measures that result in inventory change will require additional research, development and in some cases the identification of suitable measurement metrics. This includes actions such as extended grazing, draining wet mineral soils and straw incorporation on arable lands. Several actions also require further development in advance of practical implementation at farm level including sexed semen.

Marginal Abatement Cost Curves (MACC)

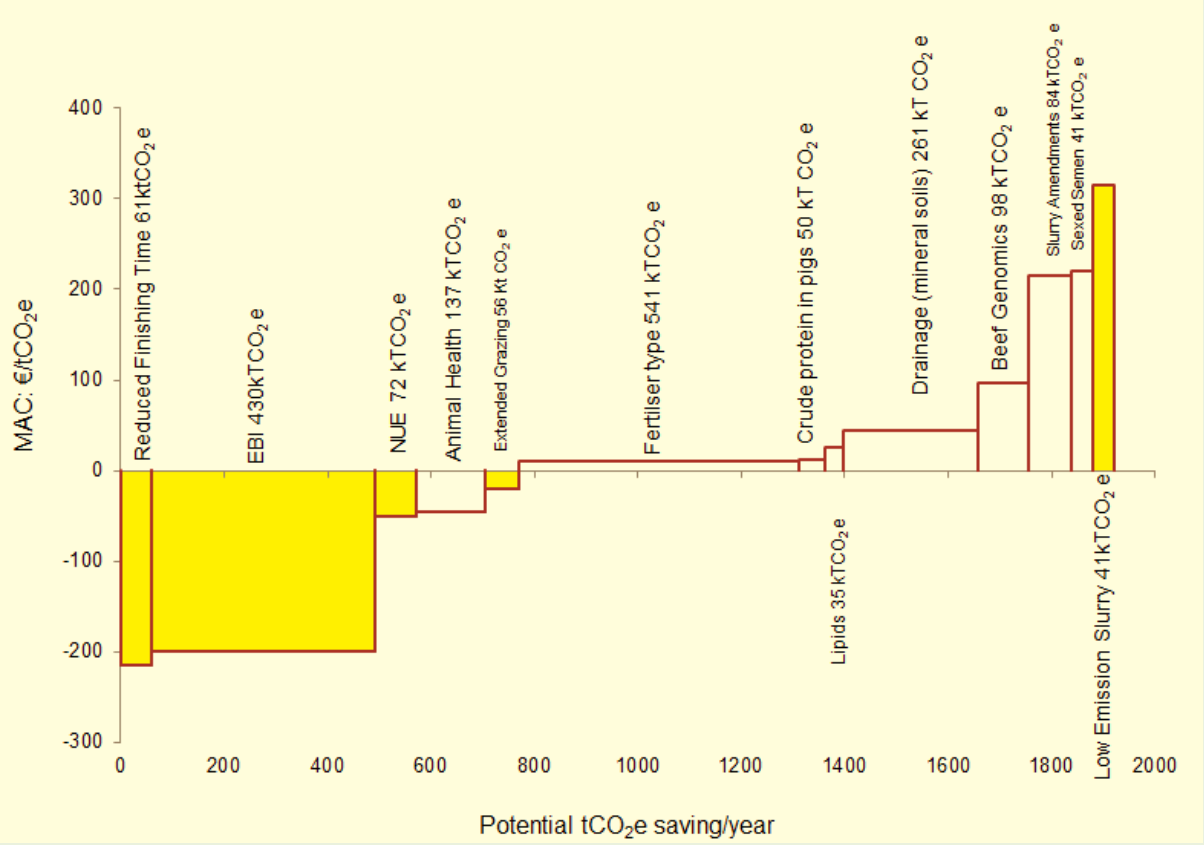
A Marginal Abatement Cost Curve (MACC) is a graph that visualises the abatement potential of GHG mitigation measures, and the relative costs associated with each of these measures.

A MACC:

1. Ranks the mitigation measures from cost-beneficial (i.e., measures that not only reduce GHG emissions, but also save money in the long term) to cost-prohibitive (i.e., measures that save GHG emissions, but are expensive in the long term)

2. Visualises the magnitude of the abatement potential of each measure, as indicated by the width of the bar

The graph below is an agricultural mitigation MACC, one of three MACCs prepared by Teagasc, the others being a land-use and land management MACC and an energy MACC.



