Joint Committee on Agriculture, Food and the Marine

Climate Change and Sustainability in the Agriculture and Food Sectors

July 2018
An Comhchoiste um Thalmhaíocht, Bia agus Muir

An tAthrú Aeráide agus an Inmharthanacht in Earnálacha na Talmhaíochta agus an Bhia

Iúil 2018

Joint Committee on Agriculture, Food and the Marine

Climate Change and Sustainability in the Agriculture and Food Sectors

July 2018
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Chairman’s Foreword

Undoubtedly, Climate Change is the most significant issue of our time and one of the greatest challenges faced by all sectors. This could not be more relevant to any other sector than the agri-food sector. In undertaking this body of work, the Joint Committee on Agriculture, Food and the Marine wanted to explore the challenges specific to its remit and identify potential policy solutions for these challenges.

A large number of organisations engaged with the Committee, representing farming, sectoral, marine and environmental sectors. While engagement from the fisheries sector has been limited, the Committee plans to examine the environmental issues concerning the marine in wider detail in its upcoming Work Programme item on Harnessing Ireland’s Ocean Wealth.

This Report focuses predominantly on the agriculture and food sectors. Farmers are the natural custodians of the rural environment and have, for generations, maintained a rural landscape that Ireland remains renowned for worldwide. However, while substantial efforts have been made, climate change is an issue that all sectors in agriculture must now face, and while carbon emissions have remained at a stable level, they continue to represent the highest proportion of our overall emissions.

In the absence of heavy industry, the agri-food sector is our indigenous industry, which further underlines the need to promote efficiency, balance in production and value, and action aimed at continued improvement. Everyone has a part to play, and as the report sets out, efforts and successes need to be communicated and shared, while supports and incentives should be aimed at those who play a part.

The Committee’s report and recommendations are intended to provide a basis for engagement between stakeholders and Government, enabling the development of a common agriculture strategy, continuing Irish agriculture’s success story, while finding new successes in sustainability and the environment.

Finally, I would like to sincerely thank all stakeholders who engaged with the Committee, made submissions and attended the Committee’s meetings on this issue.

Pat Deering T.D.
Chairman
10 July 2018
Introduction

Taken with Reform of the CAP, Brexit and increased competition from new markets, Climate Change is a significant challenge facing the agriculture sector. The Joint Committee on Agriculture, Food and the Marine (the Committee) recognises this issue as perhaps the most serious issue for farmers as unlike trade, Brexit or subsidies, there are fears that environmental and climatic consequences cannot be mitigated.

Agriculture is a sector of some significance in the climate change debate. As the Committee heard, it is the highest contributor to emissions in Ireland. However, of dairy sectors in the EU, it is the most efficient and of the beef sectors in the EU, it is the fifth most efficient. Additionally, the agri-food sector is Ireland’s largest indigenous industry. Therefore, the scope to achieve reductions in emissions appears limited and any actions need to be considered carefully in the context of the value of the agri-food sector to the Irish Economy.

Nevertheless, many of the concerns raised by environmentalists cannot be ignored, and more efficient and incentivised means of defending the environment should be explored. The objectives of new strategies should be mitigating climate change and introducing new production efficiencies aimed at producing more from less.

As part of its work, the Committee reviewed documentation and studies, and is particularly grateful to the Environmental Protection Agency and Science Foundation Ireland for sourcing supplementary material that has been very useful in the compilation of this report. The Committee also examined statistical data available from the Central Statistics Office, the Environmental Protection Agency and Eurostat.

However, the key input to the Committee’s consideration was the written submissions received from key stakeholders representing a variety of sectors, including the meat, dairy and tillage sectors. The Committee is grateful to all those who made submissions and is particularly grateful to those who attended Committee meetings on the matter.

The Committee has also undertaken some engagement with the marine sector, but notes that the climate change issues are significantly different in this sector. The Committee will address the climate change challenges in more detail in the context of its consideration of Harnessing Ireland’s Ocean Wealth later this year. However, the Committee felt some salient points were made in relation to impact on the Marine and should be included at this stage.
In its consideration of this topic, the Committee invited a number of key stakeholders to make written submissions on the topic of Climate Change within the remit of Agriculture, Food and the Marine. A consolidated version of the submissions may be accessed via the link in Appendix 4 to this report. From these submissions, a number of agencies and representative bodies were also invited to attend meetings of the Committee as set out in the below table:

**Table 1 - Stakeholders Engaged by the Committee**

<table>
<thead>
<tr>
<th>Dates</th>
<th>Organisation</th>
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<tr>
<td>14 November 2017</td>
<td>Government&lt;br&gt;- Department of Agriculture, Food and the Marine</td>
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<td>12 December 2017</td>
<td>Forestry&lt;br&gt;- Coillte</td>
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<tr>
<td>23 January 2018</td>
<td>Food Promotion&lt;br&gt;- Bord Bia</td>
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<tr>
<td>13 February 2018</td>
<td><strong>Farming and Industry</strong>&lt;br&gt;- Irish Farmers’ Association&lt;br&gt;- Irish Cooperative Organisation Society&lt;br&gt;- Irish Creamery and Milk Suppliers’ Association&lt;br&gt;- Macra na Feirme</td>
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<tr>
<td>20 February 2018</td>
<td><strong>Farming and Industry</strong>&lt;br&gt;- Meat Industry Ireland&lt;br&gt;- Irish Grain Growers&lt;br&gt;- Irish Natura and Hill Farmers Association</td>
</tr>
<tr>
<td>6 March 2018</td>
<td>Environment&lt;br&gt;- Environmental Protection Agency&lt;br&gt;- Environmental Pillar&lt;br&gt;- Stop Climate Chaos Coalition&lt;br&gt;- Marine Institute&lt;br&gt;&lt;br&gt;<strong>Farming and Industry</strong>&lt;br&gt;- Dairy Industry Ireland&lt;br&gt;- Irish Organic Farmers and Growers Association&lt;br&gt;- Teagasc&lt;br&gt;- Irish Cattle and Sheep Farmers Association</td>
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<td>11 April 2018*</td>
<td>Government&lt;br&gt;- Minister for Agriculture, Food and the Marine</td>
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<td>15 May 2018*</td>
<td>Conservation Agriculture&lt;br&gt;- BASE Ireland</td>
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<tr>
<td>29 May 2018*</td>
<td>New Approaches to Agriculture&lt;br&gt;- University College Dublin</td>
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<td><strong>Additional Material</strong></td>
<td>Written Submissions&lt;br&gt;- Science Foundation Ireland&lt;br&gt;- Dawn Meats&lt;br&gt;- Prof. Peter Thorne, NUI Maynooth&lt;br&gt;- National Inshore Fisheries Forum&lt;br&gt;- Coastwatch</td>
</tr>
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*While these meetings were not held on the issue of Climate Change, issues emerged that the Committee considered relevant to this report.*
Executive Summary

Agriculture and the environment are very closely related, and the Joint Committee on Agriculture, Food and the Marine has, in recent months, considered this relationship in some detail. Climate change is a very significant challenge facing the agri-food sector, and the need to pursue sustainable practices has never been more important. As part of this consideration, the Committee decided to undertake a comprehensive review of this challenge, with the objective of establishing clear and achievable recommendations.

The Committee notes however that agriculture itself is of highly significant importance to Ireland with export levels in excess of €13 billion and employing, directly and indirectly, over 300,000 people. In the absence of any heavy industry, it is our largest indigenous business sector and a vital component to the economy. However, in a global context, climate change is taking on a new focus as governments tackle this issue with a renewed sense of urgency. In 2015, this culminated with the Paris Agreement, which set global targets for the reduction of GHG emissions. In a national context, a focus of GHG reduction is firmly on the level of action in agriculture, which contributions in excess of 30% of total emissions.

This Report examines the issue of Climate Change from a number of perspectives:

1. The importance of agri-food to the Irish economy;
2. The general challenges facing the agriculture sector, including the challenge of greenhouse gas (GHG) emissions;
3. The upcoming reform of the Common Agricultural Policy and the recent report of the Citizens’ Assembly;
4. Challenges posed by the Livestock sector, primarily consisting of enteric fermentation, which contributes over half of all GHG emissions;
5. Challenges posed by nutrient and soil management, considering emissions from manure management and soils make up almost 40% of overall emissions from agriculture.
6. Possible solutions in carbon sequestration, particularly from forestry, agroforestry and grasslands; and
7. Related challenges in the marine sector, including marine pollution from the food industry and the impacts of extreme weather on the agri-food sector.

In summary, it is clear that Ireland needs to take action aimed at reducing its GHG emissions and the agriculture sector has a significant role to play in achieving this objective. The role of efficiency is very important, particularly in reconciling the level of emissions with the ambition and targets of Food Wise 2025, while research and technology also have a significant role to play.

To this end, the Committee puts forward 35 practical, implementable recommendations in this report.
Summary of Recommendations

Agriculture and Climate Change

1. The Committee welcomes the work of the Citizens Assembly and notes the recommendations made which are clearly aimed at reducing GHG. However, the Committee considers that there are additional implications arising for the agri-food sector, in particular the Committee recommends that further emphasis is added to the absence of heavy industry in Ireland in the consideration of climate change targets.

2. The Committee recommends that an incentive is put in place to encourage all Irish farmers to adopt practices that reduce emissions in all three major areas; livestock emissions, manure management and agricultural soils / fertilisers. The greater levels of subsidiarity proposed in the new Common Agricultural Policy should allow climate change and environmental challenges to be at the centre of Irish CAP strategic plans.