Marginal Abatement Cost Curve for agriculture for 2021-2030 (methane and nitrous oxide abatement). Values are based on linear uptake of measures between the years 2021-2030 and represent the mean

yearly abatement over this period. Measures principally impacting on methane are indicated in white and N20 in pink. The dashed line represents Carbon cost of €50 per tonne of CO_2.

By way of example on how to read the MACC, the graph demonstrates that increasing the adoption of protected Nitrogen will result in an estimated reduction in GHG emissions of 541 Kt CO_2-e per annum, at a cost of €8.3/tCO_{2eq} or €4.2m total cost.

1. Reduce agriculture emissions to at least 19 Mt CO_2eq by 2030

Actions required to meet this ambition:

Action 1: Enhance soil fertility and nutrient efficiency to reduce nutrient loss to the environment.

- Adopt On line nutrient management planning – lime use & fertiliser use efficiency (linked to action 6)
- Achieve a target of 60% of all slurry spread by low emissions slurry spreading by 2022; 75% by 2025; and a longer-term ambition of 90%.
- Require Slurry/Farm Yard Manure applied to arable land to be incorporated within 12 hours by 2022
- Require all newly constructed external slurry stores to be covered by 2022 and all recently constructed external slurry stores (i.e. within the last 5 years) by 2025
- Promote the use of anapproved software package as a decision support tool for the majority of dairy farmers by 2022. Furthermore, promote beef and sheep farmers to use Grass10 as a model for improving grass utilisation.
- Require incorporation of clover (and mixed species) in all grass reseeds by 2022
- Develop a blueprint for zero/near zero nitrogen use and carbon neutral production suitable to all productivity levels and support its implementation
- Develop an electronic fertiliser and manure data base to support best practice and evidence of optimum nutrient management and soil fertility

Action 2: Promote the use of protected nitrogen products

- Aim to have 50% of CAN sales as protected urea by 2022.
- Prohibit the use of urea (replacing with protected urea), in particular on grassland by 2025
- Create an information portal on protected N products that will:
    - Ensure the widespread dissemination of information on the different types of nitrogen protection inhibitors including specifications for their use
    - Increase awareness around the use and benefits of protected nitrogen products

Action 3. Develop enhanced dairy and beef breeding programs, that; (i) increase our rate of genetic gain for key indicators linked to profitability, sustainability and climate efficiency, (ii) promote greater herd and animal performance recording and (iii) help achieve a reduction in our overall GHG output at a national level, by 2025**.**

- Increase rate of national genetic gain in Dairy Economic Breeding Index (EBI) from current €10/cow/year to €15/cow/year, bearing in mind the need to take calf welfare considerations into account
- Increase rate of national genetic gain in Dairy Beef Index (DBI) from current €0/calf/year to €5/calf/year to address the current declining beef quality in calves from the dairy herd
- Increase rate of national genetic gain in €uro-Star Replacement Index from current €5/cow/year, to €10/cow/year
- Increase number of dairy herds in milk recording from current 50% to 75% and suckler beef herds in beef weight recording from current 30% to 60%, respectively
- Increase number of dairy herds in genomic programs from current 1% to 75% and suckler beef herds in genomic programs from current 40% to 75%, respectively
- Achieve targeted improvements in key metrics relating to age at slaughter and age at first calving for our national dairy and beef herds.
- Incorporate new breeding indexes for climate/environment into EBI, DBI and €uro-Star Replacement Index respectively and ensure alignment of these new breeding indexes, including relevant animal-based support tools, into GHG MACC and Bord Bia Origin Green programs.

Action 4: Develop a charter with animal feed manufacturers on crude protein content of livestock feeding stuffs to minimise ammonia loss.

- Reduce levels of crude protein in pig and ruminant feed taking account of the latest science and decision support tools in order to reduce excess protein in animal's diets.

Question 1

Are there other actions that could be considered for inclusion to further enhance progress and credibility of agricultural actions? Is there more that farmers and the food industry itself can do?

Question 2

Have you any feedback on how uptake of these actions can be encouraged and facilitated?

2. Enhance the development of sustainable land management practices by delivering 26.8 Mt CO_2eq abatement through LULUCF actions over the period 2021 to 2030.

Actions required to meet this ambition:

Action 5: Review the National Forestry programme with the aim of delivering 8,000 ha of newly planted forestry, including agroforestry per annum.

- Planting of 18.6million trees a year.