3. The Committee recommends measures to incentivise the reduction of emissions and the pursuit of more efficient processes, which is in line with proposals for the post-2020 CAP. For example, the basing of CAP payments on achieving environmental / green targets may be a more optimal system than a carbon tax.

4. The Committee recommends that an immediate impact assessment of the climate change and sustainability targets in Food Wise 2025 be undertaken.

5. Incentives aimed at reducing food waste and supporting both forestry and organic farming should be encouraged.

6. Addressing the twin challenges of Climate Change and Brexit should be addressed in a balanced way. The Committee recommends that the necessary levels of production and expansion are undertaken to mitigate the economic impact of Brexit, but stresses that sustainability must also be at the core of any expansion plans.

7. The Committee recommends that readily available measures are put in place to assist farmers and rural communities in responding to the impact of extreme weather events, such as shortages of fodder, heatwaves and winter storms.

Livestock Sector

8. The Committee recommends that the Minister for Agriculture, Food and the Marine promotes all schemes and practices that are orientated towards the goal of carbon neutrality.

9. The Committee recommends that the multi-stakeholder Dairy Sustainability Ireland initiative is supported.

10. The Committee recommends that the Smart Farming programme be expanded.

11. The Committee recommends that greater resourcing is provided to research and knowledge-sharing aimed at providing the necessary tools and aids to Irish farmers to assist them in climate change mitigation.

12. The Committee recommends that the issue of efficiency is highlighted and explored further at EU and international level, in particular the need for all processes contributing to agricultural emissions to be as productive and efficient as possible.
13. The Committee recommends that the Organic Farming Scheme continue to be included in Irish environmental measures, including the Common Agricultural Policy post-2020. An enhanced and expanded organic farming scheme, focused on emission-reducing practices, may be of benefit in addressing Irish agricultural emissions.

14. The Committee recommends that a Communications Strategy be developed which highlights the scale of Irish food production in the dairy and beef sectors, in particular stressing the levels of efficiency achieved.

15. The Committee recognises the merit of a Single Environmental Area between Ireland and Northern Ireland, as well as the need for a commonality in approach in addressing GHG emissions form the island of Ireland as a whole. The Committee recommends an identification of Member States of the EU, the EEA and the OECD facing similar challenges, with the objective of establishing channels of knowledge exchange.

16. The Committee recommends that ways in which current initiatives to optimise breeding, including the Beef Data and Genomics Programme and the use of sexed semen, can be enhanced be further explored.

17. The Committee recommends that resourcing be provided to examine the potential for seaweed additives and smart grass as a means of mitigating GHG emissions from livestock.

18. The Committee recommends that the Carbon Navigation Programme, as part of Origin Green, be continued and enhanced. The potential of carbon accounting being focused on emissions per unit output should also be highlighted as a means of measuring GHG emissions.

19. Noting the increases in production, the constant level of GHG emissions and the slight differences in statistics, the Committee recommends that the criteria used in the accounting of carbon emissions for rapidly expanding sectors, such as the dairy sector, are kept under review, in order to ensure consistency.

**Agricultural Soils, Manure Management and the Bio-economy**

20. The Committee recommends that the potential of the bioeconomy be further explored.

21. The Committee recommends the development of a Climate Activation Programme, to include measures such as an enhanced GLAS Scheme and energy tariffs which incentivise the use of renewable energy by farmers. The Committee also recommends the introduction of a premium tariff or subsidy that encourages the use of renewable energy.

22. The Committee recommends that GLAS be reviewed to include requirements on the pH level of soils, with a view to making an increase in pH level a specific objective of the scheme. The Committee also recommends that consideration be given to bringing the use of lime within the scheme, as this is known to increase pH level.

23. The Committee recommends a scheme that promotes the increase in the number of anaerobic digesters among farmers and producers, noting its potential as an energy source and as a means of producing highly effective fertiliser. Any schemes should provide financial supports for the installation of such digesters, as well as reward the use of such equipment.

24. The Committee believes that the potential for bioplastics should be explored, and recommends that resourcing be provided to enhance research in this area and the potential of crops such as hemp to assist this area.
25. The Committee believes that the possible impacts on pollination should not be ignored and recommends that a scheme encouraging the growth of beans, peas, oilseed rape and cover crops be put in place by the Minister, as well as incentives to encourage a stronger beekeeping sector.

**Forestry and Grasslands**

26. The Committee recommends a scheme that promotes agroforestry among Irish farmers through the provision of adequate supports and incentives, including that consideration be given to making designated land available for planting.

27. The Committee recommends that consideration be given to resuming public plantings of new forests, in addition to current measures encouraging private planting.

28. There is much opportunity in the area of biomass, and the Committee recommends that appropriate incentives are introduced to encourage and revitalise biomass production.

29. The Committee recommends that no forestry scheme should focus on a single type of tree i.e. monoculture, and practices to ensure biodiversity should be encouraged. As part of this, the Committee suggests that current requirements for biodiversity (15%) be reviewed with consideration given to increasing this requirement.

30. The Committee recommends providing support and guidance to farmers on the adoption and practice of organic and conservation agriculture.

31. The Committee recommends a scheme to encourage the use of mixed swards and grasslands containing clover.

**Marine Sector**

32. The Committee is gravely concerned by the implications of plastic packaging and its impact on the oceans and recommends that measures are put in place to limit Ireland’s contribution to this issue.

33. The Committee recommends that the potential risks to aquaculture be monitored, particularly in the oyster and mussel sectors and the possible health impacts from algal blooms and phytoplankton.

34. The Committee notes that Climate Change may result in warmer waters and recommends that a study be undertaken on the likely economic advantages, for example hake and monkfish sectors where stocks may increase.

35. The Committee recommends that measures be taken to prepare for any adverse impact of Climate Change on stocks, such as cod and haddock in the fisheries sector and wild salmon in the angling sector.
1. Agriculture and the Economy

Among the central challenges in addressing the climate change issue is reconciling the need for emissions reduction with the importance of the agri-food sector to the Irish economy. Based on evidence to the Committee and supporting data, the agri-food sector is Ireland’s largest indigenous industry, supporting some 137,400 jobs directly, increasing to 300,000 when indirect jobs are taken into consideration. Direct employment is measured at approximately 65% of jobs in the agriculture, forestry and fishing sector.¹

The importance of the agri-food sector to the Irish economy featured prominently in written submissions. It is Ireland’s largest indigenous sector, with food, drink and forest exports worth over €13.5 billion in 2017.²

Figure 1 - Approximate Value of Agri-Food Exports (€000)³

The Department of Agriculture, Food and the Marine states the total value of exports to be €13.6 billion in 2017, an increase of 11% on 2016. Additionally, the agri-food sector is one of the fastest growing sectors in the Irish economy, accounting for 11.1% of total exports in 2017 (an increase of 74% between 2009 and 2017).⁴ Cattle related sectors account for 52% of such exports, dairy comprising 34% and beef comprising 18%.

The dairy sector is particularly important, with the Irish dairy herd exceeding 1.3 million cows and the total value of Irish beef and dairy export markets measured at €6.52 billion according to the ICMSA.⁵ As noted above, the Department of Agriculture, Food and the Marine’s approximation of this figure is stated as being closer to €7 billion. The number of cattle overall in the Irish sector is also of relevance, with the Irish dairy and beef sectors accounting for over six million cattle, spread across a variety of purposes. While there is some variance in the figures put forward within the sector, these figures stress the significance of dairy and beef as primary industries in Ireland.

¹ Factsheet on Irish Agriculture, January 2018, citing the National Household Survey, 2016
² Irish Farmers’ Association, Submission to the Committee
³ Department of Agriculture, Food and the Marine, Trade Fact Sheet, March 2018. This graph is based on information available from the CSO. The Department and the CSO agree statistics for 24 commodity groups which represent the agri-food sector.
⁴ Department of Agriculture, Food and the Marine, Trade Factsheet, March 2018
⁵ Irish Creamery and Milk Suppliers’ Association, Submission to the Committee
The following figures are highlighted by the Department of Agriculture, Food and the Marine in measuring the export output of key agri-food sectors:

Table 2 - Export Value of Key Sectors in the Agri-Food Industry\(^6\)

<table>
<thead>
<tr>
<th>Export Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>€4.600 billion</td>
</tr>
<tr>
<td>Beef</td>
<td>€2.400 billion</td>
</tr>
<tr>
<td>Pigmeat</td>
<td>€0.790 billion</td>
</tr>
<tr>
<td>Beverage</td>
<td>€1.400 billion</td>
</tr>
<tr>
<td>Seafood</td>
<td>€0.605 billion</td>
</tr>
<tr>
<td>Fruit and Vegetable</td>
<td>€0.300 billion</td>
</tr>
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**Export of Food and Supporting Global Populations**

The Committee heard that agri-food continues to be an important export-driven sector of the economy, with almost 90% of produce being exported.\(^7\) Much of these exports are focused on the United Kingdom and continental EU markets.\(^8\) In turn, the Stop Climate Chaos Coalition argue that due to the export to premium markets, the suggestion that Ireland supports global populations is without merit as exports are not going to regions where they are needed.\(^9\) However, the role of Irish producers in humanitarian and aid initiatives to alleviate crises relating to climate change abroad, such as droughts, is also acknowledged. The need for policy coherence within a whole of government approach was emphasised by the Joint Committee on Foreign Affairs and Trade, and Defence in its recent Review of the Irish Aid Programme.\(^10\)

**Economic Challenges**

In its report, the EPA advises that the economic challenges faced by Ireland’s farming community are clear, with the estimation that just over one-third of the largest 79,000 farms in the country are economically viable.\(^11\) The same report highlights that the dairy sector is the most profitable sector, and the cattle rearing sector the least profitable.\(^12\)

A key challenge is generational renewal, with approximately 1,000 young people in the EU leaving farming everyday.\(^13\) The importance of the family farm structure to Irish agriculture and the need to provide further incentives for young people to enter farming is central to this challenge. With regard

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\(^6\) Department of Agriculture, Food and the Marine, Trade Fact Sheet, March 2018

\(^7\) Irish Creamery and Milk Suppliers’ Association, Evidence to the Committee, 13 February 2018


\(^9\) Stop Climate Chaos Coalition, Evidence to the Committee, 6 March 2018. See also, Stop Climate Chaos Coalition / Environmental Pillar, Joint Submission to the Committee

\(^10\) Joint Committee on Foreign Affairs and Trade, and Defence, *Review of the Irish Aid Programme*, February 2018 at pp.22-23


\(^12\) Ibid.