Action 6: To deliver the balance of agriculture commitments under carbon sequestration and through the better management of peatlands and soils

- Target 40,000ha of peat based agricultural soils for reduced management intensity.
- Target 450,000 ha with optimised soil pH for soil fertility (linked to action1).
- 50% of arable spring production to grow cover crops.

Question 3

Are there other actions that could be considered to maximise the contribution of sustainable land management? Is there more that farmers and the food industry itself can do?

Question 4

Have you any feedback on how uptake of these actions can be encouraged and facilitated?

3. Contribute to sustainable energy and decarbonisation of energy system

It is recognised that the agriculture sector has a key role to play in helping Ireland meet its renewable energy targets. In addition, adoption of energy efficiency and renewable technology generation can enhance the green image of the agri-food sector both nationally and globally.

In the longer term, increasing the provision of bioenergy feedstocks, including forest thinning and animal by-products such as residues from meat processing and slurries, will be an important part in the renewable energy mix for Ireland and in displacing fossil fuel usage. These will be influenced by policy developments such as the Renewable Electricity Support Scheme (RESS) and the Support Scheme for Renewable Heat (SSRH). Further information about these schemes is available here: www.dccae.gov.ie/energy. The agriculture sector has a key role to play in the provision for bioenergy feedstocks for the production of biogas/ biomethane as a key renewable energy resource for the decarbonisation of the transport and head sectors in particular.

In the short term, based on the technologies that are currently readily available, there is an opportunity for the sector to contribute by using energy more efficiently and becoming more self-sufficient in terms of renewable energy production. Currently the adoption rates of energy efficiency measures on farms varies considerably and in some instances are quite low (the generation of renewable energy for self-consumption is less than 1%).

Actions required to meet these ambitions:

Action 7: Explore options for supporting sustainable energy with DCCAE on ensuring a fair share for community engagement on the supply side.

Action 8: Collaborate with DCCAE to ensure the enabling framework for microgeneration facilitates opportunities for the agri sector and rural communities to contribute to electricity decarbonisation.

Action 9: Actively participate in the development of a National AD strategy including the consideration of appropriate sustainability criteria for biomass materials.

Action 10: Collaborate with DCCAE and other key stakeholders to set a target for the level of energy to be supplied by indigenous biomethane injection and consider the necessary supports including funding mechanisms.

Action 11: We will double biomass production from forestry by 2030 and ensuring mobilisation for heat production –

- Enable increased access into forests to allow for efficient and timely harvest of timber for delivery to the market
- Displacing approx. 2 Mt CO2eq in the energy sector.

Action 12: Continue to support actions such as photo-voltaic (PV) panels and energy efficiency measures to generate at least a 20% reduction in energy use in the agriculture sector by 2030.

Action 13: Realise carbon savings from Anaerobic Digestion of up to 0.7Mt CO_2 eq per year by 2030 and 2 Mt CO_2eq per year by 2050.

Question 5. Are these actions sufficient, or are there others you would suggest? Is there more that farmers and the food industry itself can do?

Question 6

Have you any feedback on how uptake of these actions can be encouraged and facilitated?

DAFM would also like to hear your views on the barriers and challenges to deployment of energy efficiency and renewable technology and also the types of supports and incentives that could increase deployment and wide spread adoption.

Part 2: Acting in Partnership

The state will play its part through:

I. Using the reform of the CAP for the period 2021-2027 to help the agri-food sector achieve the maximum possible progress in climate change mitigation and adaptation, and reduction of greenhouse gas emissions, consistent with commitments at EU level.

II. Facilitating collaboration across the food production system:

   a. A greater role for producers, farm advisors and processors through the establishment of a charter with industry to deliver clear sustainability initiatives and assist farmers in achieving improved efficiency at farm level

   b. Development of an advisory strategy to underpin implementation of the MACC measures

   c. Development of a network of demonstration ('sign post') farms demonstrating best practice in implementation of the MACC.

III. Continued support in research and development

Introduction

Our ambition to be a leader in sustainable food production requires a sustained collaborative effort. The Department of Agriculture, Food and the Marine and its agencies – Teagasc and Bord Bia – recognise that only a collaborative approach to climate action will work. This means that all stakeholders along the food chain have to participate, contribute and do their part. We will only make progress if we work together. This is a shared challenge that will require a shared response.

The State will play its part

The State has an important role to play in ensuring that the agri-food sector plays its part in meeting the climate and air challenges that we face. DAFM, in conjunction with its state agencies, will fulfil its role in this regard, whether through setting the regulatory and policy environment or facilitating and enabling producers and processors to make climate friendly decisions. Given that one of the nine key objectives of the next CAP is to **contribute to climate change mitigation and adaptation, as well as sustainable energy,** we will ensure that the new CAP 2021-2027 is framed in such a way that facilitates

and enables primary producers to implement more climate friendly farming practices, particularly around mitigation of emissions as well as sequestration of carbon

The EU Common Agricultural Policy 2021-2027

Agriculture, forestry and other rural sectors are particularly vulnerable to the effects of climate change. The Common agricultural Policy (CAP) has therefore a key role to play in promoting climate mitigation and supporting these sectors to adapt to climate change and ensuring coherence between climate and food production objectives.

Since 1990, GHG emissions from agriculture at EU level, decreased consistently by more than 20%. While all efforts undertaken by farmers are welcome, it's important to recognise that a transition to a greener agriculture is needed. The post-2020 CAP proposals recognise this challenge and have set out the following ambitions:

- set higher environmental and climate ambitions with a new green architecture to facilitate and encourage environmental care and climate action in agricultural practices
- introduce a 'new way of working' to allow Member States to design their CAP Strategic Plan to achieve the EU common environmental and climate change objectives, setting quantified targets and taking specific local needs and conditions into consideration
- require Member States to demonstrate how their CAP strategic plans will contribute to climate action objectives
- increase the budget for research and innovation (R&I) in food, agriculture, rural development and the bioeconomy, this will play a key role in reducing agricultural emissions and improve environmental care.

Negotiations on the Commissions' proposals for the new CAP are ongoing, and when concluded will be implemented in Ireland through the development of a strategic plan for the period 2021 to 2027. DAFM has put in place a cross departmental and stakeholder Consultative Committee to allow engagement on the mainstreaming of early intervention climate action opportunities which optimise synergies for the abatement of other environmental pressures from agriculture.

Farmers require support and the right tools to face the effects of climate change. Ireland's declaration of a climate and biodiversity emergency highlights that more needs to be done and fast. It is for this reason we want to engage with our stakeholders including through this discussion paper on a new climate roadmap for the post-2020 Common Agricultural Policy to set higher environmental and climate ambitions, necessary to respond to this challenge.

In addition, implementation of the actions outlined comes at a cost. If we are to achieve the ambition of the sector it will be necessary to incentivise positive climate action.

Action 14: We will use the reform of the CAP for the period 2021-2027 to help the agri-food sector achieve the maximum possible progress in climate change mitigation and adaptation, and greenhouse gas emissions reduction, consistent with commitments at EU level.

Action 15: We will actively engage with all stakeholders, through the CAP Consultative Committee to consider the most appropriate means of mainstreaming climate action in Ireland's strategic plan which maximise synergies for nature-based solutions for water protection and biodiversity enhancement.

Origin Green helps differentiate and make Irish food and drink more compelling to the world's consumers and trade partners alike. As outlined in the Bord Bia Statement of Strategy 2019 – 2021, Origin Green will continue its evolution to create deeper engagement with members, to drive sustainability improvements in performance, to collaborate with best in class sustainability leaders and to work towards increasing market access and value for Origin Green members.

Action 16: We will develop a charter with industry forging a sustainability partnership to support farmers in achieving market demands.

- DAFM, Teagasc, Bord Bia and Industry will revise Origin Green's quality assurance schemes to set stretch targets for participants in line with best practice advice which will support farmers in delivering verifiable market driven sustainability.

Question 7. Are there other actions which the State could consider, particularly in partnering with Industry?

A greater role for producers, farm advisors and processors

New partnerships, at both a technical and financial level, between producers and processors and processors and customers, with state involvement where necessary, will be required. Recent initiatives such as the Dairygold Milk Supplier Sustainability Bonus, or the Glanbia Ireland-Kepak Calf to Beef Club which includes a requirement for a reduction in the average carbon footprint of participating farms (among other things) are commendable. There is an urgent need for similar type programmes and schemes to be developed. This would further demonstrate to customers and markets of Irish food the seriousness with which it takes the climate and air challenge and its willingness to be proactive in pursuing a transition to an even more sustainable system of food production.