\(^13\) European Court of Auditors, Evidence to the Committee, 24 January 2018. This meeting was not part of the Committee’s consideration on Climate Change, but makes a relevant point on the need to incentivise young people to enter agriculture.
to climate change and sustainability, the Committee believes that opportunities may exist in agricultural science, precision agriculture and the expansion of the use of technology in farming as a means of attracting more young people to agriculture.\textsuperscript{14}

The future of the CAP and other market supports is also important. The Committee does not anticipate the outcome of the current reform process, but does expect the new policy to contain a strong environmental element.\textsuperscript{15} A key concern is the level of undertaking or investment that would be required of farmers, and the suggestion that rewards through proposed eco-schemes will form part of the basic payment structure are to be welcomed. However, there is an expected cut of 5 to 10% for the overall CAP, which will highlight the issue of farming efficiency within the direct payment structure and the balance between Pillar I and Pillar II allocations.

The proposed changes to national ceilings under the proposed CAP, which are central to any possible economic impact, are approximated as follows:

\textbf{Table 3 - Comparative Values of CAP Pillar I & II - 2014-2020 & 2021-2027}\textsuperscript{16}

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<th>National Ceilings - Ireland (€000)</th>
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<td>7</td>
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<td>Total</td>
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\textbf{UK Withdrawal from the EU}

The issue of Brexit continues to dominate the agenda and, indeed, is a critical economic challenge facing the Irish agri-food sector. However, this needs to be balanced with the longer-term challenge of climate change. This may be particularly difficult for sectors that are heavily reliant on the UK market, e.g. increased competition and the potential application of tariffs may increase costs and, in turn, limit the capacity to address climate-related issues.

In its previous report on the impact of the UK Referendum on the Agri-Food Sector, the Committee noted many of these concerns, highlighting that diminishing growth in GDP in the UK is likely to have implications for Ireland too, which are “likely to be felt most by sectors which export disproportionately to the UK”.\textsuperscript{17} The same report also notes the impact of currency fluctuations and trade diversion, stressing that the latter poses a significant because of the high tariffs applied to food produce.\textsuperscript{18} Among the reports recommendations were the need for a swiftly concluded trade

\textsuperscript{14} University College Dublin, Evidence to the Committee, 29 May 2018.
\textsuperscript{15} European Commission, COM(2017) 713, \textit{The Future of Food and Farming - Communication from the Commission to the European Parliament, Council, the European Economic and Social Committee and the Committee of the Regions.}
\textsuperscript{17} Joint Committee on Agriculture, Food and the Marine, \textit{Impact of the UK Referendum on Membership of the European Union on the Agri-Food and Fisheries Sectors, February 2017 at p.35}
\textsuperscript{18} Ibid. at p.37
agreement with the UK, as well as market diversification and a re-evaluation of the Food Wise 2025 targets.

In 2017, the cross-border impact on the agri-food trade has been highlighted by the British-Irish Parliamentary Assembly. The possible impacts of regulatory divergence between Ireland and Northern Ireland are well documented, with the Seanad Special Select Committee on the Withdrawal of the United Kingdom from the European Union proposing the establishment of a mechanism that ensures that environmental regulation between Ireland and Northern Ireland is aligned. This is important as it is understood that the output of emissions between Ireland and Northern Ireland is a very similar percentage of total emissions.

In any case, the need to increase production and expand markets continues to remain extremely important. This has been acknowledged by the Department of Agriculture, Food and the Marine, in highlighting the growth of trade between 2009 and 2017, on which it notes that “[e]xports to the UK during this period increased by 40%, with exports to the rest of the EU increasing by 68%. However the most significant export growth was seen in exports to non-EU destinations (+162%)”. Continuing to support this, the Department has also put a number of supports in place, with the provision of €25 million to support loans to farmers, fishermen and food businesses and a loan scheme aimed at providing up to €300 million to support SMEs.

19 Interim Report of Committee C, British-Irish Parliamentary Assembly, July 2017 at pp.5 to 8.
20 Report of the Seanad Special Committee on the Withdrawal of the UK from the UK, Brexit: Implications and Potential Solutions, June 2017 at p.30
21 Department of Agriculture, Food and the Marine, Brexit Factsheet, April 2018
2. Agriculture and Climate Change

Context

Over the past century, there is evidence to suggest that Ireland, like the rest of the globe, has warmed. The information appears to suggest that “[c]hanges at the regional level contain more variability than changes in the global mean, yet an emerging signal of change is clear”. The recent weather events in Ireland, particularly Storm Ophelia and Storm Emma, further underline the impact of extreme climate events for agriculture and their potential frequency in the years and decades ahead. The Stop Climate Chaos Coalition highlighted how this challenge has already manifested itself:

“In fact, agriculture is particularly dependent on a stable climate. In recent years we have seen this in the damage done by flooding and the fodder crisis and, in recent days, by the damage done by the combination of Storm Emma and the “beast from the east”. All these extreme weather events are made more likely by global warming”.

Agricultural emissions are classed as non-ETS emissions, meaning that they cannot be traded through the EU’s Emissions Trading System. While this underlines the challenge of reducing emissions, this classification of emissions also raises a number of points on how emissions are accounted for, how they are calculated, whether they are measured at the point of production or consumption and whether the system used is fair to Member States of differing economic structures. Examples of emissions that can be traded (ETS emissions) include emissions from the generation of heat and electricity, and commercial aviation.

Mitigation

Mitigation refers to measures aimed at alleviating the impact of emissions and other causes of climate change. Most notably, this includes the aim of reducing GHG emissions as required under the Paris Agreement, but can also include the development of measures to:

- improve carbon sequestration;
- develop carbon sinks such as soils; and
- increase production efficiency in industries which are sources of emissions.

Adaptation

Adaptation refers to the process of adapting to new climatic conditions resulting from climate change. In contrast to mitigation, the Committee notes that this course of action accepts climate change as inevitable and that new practices are required. The Environmental Protection Agency, in its report, the *State of Knowledge on Climate Change Impacts for Ireland*, cited possible changes as the following:

- Temperature increases;
- Changes in precipitation patterns and heavy rainfall;

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23 Prof. Peter Thorne, NUI Maynooth, Submission to the Committee
24 Stop Climate Chaos Coalition, Evidence to the Committee, 6 March 2018
- Extreme events (including heatwaves and cold events); and
- CO2 concentration.

Already, adaptation measures being implemented have experienced challenges, one being the modification of fodder crops for animal diet, e.g. seaweed, where the challenge is whether enough seaweed can be produced to provide additives for most or all of Ireland’s cattle population. Other adaptation measures such as adoption of earlier planting / harvesting, increased drainage and measures to protect from the elements have also been implemented.

**Temperature and Rainfall**

A number of indicators exist to suggest that Climate Change is a real phenomenon, and that the globe has warmed in general terms over the last 150 years. Ireland, like the rest of the globe, has warmed also and although the data may contain greater levels of variability than the global mean the level of change is evident. For example, according to data concerning 30-year mean temperatures, available from Met Éireann and illustrated in the below graph, the mean temperature has risen between the period 1961-1990 and the period 1981-2010 by 0.2°C at Dublin Airport and 0.5°C at Valentia. While this is a very slight increase, it is an indicator of rising temperatures.

**Figure 2 - Mean Temperature (30 Years)**

![Graph showing mean temperature changes over 30 years at Dublin Airport and Valentia](https://www.met.ie/climate/30-year-averages)

The impact on moisture is an issue that is timely given the extraordinarily long winter experienced by Ireland’s farming community over the 2017-2018 period. On average, summers are expected to be drier and winters wetter. However, extreme rainfall events, which are uncommon, were also raised in submissions to the Committee. Human-influenced climate changes, such as those resulting from GHG emissions, mean that such rainfall events are likelier, both as winter-storm based precipitation during the winter, and convective rainfall events in the summer. Equally, the likelihood of...