Use current partnerships in the livestock breeding domain e.g. ICBF to discuss the future-proofing of the environmental aspects of breeding policy and suggest ways of ensuring these indexes are used by all farmers. These discussions will inform farm advisory programmes in that regard.

Agricultural Knowledge and Innovation Systems

Agricultural Knowledge and innovation Systems (AKIS) have a key role to play in meeting challenges faced by agriculture and rural areas, however this information is often held in a fragmented manner and insufficiently applied in practice especially among smaller farmers.

There is need to increase efforts to develop new knowledge and innovative solutions as well as achieve quicker innovation and better valorisation of existing knowledge to achieve climate and productivity objectives.

Successful AKIS strategies include four groups of actions:

(1) Enhancing knowledge flows and strengthening links between research and practice;

(2) Strengthening all farm agricultural advisory services, making them strongly interconnected with the AKIS;

(3) Boosting cross-thematic and cross-border interactive innovation;

(4) Supporting the digital transition in agriculture.

Action 17: We will develop an Inclusive advisory strategy maximising the use of latest available decision support tools and metrics on performance to underpin implementation of the GHG and ammonia MACC with a particular focus on building climate resilience in our production systems, improving soil fertility and reduced fertiliser use through more effective nutrient management optimising the use of livestock manure and biological N fixation.

Action 18: We will develop a network of demonstration 'sign post' farms to underpin confidence, behavioural change and provide on farm experience of the benefits of embracing climate action.

Action 19: Monitor methane emissions with a view to stabilising methane emissions by 2020. Examine options to help drive innovation in reducing emissions while allowing choice of land use.

Action 20: Promote the engagement with land diversification options and ecological focus area to enhance opportunities from nature-based solutions such as hedgerows farm woodlands and peatlands, to building climate resilience in the landscape and in food systems

Action 21: Further enhance animal health strategies to support climate ambitions and environmental sustainability through promotion of sustainable animal health and welfare practices and enhancing food safety and authenticity.

Action 22: Explore options with stakeholders and land owners for the development of a land use framework which optimises the opportunity for coherent balancing of productivity, climate and ecosystems service objectives of land use.

Action 23: Engage with Teagasc, NESC and other stakeholders to review and analyse the full suite of land diversification options ranging from horticultural production; protein crop production and organic farming to afforestation and agroforestry to consider the alternative economic opportunities that could assist with a just transition to lower emissions land use.

Action 24: Engage with farmers and communities to address behavioural barriers and ensure a just transition to land use change.

Action 25: Support supply chain development including role of producer organisations where new market opportunities need support – e.g. new business models and supporting development of critical size.

Question 8. Are these actions sufficient, or are there others you think that Industry should pursue?

Question 9. Given that the State and policies such as the CAP can't finance or deliver all of the actions required, which actions or measures could Industry fund?

Question 10. Do you have views on how the market could better incentivise and/or reward primary producers for adopting and implementing the necessary actions?

Part 3: Preparing for the Future

I. Build on lessons learnt under parts 1 and 2
   a. Implementing changes now
   b. Acting in Partnership
II. Build resilience by embedding adaptation planning
III. Continue to invest in R&D and KT services

Introduction

The role of the Department of Agriculture, Food and the Marine and its agencies is to develop and implement policy to guide the development of the agriculture and land-use sector. This DRAFT roadmap articulates a direction of travel for the sector and aims to guide the future transformation of the sector to support Ireland's climate and energy obligations in the context of 2030 and beyond.

Preparing for the Future

Preparing for the future involves building on the experiences learnt under implementing changes now and developing partnerships to reduce emissions, enhance removals and contribute to energy decarbonisation.

Additionally, building resilience to climate change is key to having a strong and robust sector that is well placed to take on the challenges and opportunities presented by our changing climate.

Climate action requires that in addition to the sector doing all it can to mitigate emissions it must also be prepared to adapt to the changes in climate such as changed precipitation patterns and extreme events.

In particular preparing for the future requires investing in research and innovation to explore and develop opportunities to lower the emissions and enhance removals arising from agriculture and land use. Opportunities are clearly emerging in new farming methods, planting and soil remediation, resource recovery and the bioeconomy. These will be systematically developed through research and innovation, enterprise hubs, and skill development at both national and regional level. This task will be an explicit mandate for all key players.

In summary preparing for the future brings together all aspects of this roadmap highlighting six guiding principles which are key to providing an enabling framework that the agricultural sector will operate in between now and 2030 from a climate and air perspective. They will inform the outlook and approach and underpin policy direction in addressing climate change and air quality in the sector.

Implementing Change Now

1 **Agricultural mitigation** – We will address greenhouse gas (See Box 1) and ammonia emissions through the use of best available science to reduce the impact of these gases on temperature change and air quality. In doing so; we aim to deliver between 16.5 and 18.5 Mt CO_{2eq} cumulative abatement over the period 2021-2030.

2 Land use mitigation – We will work to promote sustainable land use and appropriate diversification to maintain and enhance long-term carbon stores through reducing emissions and to increasing carbon removals from LULUCF (Land Use, Land Use Change and Forestry). It is equally important that we implement balanced regional land use policies.

3 **Sustainable resources** – We will optimise the contribution of bio-based materials and residues to decarbonisation such as through anaerobic digestion and energy intensive materials displacement, and prioritise energy efficiency to deliver reduced energy demand.

Working in Partnership

4 Responsible, transparent and collaborative development - DAFM and its agencies will work inclusively with all stakeholders (farmers, industry and other stakeholders) to marry the ambitions of environmental sustainability and the increasing demand for food, feed and fibre in a co-ordinated and coherent way ensuring a vibrant, economically viable sector into the future (see Part 3 for more on this).

Preparing for the Future

5 Build resilience - We will embed adaptation planning within our policies in terms of the opportunities and challenges facing the sector into the future.

6 We will continue to invest in R&D and knowledge transfer services to drive innovation and adoption of best practice - Ensuring the latest research opportunities are explored in Irish context including around feed additives with the potential to reduce methane emissions and of mixed species grass swards. We will ensure Ireland is a world class leader in research and innovation building on the existing GHGMACC curve and updating regularly. More specifically, we will validate the safety and environmental integrity of novel fertiliser and feed formulations.

Role of Research and Innovation

Research plays a key role in achieving the transition to a low-carbon economy through the provision of expertise and analysis to inform policy decisions. Ongoing research will continue to develop further measures and technologies to reduce the environmental and climate footprint from the agriculture sector through analysis of potential advancements in a range of agricultural activities from animal husbandry, health, feeding and nutrient management. The Department continues to monitor ongoing research both nationally and internationally in an effort to find suitable mitigation technologies and approaches. There is close co-operation between DAFM and the EPA in ensuring that their respective environmental research programmes are complimentary.

The first annual report of the climate research coordination group (CRCG) illustrated a growing level of cooperation between members and that 32% of the budget committed for new Climate Research Competitive Awards 2017-2018 related to DAFM activities.

Six action areas identified by the CRCG set out research needs in the agricultural arena, for example to elaborate on carbon neutrality concepts; develop integrated abatement strategies and cost curves across climate, air (including GHGs), water, biodiversity and agriculture; continue investigating sequestration and land use change; identify behaviour change opportunities with farmers; and analyse the benefits of beef genomics.

Question 11

What are your views on these six guiding principles in preparing for the future? Are they sufficiently comprehensive or are there others you would add?

Question 12

Innovation is now widely recognised as a key driver of long-term growth and sustainable development and addressing of challenges such as Climate Change. What type of approaches and processes could assist the Irish agri-food innovation system to address economic and societal challenges and facilitate increased networking, collaboration and investment?

Actions required to meet this ambition of preparing for the future:

Action 27: Investigate diet quality and use of novel feed additives to reduce methane emissions.

Action 28: Support Innovation in crop production such as development of new varieties and development of technologies (covered systems or storage technologies) to enhance the viability of new crop production systems (larger crop diversity) in Ireland e.g. new protein crop varieties or other horticultural crops.

Action 29: Explore the cost effectiveness and sustainability[14] of growing crops such as grass, potatoes, sugar beet or maize to meet opportunities in the bioeconomy or as materials for energy generation.

Action 30: We will ensure a greater focus on research into land diversification options in agricultural colleges and other bodies to help educate farmers on the benefits of diversification

[14] Sustainability includes the capacity to meet sustainability criteria set by the renewable energy directive (RED II)

Action 31: Explore cost-effectiveness and feasibility of DNA testing and alternative types of DNA testing/genotyping of the national herd to enhance breeding goals, including environmental performance and traceability.