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26 Prof. Peter Thorne, NUI Maynooth, Submission to the Committee
27 Met Éireann, 30 Year Averages, available at [https://www.met.ie/climate/30-year-averages](https://www.met.ie/climate/30-year-averages), accessed 5 July 2018. While Dublin Airport and Valentia are selected for the above graphs, increases have been recorded across all weather stations.
28 See for example, EASAC, *Extreme weather events in Europe - Preparing for climate change adaptation: an update on EASAC’s 2013 study*, March 2018
29 Prof. Peter Thorne, NUI Maynooth, Submission to the Committee
memorable extreme weather events e.g. heatwaves, is highlighted as another way in which change may be considered.\textsuperscript{10}

**Domestic Action**

In January 2018, the Government published a statutory National Adaptation Framework to follow the previous framework published in 2012. The Framework identified a number of sectoral impacts relevant to this Report. There are set out as follows:

**Sectoral Impacts - National Adaptation Framework\textsuperscript{31}**

**Agriculture:** All aspects of Irish agriculture will be affected by climate change. The main impacts will result from changes in air and soil temperatures, changes in rainfall patterns and extreme events. Key impacts could include water stress for crops, heat stress for animals, plant diseases which are currently rare may occur more frequently and the mobility of machinery on fields may be affected due to increased levels of winter rainfall.

**Forestry:** Changes in climate will significantly affect forestry operations in Ireland and, when planning, foresters must adopt/adapt management practices that ensure the resilience of Irish forestry in a changing climate. Key impacts of warmer temperatures could include changes in the spatial and temporal dynamics of pest species and projected increases in periods of summer drought will cause difficulties in the establishment of forests where roots have not yet fully developed.

**Biodiversity:** Ireland’s natural landscape is one of its greatest assets and climate change is expected to have significant impacts and exacerbate existing pressures. Increasing temperatures will impact on the geographical range and phenology (the timing of lifecycle events) of native species. Projected shifts in climate, temperature and precipitation, may result in the increased occurrence of invasive species and competitive pressures for Ireland’s native species.

**Coastal areas:** Coastal erosion and flooding currently pose a serious risk to Ireland’s coastal areas and this is particularly the case as Ireland’s major cities and key pieces of infrastructure are located on the coast. Key impacts include inundation of coastal areas, increase in the intensity of cyclones which will result in more extreme storm activity and an increase in coastal erosion.

**Project Ireland 2040**

Climate Action is also a central component of the National Planning Framework, with a number of measures outlined. These include the protection of carbon sinks and the development of a sustainable bioeconomy. Specific policy objectives target the development of the circular bioeconomy, integrating the need for climate change adaptation and mitigation into planning and the promotion of renewable energy.\textsuperscript{32} Central to the need to reduce targets is the promotion of efficiency and new ways of completing processes so they are completed in a sustainable way. Crucial to this is the management of waste and the ability of producers and processors to harness the full value of product.

\textsuperscript{10} Ibid.

\textsuperscript{31} Department of Communications, Climate Action and the Environment, National Adaptation Framework - Planning for a Climate Resilient Ireland, January 2018, p.29

\textsuperscript{32} National Planning Framework, February 2018, Policy Objectives 53 to 55, pp.118-122
Challenges for Agriculture

The Committee heard that the overall policy direction is clear; farming, land management and food production must happen in harmony with the environment.\(^{33}\) In submissions, the Committee was advised that climate change was unequivocal, and that agriculture has made a substantial historical contribution to climate change.\(^{34}\) This is particularly within the context of all three major greenhouse gases (GHGs); Carbon Dioxide, Methane and Nitrous Oxide, being contributed by the sector. The main sources are understood to be:\(^{35}\)

**Table 4 - Primary Sources of Emissions in the Agriculture Sector**

<table>
<thead>
<tr>
<th>GHG</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide (CO(_2))</td>
<td>Combustion of Fossil Fuels (e.g. Energy)</td>
</tr>
<tr>
<td>Methane (CH(_4))</td>
<td>Ruminant Animals and Rice Production</td>
</tr>
<tr>
<td>Nitrous Oxide (N(_2)O)</td>
<td>Application of Fertilisers</td>
</tr>
</tbody>
</table>

The Committee heard that while agriculture in Ireland is not exempt from climate risks, particularly as agriculture is dependent on a stable climate, it is also not exempt from climate responsibility. However, the special position of the agriculture sector in the national policy position was acknowledged; the Committee hearing that while 80% reductions are required of electricity generation, buildings and transport, only carbon neutrality is required of agriculture and land use.\(^{36}\) The Committee heard that this equates to a 2% reduction in emissions every year between now and 2050.\(^{37}\) The Committee also heard that nobody is asking the agriculture sector to do more than its fair share, just its fair share.\(^{38}\)

The Committee was advised that Ireland should try to get multiple benefits for whatever actions are taken to address climate change in agriculture. These have to be good for the farmer, work for the bottom line and work for water quality, climate, nature and air.\(^{39}\) A number of specific areas form the focus of Climate Change in the agri-food sector. Among these areas are:

- Methane emissions due to enteric fermentation from ruminant animals;
- Nitrous oxide emissions from nitrogen based fertilisers used on soils;
- Methane and nitrous oxide emissions from manure management;
- The mitigation of Climate Change through carbon sequestration through forestry and soils.

However, these issues need to be views in the context of emissions from agriculture as a percentage of total emissions.

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\(^{33}\) Environmental Protection Agency, Evidence to the Committee, 6 March 2018

\(^{34}\) Prof. Peter Thorne, NUI Maynooth, Submission to the Committee

\(^{35}\) Ibid.

\(^{36}\) Stop Climate Chaos Coalition, Evidence to the Committee, 6 March 2018

\(^{37}\) Ibid.

\(^{38}\) Ibid.

\(^{39}\) Environmental Protection Agency, Evidence to the Committee, 6 March 2018
Emissions from Agriculture

According to the data available to the Committee, Irish agriculture is the largest contributor to national GHG emissions, estimated at 32%. The chart illustrates the estimated level of emissions for each sector within the Irish economy in 2016:

**Figure 3 - Percentage of Total Emissions – Ireland (2016)**

![Chart showing percentage of total emissions by sector](chart)

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Total</th>
<th>Agriculture</th>
<th>% Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td>OECD (2015)<strong>41</strong></td>
<td>59,878.21</td>
<td>19,277.11</td>
<td>32.2%</td>
</tr>
<tr>
<td>Eurostat (2016)<strong>42</strong></td>
<td>64,159.90</td>
<td>19,250.82</td>
<td>30.0%</td>
</tr>
<tr>
<td>Environmental Protection Agency (2016)<strong>43</strong></td>
<td>61,545.82</td>
<td>19,851.31</td>
<td>32.2%</td>
</tr>
<tr>
<td>Central Statistics Office (2015)<strong>44</strong></td>
<td>59,878</td>
<td>19,947</td>
<td>33.3%</td>
</tr>
</tbody>
</table>

**Table 5 - Comparative Emissions Figures– Irish Agriculture - (thousand tonnes CO2 equivalent)**

There is an element of variation in the figures for GHG emissions depending on methods of calculation and total level of emissions, but those emissions attributable to agriculture are in the region of 30% to 33.3%.

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The Committee heard that this is due to:

- Agriculture and food production being Ireland’s largest indigenous industry; and
- The absence of large-scale heavy industry in Ireland.

However, on the level of emissions a point of note is that grasslands and biodiversity are not included in measuring carbon sequestration, which would appear to be of potential benefit to Ireland.45

Historical Emissions

Based on EPA data, the level of emissions from agriculture is just over 2% less than the level of emissions in the base year of 1990.46 However, the Committee heard that this increase may be as much as 3.5%.47 Based on the statistics available, it is clear that the level of emissions is still below this base year. However, the level of emissions continues to increase, with much of this driven by increase beef and dairy productions. Additionally, the percentage of emissions from agriculture is decreasing, largely due to a higher total driven by increases in other sectors. The level of agricultural emissions as CO2 equivalent for each year between 1990 and 2016 is shown in the below graph.

**Figure 4 - Emissions from Agriculture 1990-2016 (kt CO2eq)**48

![Graph showing emissions from agriculture 1990-2016](image)

According to this graph, the level of emissions from agriculture has increased in recent years, but remains below the base year (1990), when emissions were at a level of approximately 20.3 million tonnes of CO2 equivalent. However, an anticipated increase in beef and dairy production in particular is likely to further increase emissions.

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45 Teagasc, Evidence to the Committee, 6 March 2018
47 Irish Farmers’ Association, Evidence to the Committee, 13 February 2018. It should be noted however that the measurement of emissions has differed between organisations (see previous page).
In recent years, the abolition of milk quotas has encouraged a rapidly expanding dairy sector, while the advent of beef genomics has placed a heavy emphasis in developing a high-quality beef sector. Similarly, a focus on animal health in sheep and the use of electronic tagging has transferred this focus on quality and production into other sectors.

Table 6 - Breakdown of Agricultural Emissions – EPA Data - 2016

<table>
<thead>
<tr>
<th>Source of Emissions</th>
<th>%</th>
<th>kt CO2 eq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enteric fermentation</td>
<td>56.66%</td>
<td>11247.27</td>
</tr>
<tr>
<td>Agricultural soils</td>
<td>9.79%</td>
<td>1943.29</td>
</tr>
<tr>
<td>Manure management</td>
<td>28.20%</td>
<td>5598.85</td>
</tr>
<tr>
<td>Agriculture/Forestry fuel combustion</td>
<td>2.14%</td>
<td>425.60</td>
</tr>
<tr>
<td>Liming</td>
<td>0.18%</td>
<td>35.80</td>
</tr>
<tr>
<td>Fishing</td>
<td>2.72%</td>
<td>540.70</td>
</tr>
<tr>
<td>Urea application</td>
<td>0.30%</td>
<td>59.79</td>
</tr>
</tbody>
</table>

The majority of emissions have their origin in Enteric Fermentation from ruminant animals, with Agricultural Soils and Manure Management also contributing a significant percentage of emissions. These three categories account for almost 95% of emissions which suggests that the challenge rests in the meat and dairy sectors, with residual challenges in the tillage sector, e.g. the use of nitrates, and the wider issue of agricultural waste.

Non-ETS Emissions and Projections

Agricultural emissions are non-ETS emissions. This means that Ireland cannot purchase carbon credits which are offset against the surplus reductions of other Member States. This is currently the case for other sectors such as energy and transport. According to the EPA, agriculture accounted for 47% of Irish non-ETS emissions in 2016. While production is considered as becoming more efficient (see section on Origin Green), the level of emissions is potentially increasing also.

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49 Ibid.
50 Ibid.
51 Environmental Protection Agency, Ireland’s Environment – An Assessment 2016, p.191
In this regard, the EPA notes that notwithstanding the additional measures taken, agriculture’s share of emissions may increase to 35% by 2020.52

**Comparison with other EU Member States**

In comparing Irish performance on emissions with other Member States of the EU, the Committee considered data available from Eurostat in Table 7.

<table>
<thead>
<tr>
<th>Table 7 - Greenhouse Gas Emissions - Agriculture (thousand tonnes CO2 equivalent) by EU Member States - 201653</th>
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<tbody>
<tr>
<td><strong>Position of IRL relative to other EU Member States</strong></td>
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<tr>
<td>Agriculture Emissions</td>
</tr>
<tr>
<td>France (FRA)</td>
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<tr>
<td>Germany (DEU)</td>
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<tr>
<td>United Kingdom (GBR)</td>
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<td>Spain (ESP)</td>
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<td>Italy (ITA)</td>
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<td>Poland (POL)</td>
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<td>Ireland (IRL)</td>
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<td>Netherlands (NED)</td>
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<td>Romania (ROM)</td>
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<td>Denmark (DEN)</td>
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<td>Belgium (BEL)</td>
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<td>Czech Republic (CZE)</td>
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<td>Lithuania (LIT)</td>
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<td>Croatia (CRO)</td>
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<td>Slovakia (SVK)</td>
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<td>Estonia (EST)</td>
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<td>Luxembourg (LUX)</td>
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<td>Cyprus (CYP)</td>
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<td>Malta (MLT)</td>
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<tr>
<td>European Union (EU28)</td>
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</table>

*Greenhouse gases (CO2, N2O in CO2 equivalent, CH4 in CO2 equivalent, HFC in CO2 equivalent, PFC in CO2 equivalent, SF6 in CO2 equivalent, NF3 in CO2 equivalent)*

Source: Percentages based on Eurostat Figures

Approximately 30% of emissions from Ireland come from Agriculture and this is some distance ahead of Latvia, Lithuania and Denmark, which occupy the next three places. By contrast however, Ireland ranks 14th overall in terms of total emissions, emitting over 62,000 tonnes of CO2 equivalent. This reflects the absence of heavy industry in the Irish economy. Emissions percentages are calculated by dividing Agriculture emissions by Total Emissions, but it is noted that the total figure excludes Land Use, Land Use Change and Forestry (LULUCF).

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52 EPA, Ireland’s Greenhouse Gas Emission Projections 2016-2035, April 2017 at p.6
The Department on Agriculture, Food and the Marine confirmed both the high level of agricultural emissions and the developments in efficiencies:

“The committee should know that since 2015 we have increased milk output by 13.5%, whereas emissions have only increased by 1.6%. Massive efficiency gains are happening at the moment ... agricultural emissions are unusually high here. We are a rural based country that does not really have heavy industry. At the moment we are developing more efficient agriculture.”\(^{54}\)

Similarly, in Northern Ireland, emissions from agriculture account for 29% of emissions and this level is approximately 3% lower than the base year of 1990.\(^{55}\) In more global terms, Ireland also has the second highest level of emissions from agriculture in the OECD, (New Zealand has the highest level).\(^{56}\)

**Comparison with Other Sectors**

The Committee notes the percentage of emissions from agriculture reflects the importance of agriculture to the Irish economy. The Committee also heard of the level of emissions from other Member States with respect to coal, including the opposition of Germany to the phasing out of coal, with similar issues arising outside the EU with high levels of coal production in China and Russia.\(^{57}\) When compared with other, large and more industrialised Member States by sector, the emissions data is represented as follows:

**Figure 6 - Percentage of GHG Emissions by Sector - Comparison with Key European States**\(^{58}\)

\[^{54}\text{Department of Agriculture, Food and the Marine, Evidence to the Committee, 14 November 2017}\]
\[^{55}\text{Department of Agriculture, Environment and Rural Affairs (NI), Northern Ireland greenhouse gas inventory 1990-2015 statistical bulletin, June 2017 at p.3}\]
\[^{57}\text{ICSA, Evidence to the Committee, 6 March 2018}\]
\[^{58}\text{Eurostat, Greenhouse gas emissions by source sector, available at http://ec.europa.eu/eurostat/web/environment/air-emissions-inventories/database, accessed 4 July 2018. For this graph, the comparison is made based on Eurostat data for France, Germany, Italy, the Netherlands, Spain and the United Kingdom.}\]
It is also important to note that agriculture does not have the same capacity as other sectors to achieve reductions by re-engineering the processes involved. Significant reductions occurring in the industries and construction sector since 2006 are reflected in Figure 7. Despite significant increases in output, agriculture has remained in the range of 19,000-20,000 tonnes CO2 equivalent per annum.

Figure 7 - Irish Emissions by Grouped Sectors (000 tonnes CO2 equivalent)

Grass-Based Production

The Irish grass-based production model for dairy and beef products is considered to be very important. The Committee heard that the Irish dairy sector is the most efficient in Europe, exporting a highly nutritious food source to a multiple of Ireland’s population. On the size of this multiple, it is stated by Bord Bia that over 90% of dairy products are exported to over 130 countries. This is due to the suitability of Ireland’s temperate climate for growing grass, in addition to a long grazing season (up to 300 days a year). In contrast, in global production, 80% of milk is based in confinement-based production systems. Some solutions identified in reducing emissions from grass-based production included the use of clover and the production of additives to reduce emissions e.g. from seaweed.

60 ICOS, Evidence to the Committee, 13 February 2018
Balancing Food Production and the Environmental Impact

Food Wise 2025 aims to increase the value of agri-food exports, with the value of primary production set to increase to €10 billion, resulting in a further 23,000 jobs in the sector. The challenge is balancing resurgent growth in agricultural output with mitigating environmental impacts through the control of GHG emissions. This is against a background of increased dairy production following the abolition of milk quotas and ambitious production targets. Increased sheep and pig production is also expected. However, this increase in production is expected to be achieved by improved production efficiencies rather than an increase in animal numbers.

Food Wise 2025 set the following targets:

- Increasing the value of agri-food exports by 85% to €19 billion;
- Increasing the value added in the agri-food, fisheries and wood products sector by 70% to in excess of €13 billion;
- Increasing the value of Primary Production by 65% to almost €10 billion;
- The creation of an additional 23,000 direct jobs in the agri-food sector all along the supply chain from primary production to high value added product development.

These targets have obvious implications for emissions. However, it is important to note that while output has increased significantly, the level of emissions appears to have been contained. In this regard, Food Wise 2025 was accompanied by a Food Wise Implementation Plan, which has been noted by the EPA as “a key mechanism for ensuring that relevant evidence is gathered during implementation to inform decisions on achieving and maintaining a sustainable agriculture sector”.

However, there is some concern about the role of the arable sector in Food Wise 2025. The Committee heard that this sector received less attention in the initiative. The focus appears to be on beef and dairy production, and to a lesser extent, beverages and aquaculture.

Efficiency in production is key to addressing emissions and the Committee believes that there is much evidence to suggest the agri-food sector is making substantial efforts in this regard.

The Committee also notes that action is required across a number of sectors including energy, transport, industry, construction and waste from Irish households. The Irish Grain Growers summarised the challenge as follows:

“The challenge for all in our country is to reduce carbon emissions from food production, energy use, transport and manufacturing while continuing to maintain fully traceable indigenous food output, retaining employment while maintaining a positive environmental impact.”

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62 Macra na Feirme, Submission to the Committee  
63 Environmental Protection Agency, Ireland’s Environment – An Assessment 2016, p.190  
64 Food Wise 2025, p.10  
65 For example, Department of Agriculture, Food and the Marine, Evidence to the Committee, 14 November 2017, where the Committee heard that while production has increased by 13.6%, emissions have only increased by 1.6%.  
66 Environmental Protection Agency, Ireland’s Environment – An Assessment 2016, p.191  
67 Irish Grain Growers, Evidence to the Committee, 6 March 2018  
68 Ibid.
The Committee noted that climate change was one of the issues considered by the Citizens’ Assembly, with three of its 13 recommendations focusing on the agriculture and food sectors.

“xi. 89% of the Members recommended that there should be a tax on greenhouse gas (GHG) emissions from agriculture. There should be rewards for the farmer for land management that sequesters carbon. Any resulting revenue should be reinvested to support climate friendly agricultural practices.

xii. 93% of the Members recommended the State should introduce a standard form of mandatory measurement and reporting of food waste at every level of the food distribution and supply chain, with the objective of reducing food waste in the future.

xii. 99% of the Members recommended that the State should review, and revise supports for land use diversification with attention to supports for planting forests and encouraging organic farming.”