5. Summary

Ireland faces significant challenges to meeting its climate change and air quality targets (as well as biodiversity and water quality targets). This challenge is replicated across all other sectors of the economy including transport and residential.

If Ireland wishes to remain a world leader in the production, management and marketing of low-carbon, high-quality sustainable and traceable food, then significant efforts will be required to maximise production efficiency whilst minimising the effects on the climate and reducing the environmental footprint of agriculture.

Failure to implement changes today, will mean that more radical corrective action will be necessary later to ensure achievement of our 2030 commitments. Scientific research, the adoption of best practices at farm level and working in partnership will be a critical success factor in striving towards our climate goals.

A plan focused on collaboration and a just transition for all is critical for the development of this roadmap. By working together, the sector can ensure its long-term sustainability, from an economic, social and environmental perspective.

Appendix 1 - Synergies with other environmental priorities

Achieving the measures as set out in the GHG MACC will not only lead to a reduction in carbon emissions, but there will be co-benefits for other environmental priority areas. This is explained in more detail in the following sections. The appropriate use of nitrogen is fundamental to all environmental priorities. The sector must find a way to reduce nitrogen losses to both water and air. The importance of nutrient management planning cannot be overstated, the sector must find a way to use nutrients in a more effective manner, the liming of soils is critically important in this regard. Soils are fundamental to production agriculture, and with appropriate nutrient application, soil health can be improved over the coming years.

Water Quality

Overall, water quality in Ireland is relatively good compared to other European Member States. However over recent years there are signs that water quality is declining, and that agriculture is responsible for a significant portion of the decline. The two main suspected causes of pollution in rivers are agriculture and municipal sources, accounting for 53% and 34% of cases, respectively. The EPA's 'state of the Env report 2016[6] notes that Ireland is still a long way from meeting the full legal requirements of the Water Framework Directive, against which water quality is measured. There was no overall improvement in water quality over the first river basin cycle (2009-2015); the target of a 13.6% improvement in the ecological status of surface waters (from the 2009 baseline) by 2015 was not achieved. Water quality improvements are required at approximately 50% of rivers, lakes and estuaries that are impacted by pollution or other pressures. While overall the length of unpolluted river channel has remained relatively constant, there has been a substantial loss in the number of highest quality river sites (i.e. Q value of 5). In the most recent monitoring period (2013-2015) only 21 sites were classified as the highest quality river sites (0.7% of sites) compared with 575 between 1987 and 1990 and 82 between 2001 and 2003. This is an area where substantial effort is required to protect the few remaining sites and, where feasible, return impacted ones back to their earlier extremely high quality.

By adopting the GHG MACC curve, with particular reference to actions 1 and 2 of this roadmap, agriculture would make a significant contribution to meeting its water quality objectives under Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (the Nitrates Directive) and Directive 2000/60/EC establishing a framework for the Community action in the field of water policy (Water Framework Directive).

Ammonia Emissions

The agriculture sector accounts for virtually all (99 per cent) of ammonia emissions in Ireland. Grasslands ultimately receive the bulk of the 40 million tonnes (Mt) of animal manures produced annually in Ireland along with approximately 400,000 tonnes of nitrogen in fertilisers (2018 N sales figures). A proportion of the nitrogen in these inputs is volatilised into the air as ammonia.

Ireland's national emission ceiling for NH_3 under the NEC Directive is 116 kilotonnes (kt), to be achieved by 2010 and in each year until 2019. This is equivalent to a 5.6 per cent permitted increase in emissions from the 109.8 kt 1990 baseline figure. The emissions in 2017 were 11.14kt or 10.4 per cent higher than emissions in 1990. Animal manures produce about 90 per cent of ammonia emissions

in agriculture and chemical fertilisers and road transport account for the remainder. It is estimated that approximately 15 per cent of the nitrogen in animal manures and 2 per cent of nitrogen contained in chemical fertilisers is lost to the atmosphere as NH_3. The NH_3 emissions trend is consequently largely determined by the cattle population and showed a steady increase up to 122.19kt in 1998. There was some decline in the populations of cattle and sheep after 1998, as well as a decrease in fertiliser use, which contributed to a decrease in NH_3 emissions in the period 2000 to 2011. Recent increases in cattle numbers and fertiliser use have seen NH_3 emissions increase for the last five years. Ammonia emissions increased in 2017 by 2.4kt, primarily as a result of a 3.1 per cent increase from dairy cattle and an 8.8 per cent increase from synthetic fertiliser use.