The Committee notes that Bord Bia did not present to the Citizens’ Assembly. According to An Bord Bia, the challenge facing the food industry globally is as follows:

“With the global population projected to increase by more than 2.4 billion people by 2050, the world will need to produce up to twice as much food from increasingly limited resources in uncertain climatic conditions. This is leading to long-term fears over the security of food supplies in many parts of the world.”

The Committee heard that a number of organisations are opposed to an additional carbon tax on agriculture. Mr Martin Keane, President of ICOS, stated the following regarding the recommendation for a carbon tax:

“Ultimately, agriculture systems throughout the world will have to provide extra food to feed a growing population, which is expected to exceed 11 billion by the end of this century. We must produce more food, while conserving available land, water and energy resources. For this reason, the recommendation of the Citizens’ Assembly in November 2017 to impose a carbon tax on Irish agriculture is deeply flawed. This proposal, if implemented, would damage the competitiveness of Irish agrifood exports and benefit the environment little. In reality, it would be counterproductive and there would be a possibility of carbon leakage.”

The Committee suggests that the proposed carbon tax should be re-examined with a wider range of stakeholders. In place of a carbon tax (that penalises farmers for failing to meet emissions targets), the application of additional incentives for farmers who sequester carbon may be a more effective approach in delivering change. Proposals under the new Common Agricultural Policy appear to allow scope for such initiatives. Such an approach, while not a tax, would still have the effect of disadvantaging those who continue to pollute.

70 Bord Bia, Evidence to the Committee, 23 January 2018
71 Irish Cooperative Organisation Society, Evidence to the Committee, 13 February 2018
The Committee suggests the recommendations in relation to supports for forestry and organic farming have considerable scope to limit the impact on the environment.\textsuperscript{72}

Climate change has also had an impact on agriculture outside of Ireland, with increased emissions playing a role in increased instances of drought. There is a potential for knowledge-sharing and technology which could be targeted at smallholder farmers in developing countries.\textsuperscript{73}

## Engagement with the Department of Agriculture, Food and the Marine

At the outset, the Committee heard from the Department of Agriculture, Food and the Marine (the Department) in relation to the challenges. In its engagement with the Committee, the Department highlighted the statement in Food Wise 2025 concerning the relationship between environmental protection and economic competitiveness, stating that “one cannot be achieved at the expense of the other”.\textsuperscript{74} However, the Department also acknowledged the contribution of the agri-food sector and how it has “decoupled sector growth from gross emissions”.\textsuperscript{75} This, it stated, was a result of continued research, advances in animal genetics, health and nutrition, and optimising the use of fertilisers.

The Department made reference to a number of measures currently being explored and implemented, including:

- The Beef Data and Genomics Programme and the introduction of the economic breeding index, EBI;
- The targeted agri-investment programme is supporting the introduction of more efficient manure application techniques;
- The agri-environment scheme, GLAS, includes specific measures to support climate change objectives with 50,000 farmer members;
- The organic farming scheme, which has attracted 1,264 applications, supports organic farming as an alternative farming system, which contributes to improving soil quality and mitigation and adaptation to climate change.

These and other related issues are discussed in the following chapters. The Department also advised the Committee in relation to carbon sequestration and the role of afforestation, which also contains targets that have been acknowledged as ambitious; the increase in planting to more than 8,000 ha per annum in 2020 and achieving forest cover of 18% by 2050. The Department described how agriculture is the only sector that can sequester emissions through forests and land use. Some action points and discussion emerged in the course of Committee hearings.


\textsuperscript{73} Stop Climate Chaos Coalition, Evidence to the Committee, 6 March 2018

\textsuperscript{74} Department of Agriculture, Food and the Marine, Evidence to the Committee, 14 November 2017

\textsuperscript{75} Ibid.
Recommendations

Agriculture and Climate Change

1. The Committee welcomes the work of the Citizens Assembly and notes the recommendations made which are clearly aimed at reducing GHG. However, the Committee considers that there are additional implications arising for the agri-food sector, in particular the Committee recommends that further emphasis is added to the absence of heavy industry in Ireland in the consideration of climate change targets.

2. The Committee recommends that an incentive is put in place to encourage all Irish farmers to adopt practices that reduce emissions in all three major areas; livestock emissions, manure management and agricultural soils / fertilisers. The greater levels of subsidiarity proposed in the new Common Agricultural Policy should allow climate change and environmental challenges to be at the centre of Irish CAP strategic plans.

3. The Committee recommends measures to incentivise the reduction of emissions and the pursuit of more efficient processes, which is in line with proposals for the post-2020 CAP. For example, the basing of CAP payments on achieving environmental / green targets may be a more optimal system than a carbon tax.

4. The Committee recommends that an immediate impact assessment of the climate change and sustainability targets in Food Wise 2025 be undertaken.

5. Incentives aimed at reducing food waste and supporting both forestry and organic farming should be encouraged.

6. Addressing the twin challenges of Climate Change and Brexit should be addressed in a balanced way. The Committee recommends that the necessary levels of production and expansion are undertaken to mitigate the economic impact of Brexit, but stresses that sustainability must also be at the core of any expansion plans.

7. The Committee recommends that readily available measures are put in place to assist farmers and rural communities in responding to the impact of extreme weather events, such as shortages of fodder, heatwaves and winter storms.
3. Livestock Sector

The focus of the Committee is enteric fermentation, which relates to the emission of methane from livestock, primarily from ruminant animals. Ruminants are animals including cattle, sheep, goats and farmed deer, although in the context of Irish agriculture, ruminants farmed are predominantly cattle and sheep.

Enteric fermentation contributes over 55% of all agriculture emissions. Reducing this level is difficult when framed along with policy objectives aimed at significantly increasing production. CSO figures show that the number of cows is increasing, as is the number of dairy cattle. The total number of ruminants overall is also increasing, with the numbers of sheep and cattle illustrated below, though the number of sheep was still lower in 2017 than it was in 2005.

Figure 8 - No. of Cattle / Sheep - 2005-2017 (thousands)

There is some correlation between the number of ruminants and the level of emissions, which is demonstrated by the below chart.

Figure 9 - No of Ruminants (Cattle and Sheep) vs Total Emissions from Enteric Fermentation

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76 Central Statistics Office, Statbank, Livestock and Farm Animal Numbers, available at https://cso.ie/px/pxestatire/SelectTable/Omra0.asp?PLanguage=0, accessed 4 July 2018

**Beef and Dairy**

The beef and dairy sectors comprise approximately €7 billion in terms of exports (of a total of €13.6 billion). Additionally, other meat sectors such as pigmeat and poultry are important, but less so. Concerns were expressed about the current level of meat and dairy production, with the industry focus on meat and dairy production described as posing “fundamental risks for Irish farming, rural development, as well as Ireland’s international reputation” because of the resulting increase in GHG emissions and as it contradicts Ireland’s international obligations.  

**Seaweed**

Concern was expressed at the lack of mitigating opportunities for methane. As noted already, it is not possible to re-engineer the biological processes involved. However, there is some value in enhancing the efficiency of the biological processes involved. This may be achieved through the use of seaweed additives and requires further research. The Committee also heard that the level of seaweed needed to make an impact on emissions would be quite substantial. The issue is also relatively untested in Ireland and seaweed production would need to be significantly increased to accommodate an inclusion rate of 2% in the diets of cattle. However, research undertaken by the James Cook University in Queensland, Australia found that the introduction of seaweed into the diets of cattle potentially reduced emissions by 99%.  

**Smart Grass**

Emphasis was placed on Ireland’s grass-based system of production for beef and dairy products and the role the modification of foods given to cattle could have in reducing emissions. It was also highlighted that the use of “smart grass” as part of research carried out by UCD, can reduce emissions by up to 90%. This involves the use of deeper-rooted plants which would help put more carbon into the soil, while also utilising options beyond a rye grass monoculture.  

**Efficiency**

Ireland is already at an advanced stage in terms of the environmental efficiency of its bovine sector, maintaining a low level of GHG emissions per unit of output, both within Europe and globally. Under the Origin Green programme, some improvements have already been observed, with its Sustainability Report 2016 noting improvements in the carbon efficiency of participating farms. These are highlighted in the report as below:

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78 Stop Climate Chaos Coalition / Environmental Pillar, Joint Submission to the Committee.
79 Meat Industry Ireland, Evidence to the Committee, 20 February 2018.
80 Dairy Industry Ireland, Evidence to the Committee, 6 March 2018. The inclusion rate was discussed by the Department of Agriculture, Food and the Marine on 14 November 2017.
81 Irish Times, *Seaweed shown to reduce 99% methane from cattle*, 16 July 2017
82 Irish Organic Farmers and Growers Association, Evidence to the Committee, 6 March 2018
83 Teagasc, Submission to the Committee
84 Origin Green Sustainability Report 2016, at p.14 (beef) and p.18 (dairy).
The Committee heard that the Beef Genomics Programme focuses breeding on more productive and efficient cattle, and can play a role in reducing Irish agricultural emissions. The scheme is relatively new, with the level of expenditure having substantially increased in recent years and peaking in 2016, while the number of participants is stated as 24,865 (against a target of 27,000) and 98% participation in training from BDGP participants. The Committee however notes the concerns of some sectors within the beef industry with regard to the impact on the quality of cattle produced.

The Beef Data and Genomics Programme has a focus on breeding more productive and efficient cattle, and is described by Meat Industry Ireland as follows:

“A key initiative on the beef side has been the introduction of the beef data and genomics programme, which is targeting improvement in key productivity parameters such as age at slaughter, calving interval, age at first calving and so forth in order to lower the intensity of greenhouse gas emissions and to deliver dividends in the economic performance of beef enterprises for farmers.”

The Committee heard that the programme involves the close cooperation between Teagasc and the Irish Cattle Breeding Federation, and while the programme has been in place for a short number of years, the progress made on these productivity parameters (as outlined above) and the benefits accruing in terms of reduced greenhouse gas emissions has been demonstrated.

However, the Committee also heard that continued support for the programme is needed if the benefits to the national suckler herd are to be maximised. Specific benefits of the programme were brought to the Committee’s attention, including:

- Calving intervals have declined by 12 days.
- The number of calves in the suckler cow herd has increased from 79 per 100 to 85 per 100, with a target of 95 per 100, (the ratio in the dairy sector).

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85 Origin Green Sustainability Report 2016, at p.14 (beef) and p.18 (dairy)
86 Revised Estimates of Public Expenditure, Vote 30, Agriculture, Food and the Marine. The 2018 measure of expenditure is stated as €49.5 million.
87 The Committee has engaged separately with stakeholders concerning the BDGP scheme on 22 May 2018, with the issue of quality being a central issue.
88 Meat Industry Ireland, Evidence to the Committee, 20 February 2018
89 This refers to the length of time between the birth of a calf and the birth of the next calf from the same cow.
90 Meat Industry Ireland, Evidence to the Committee, 20 February 2018
Separately, sexed semen refers to a process through which the gender of a calf is predetermined. Its potential was highlighted to the Committee in hearings, where ICOS listed two potential initiatives to the Committee:

1. The need for technology that predetermines the gender of a calf, in particular sexed semen, due to the potential to maximise dairy calf heifer numbers. This must also facilitate an increased usage of quality beef bulls; and
2. The development of a dairy beef index by the ICBF would be beneficial.

The initiative of using sexed semen is supported by both Meat Industry Ireland and ICOS and has the potential to optimise dairy replacement heifer numbers while also enabling more usage of beef sires in the dairy herd offspring, thereby improving overall productivity.

Limitations to Mitigation of GHG Emissions

In its 2010 report, the Joint Research Centre found that Ireland is the most carbon efficient dairy producer in the EU (approximately 1kg CO2 equivalent per kg milk), and the fifth most efficient beef producer (approximately 19kg CO2 equivalent per kg beef). It would seem that the level of efficiency continues to improve. However, the Committee believes that more regular and extensive collection of data is needed. In addition, the scope for further progress is limited. Unlike other industries where more efficient processes can be engineered, agriculture involved biological processes which cannot be re-engineered.

“All of this comes back to the fact that we are discussing biological processes, not changing a car engine or moving to electric. We will not have electric cows. We are stuck with a biological system, so the mitigation potential is limited.”

Macra na Feirme stressed how the farming community has often viewed the GHG reduction policies in various EU and national strategies with scepticism, with emission reduction targets being set without taking into account of the technical capacity of the sector to reduce emissions. Additionally, if emissions can only be effectively reduced through a reduction in farming activity, this would negatively impact on farming livelihoods.

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91 Irish Cooperative Organisation Society, Evidence to the Committee, 13 February 2018.
92 Dairy beef index refers an index that can assist dairy farmers identify beef sires suitable for use on dairy cows. See Teagasc Beef Manual, October 2016 at p.112.
93 Leip et al, European Commission Joint Research Centre, Evaluation of the livestock sector’s contribution to the EU greenhouse gas emissions (GGELS), November 2010. This has also been acknowledged by the Department of Communications, Climate Action and the Environment in the National Mitigation Plan 2017 at p.128.
94 Origin Green Sustainability Report 2016, at p.14 (beef) and p.18 (dairy).
95 Meat Industry Ireland, Evidence to the Committee, 20 February 2018
96 Macra na Feirme, Evidence to the Committee, 13 February 2018.
97 Ibid.
Policy Measures and Initiatives

The Committee noted a number of the policy measures, including the Origin Green Programme, Dairy Sustainability Ireland and the Smart Farming Programme. In addition, the Committee noted the Nitrates Action Programme, actions under the Climate Action and Low Carbon Development Act 2015 and the management of river basins pursuant to the Water Framework Directive. The Committee also considered the research of the EPA, which reports initiatives in the pig and poultry sectors, e.g. Industrial Emission Licences, noting the significant improvements in production efficiency in the sector.

Origin Green

“Bord Bia developed and launched Origin Green, Ireland’s national sustainability programme for the Irish food and drink industry in 2012. The programme was developed in response to international market research, commissioned by Bord Bia, that confirmed the positive perception of Ireland, internationally, as a green and natural food producing country. However, the market research also showed that, in future, ongoing proof of our sustainability credentials would be required. Origin Green is the programme to provide such proof.”

Members of Origin Green are certified members of Bord Bia’s Sustainable Farm Assurance Schemes, which provide a level of assurance for consumers and producers. In terms of GHG emissions, a central feature of the Origin Green programme is carbon auditing and assessing the level of efficiency in Irish food production. To date, 170,000 carbon footprint assessments have been completed.

However, concerns were also expressed that Ireland’s international reputation may be damaged by the programme as rising emissions become difficult to reconcile with a green labelling of products:

“Major issues arise with regard to Origin Green, a branding and labelling system that could cause serious reputational damage to Ireland when reconciled with the reality of our rising climate emissions and the difficulties we will experience meeting nitrates and water quality targets as a result of increasing stocking levels. The problem applies not only to the bovine sector, but also in horticulture, including the extraction of peat for horticultural use.”

While stocking is increasing, the level of emissions must be controlled. While the dairy sector has put an initiative in place to achieve sustainable dairy production, it has received some negative commentary, although the Committee heard a balanced perspective from the EPA:

“There is no doubt it is a marketing tool. Many companies and farmers are involved in it and it includes farm sustainability audits and sustainability plans for food businesses. Anything like this is a good thing because it helps to drive behaviour change, particularly with small companies involved in the food sector.”

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98 Environmental Protection Agency, Ireland’s Environment – An Assessment 2016, pp.197-199
99 Ibid. at p.199
100 Bord Bia, Evidence to the Committee, 23 January 2018
101 Environmental Pillar, Evidence to the Committee, 6 March 2018
102 Environmental Protection Agency, Evidence to the Committee, 6 March 2018
Food Wise 2025 identifies over 70 actions for achieving agricultural sustainability, on which it was noted by Bord Bia that collaboration and cooperation from all stakeholders in the industry would be required to achieve this ambition.\(^{103}\)

**Dairy Sustainability Ireland**

The Committee heard of the importance of the dairy industry to the economy. Since 2015, with the removal of milk quotas there has been a substantial increase in yield and herd sizes, with 5.5 billion litres of milk processed increasing to 7.5 billion litres,\(^{104}\) and average herd sizes increasing from 68 cows in 2015 to 75 in 2017.\(^{105}\) Of particular interest to the Committee was the combined initiative of industry, producers and public agencies known as Dairy Sustainability Ireland (DSI). Appearing before the Committee, Dairy Industry Ireland described the initiative as follows:

> “Dairy Sustainability Ireland is a pro-active industry led, whole of sector and whole of Government partnership which is working to develop and implement new approaches to dairy farm sustainability at both economic and environmental levels.”\(^{106}\)

Central to the DSI initiative is the involvement of its members, farm organisations and governmental agencies.\(^{107}\) Key DSI targets relate to water quality, soil issues and farmyard management with the principles of DSI fully aligned with a Government initiative called the Sustainability and Advisory Service, which is also in place.

This service has a number of commitments and outcomes, including:

- The support of processing dairy co-ops;
- The provision of Sustainability Advisors;
- The training of farmers in the new approach; and
- Communications measures.

The outcomes include the expansion of current company farm pilots, the establishment of two new pilots, the promotion of the New Nitrates Action Programme, the implementation of best practice in National Mitigation Plan by 2021, as well as the promotion of learnings from the Phase 2 pilots. The Committee notes that the Dairy Sustainability Ireland initiative also provides practical assistance e.g. guides to assist participants in achieving optimal levels of soil fertility.\(^{108}\)

**Smart Farming**

In relation to the Smart Farming initiative the Irish Farmers’ Association advised the Committee that:

> “In IFA, we are leading a voluntary initiative called Smart Farming with the Environmental Protection Agency, which aims to address the dual challenges of improving farm incomes while

\(^{103}\) Bord Bia, Evidence to the Committee, 23 January 2018  
\(^{104}\) Dairy Industry Ireland, Evidence to the Committee, 6 March 2018  
\(^{106}\) Dairy Industry Ireland, Evidence to the Committee, 6 March 2018  
\(^{107}\) Dairy Industry Ireland, Submission to the Committee  
\(^{108}\) Ibid.
reducing the environmental impact. In 2017, the average cost savings identified by participating farmers was €8,700 with average emissions reductions of 10%.\(^{109}\)

Smart Farming applies heavily to the livestock sector, and is an initiative of the IFA and several other bodies including the EPA, Teagasc, UCD, FTMTA, the Fertiliser Association of Ireland, the Irish Grassland Association and the Sustainable Energy Authority of Ireland. The initiative focuses on eight main areas: Soil Fertility; Energy; Grassland; Water; Feed; Inputs and Waste; Machinery; and Time Management. A Smart Farming guide has been developed and the Carbon Navigator tool developed by Teagasc in partnership with Bord Bia has been rolled out. Savings identified by participating farmers averaged €6,600 per farm in 2014, which appears to have increased to €8,700 in 2017. This would suggest Smart Farming has had an impact in improving efficiencies for farmers.