The emissions of NH_3 are compliant with the 2010 ceiling for years 2010 to 2015, however Ireland exceeded the emission ceiling in 2016 and 2017. Limiting and reducing NH_3 emissions into the future could be problematic given the strong performance of the agriculture sector in line with the ambitious targets of Food Wise 2025. Furthermore, there is a requirement for 1% reduction on emissions compared to 2005 levels by 2020 onwards and 5% reduction in emissions compared to 2005 levels by 2030 onwards. Reducing NH_3 is a challenge, with almost all our ammonia coming from grass based agricultural activities where grazing is already considered a cost-effective Category 1 abatement option (i.e. associated with lower emissions than confined housing systems).

As well as potentially damaging the environment, the release of ammonia is a cost to the farmer through the loss of a valuable plant nutrient. Nitrogen is a key farm input (through fertilisers and feedstuffs) and the priority should be to take steps to (i) introduce no more N into our production systems than is necessary and efficient and (ii) retain it within the production system rather than releasing it to the atmosphere. Utilising N efficiently will result in higher nutrient use efficiency on farm and the need for less additional nutrients.

As in the case of water quality above, by adopting the GHG MACC curve, with particular reference to actions 1 and 2 of this roadmap, agriculture would make a significant contribution to meeting its ammonia targets over the coming decade.

Biodiversity

Ireland's habitats are protected under the EU Nature Directives. The Habitats Directive and the Birds Directive aim to ensure the protection of habitats and species which have been selected for conservation within Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). These sites comprise the EU Natura 2000 network. The Directives have been transposed into national law under the European Communities (Birds and Natural Habitats) Regulations 2011, the Planning Acts and the Wildlife Acts. In Ireland, the network of European sites (SACs and SPAs) is complemented by the designation of sites of national importance as Natural Heritage Areas (NHAs) under the Wildlife (Amendment) Act 2000. There are 439 SACs, 154 SPAs and 148 NHAs. These make up 13.66% of the terrestrial area of the State. It has been estimated that there are circa 35,000 farmers with land in SACs and SPAs.

The Farmland Bird Index figure for 2008 was 92.4, compared to a base index of 100 for the year 2000. However, work completed for the Department of Agriculture, Food and the Marine by Birdwatch Ireland found that the state of Ireland's common and widespread breeding bird populations overall is

favourable for the period 1998 to 2009. While some species of conservation concern in Ireland are also faring well, showing stability during this period, other species such as the corncrake, hen harrier, chough, twite, grey partridge and breeding waders have declined. Most species that were selected as farmland indicators were stable or increased during this period.

Hedgerows are estimated to cover 3.9% of the Irish landscape or 660,000 km length. Various AECM schemes facilitated the planting of approximately 11,000 km of new hedgerows and the rejuvenation of some 6,000 more. The total area of hedgerow and non-forest woodland patches across the landscape could possibly represent a significant carbon sink and could potentially be used as a mitigation option.

High Nature Value (HNV) farmland areas and features have been widely recognised as a valuable asset of European agricultural landscapes, providing highly varied living conditions for a wide range of species and thereby contributing to biodiversity[8]

HNV farming is therefore a key indicator for the impact assessment of policy interventions with respect to the preservation and enhancement of biodiversity, habitats and ecosystems dependent on agriculture and of traditional rural landscapes.

HNV farmland is extensively managed farmland that has high biodiversity. This farmland is important for the conservation of semi-natural habitats and the plants and animals linked with them but also in providing environmental public goods and ecosystem services. Supporting this type of farmland will ensure high levels of farmland biodiversity, high water, air and soil quality and resistance to flooding as well as maintaining viable communities in these areas. These farms occur most frequently in areas that are mountainous, or areas where natural constraints prevent intensification. Farming sustains the biodiversity of these landscapes and is integral to maintaining their high nature value. In HNV farmland semi-natural habitats are essential parts of the grazing and hay or silage systems. In Ireland these important farmland habitats fall into two categories: peatland (heath and blanket bog) or semi-natural grassland habitats. Both have a low stock carrying capacity but grazing of cattle or sheep is an important component of maintaining these habitats. Improved management of peatland soils can enhance biodiversity as well as reducing carbon loss from peat degradation. In addition, better managed peatlands can contribute to improved water regulation through the landscape.