**Knowledge Transfer and Innovation**

Carbon assessment tools, such as the Carbon Navigator, should be extended, with the provision of additional support to establish a structured knowledge sharing programme on climate change (including one-to-one engagement and discussion group formats).\(^{110}\)

There is a large element of research on the bioeconomy and the Committee was particularly impressed with the work of Science Foundation Ireland, visiting its BEACON centre in Dublin in June 2018. Specific examples of this research include measures to improve the resistance of crops of diseases and the design of bioplastics aimed at mitigating damage to the environment caused by conventional plastics. In its submission to the Committee, Science Foundation Ireland also described its FutureMilk Centre, which is “to be an agent of growth for the Irish dairy industry by being a world leader in the fundamental and translational research for precision pasture-based dairying”.\(^{111}\)

**Summary**

It is clear the level of emissions represents a very serious problem. In the years ahead, the focus should be on action. It is somewhat difficult to reconcile ambitions and targets for higher levels of production such as Food Wise 2025 with the need for reductions in emissions levels. Therefore, the issues of efficiency and the practice of carbon auditing are extremely important.

The Committee is of the opinion that there is some merit in communicating this efficiency to the wider public. The Committee also recommends a stronger focus on Knowledge Transfer and Research. While some promise has been shown in the area of seaweed production, other means of addressing emissions, such as the use of clover in swards (discussed below) should also be considered.

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\(^{109}\) Irish Farmers’ Association, Evidence to the Committee, 13 February 2018

\(^{110}\) Irish Cooperative Organisation Society, Submission to the Committee

\(^{111}\) Science Foundation Ireland, Submission to the Committee
# Recommendations

## The Livestock Sector

8. The Committee recommends that the Minister for Agriculture, Food and the Marine promotes all schemes and practices that are orientated towards the goal of carbon neutrality.

9. The Committee recommends that the multi-stakeholder Dairy Sustainability Ireland initiative is supported.

10. The Committee recommends that the Smart Farming programme be expanded.

11. The Committee recommends that greater resourcing is provided to research and knowledge-sharing aimed at providing the necessary tools and aids to Irish farmers to assist them in climate change mitigation.

12. The Committee recommends that the issue of efficiency is highlighted and explored further at EU and international level, in particular the need for all processes contributing to agricultural emissions to be as productive and efficient as possible.

13. The Committee recommends that the Organic Farming Scheme continue to be included in Irish environmental measures, including the Common Agricultural Policy post-2020. An enhanced and expanded organic farming scheme, focused on emission-reducing practices, may be of benefit in addressing Irish agricultural emissions.

14. The Committee recommends that a Communications Strategy be developed which highlights the scale of Irish food production in the dairy and beef sectors, in particular stressing the levels of efficiency achieved.

15. The Committee recognises the merit of a Single Environmental Area between Ireland and Northern Ireland, as well as the need for a commonality in approach in addressing GHG emissions form the island of Ireland as a whole. The Committee recommends an identification of Member States of the EU, the EEA and the OECD facing similar challenges, with the objective of establishing channels of knowledge exchange.

16. The Committee recommends that ways in which current initiatives to optimise breeding, including the Beef Data and Genomics Programme and the use of sexed semen, can be enhanced be further explored.

17. The Committee recommends that resourcing be provided to examine the potential for seaweed additives and smart grass as a means of mitigating GHG emissions from livestock.

18. The Committee recommends that the Carbon Navigation Programme, as part of Origin Green, be continued and enhanced. The potential of carbon accounting being focused on emissions per unit output should also be highlighted as a means of measuring GHG emissions.

19. Noting the increases in production, the constant level of GHG emissions and the slight differences in statistics, the Committee recommends that the criteria used in the accounting of carbon emissions for rapidly expanding sectors, such as the dairy sector, are kept under review, in order to ensure consistency.

Ireland’s temperate climate is considered ideal for the arable sector, consisting of long, cool, summer days, reasonably consistent rainfall and fertile soils which in turn allow for some of the highest yields in the world.\textsuperscript{112} The climate also supports strong grass growth, which is considered pivotal to supporting the Irish meat and dairy sectors.

**Soils**

Soil is “a biologically active, complex mixture of weathered minerals, organic matter, organisms, air and water” and the health of both Irish soils and the Irish agriculture sector are intrinsically linked and dependent on one another.\textsuperscript{113} There are a number of initiatives which encourage farming practices that maintain soil fertility. However, significant challenges include the loss of nitrogen and phosphorus from the soil.

The Committee heard that Ireland is a net source of carbon dioxide, with land either being a carbon sink or a carbon source.\textsuperscript{114} However, after enteric fermentation, agricultural soils are the next highest source of GHG emissions from agriculture. Agricultural soils accounted for over 30% of agricultural emissions in 2015, which suggests that Irish soils are currently a net source of carbon emissions.

**Soil Fertility and Nutrient Management**

Soil fertility and the presence of nutrients associated with the retention of carbon in the soil was considered by the Committee. There is scope to improve soil fertility levels in Ireland, with ICOS highlighting three initiatives:\textsuperscript{115}

- Soil testing: This involves co-ops incentivising soil testing as a means to improve nutrient management planning. However, renewed focus is required of advisory and extension services to ensure test results and recommendations are implemented and better understood.

- Lime Promotion: A national lime promotion campaign could increase application rates, improve soil pH levels and maximise grass yield and availability. The Committee heard that only 10% of Irish soil was at optimum pH level.\textsuperscript{116}

- Trailing Shoe Equipment: This allows for nitrogen to be delivered into the soil in a more accurate and consistent way.

Soil organic carbon stocks are shown to be higher on organic farms, with organic agriculture associated with higher carbon sequestration.\textsuperscript{117} Biodiversity and soil quality are a key feature of organic farming systems when compared with conventional farms, with:

\textsuperscript{112} Irish Grain Growers, Submission to the Committee
\textsuperscript{113} Environmental Protection Agency, *Ireland’s Environment: An Assessment 2016* at p.107 and p.112
\textsuperscript{114} Environmental Protection Agency, Evidence to the Committee, 6 March 2018
\textsuperscript{115} Irish Cooperative Organisation Society, *Positive Steps toward a low carbon future for the Irish dairy sector*, January 2018, p.32
\textsuperscript{116} Irish Creamery and Milk Suppliers’ Association, Evidence to the Committee, 13 February 2018
\textsuperscript{117} Irish Organic Farmers and Growers Association, Submission to the Committee
- 30% more biodiversity;
- Biodiversity of plant species is 70%-100% higher;
- Weed abundance is 75-150% higher.\textsuperscript{118}

Additionally, there is less reliance on synthetic pesticides and fertilisers (which are understood to have an adverse impact on aquatic life in runoffs and watercourses). The importance of soil fertility has also been recognised by the dairy industry, which provides a detailed guide on achieving higher fertility in soils, including:

- The promotion of soil testing;
- Spreading lime;
- Correcting the phosphorus (P) and potassium (K) levels;
- Using slurry where possible; and
- Balancing the use of slurry with compound fertiliser.\textsuperscript{119}

The issue of N Fertiliser was raised by ICOS in its submission, in reference to the use of urea protected with an inhibitor called N-(n-butyl) thiophosphoric triamide (NBPT) can reduce greenhouse gas emissions, while delivering a similar yield to calcium ammonium nitrate (CAN), but noted that more research is needed.\textsuperscript{120} Teagasc has also completed some research on this area, noting the similarity in yields between CAN, urea and urea stabilised with NBPT.\textsuperscript{121}

In relation to the GLAS scheme, it was recommended to open the scheme to the commercial farmer. The Committee is aware that the scheme is oversubscribed and recommends the reopening of the scheme to allow for maximum participation.\textsuperscript{122}

**Biodiversity as a Public Good**

A number of submissions and presentations noted the contribution of Ireland’s farming community to generating public goods and advised that “[w]here it delivers public goods [in terms of landscape, environmental and biodiversity management] the farmers must be rewarded for doing so”.\textsuperscript{123}

The importance of biodiversity was also stressed by ICOS; in its opinion sustainability without biodiversity is not sustainability and as part of the new CAP, “farmers should be incentivised to maintain a habitat management plan on their farms on a voluntary basis”.\textsuperscript{124}

**Conservation Agriculture**

The Committee engaged with BASE Ireland on the issue of Conservation Agriculture (CA) on 15 May 2018 in relation to different approaches and new opportunities for Irish agriculture. Some practices were raised that the Committee considered relevant to the issue of soil carbonisation and the role of

\textsuperscript{118} Ibid.
\textsuperscript{119} Dairy Industry Ireland, Submission to the Committee
\textsuperscript{120} Irish Cooperative Organisation Society, Submission to the Committee.
\textsuperscript{121} Teagasc, N-Fertiliser Factsheet, available at https://www.teagasc.ie/media/website/publications/2017/Urea-N-Fertiliser-factsheet.pdf, accessed 2 July 2018. N-Fertiliser refers to the use of nitrogen in fertilisers, with urea and CAN the two main forms that are used in Ireland.
\textsuperscript{122} Irish Farmers’ Association, Evidence to the Committee, 13 February 2018
\textsuperscript{123} Irish Natura and Hill Farmers Association, Submission to the Committee
\textsuperscript{124} Irish Cooperative Organisation Society, Submission to the Committee
the soil as a carbon sink, including “minimum soil disturbance, permanent soil cover with residues and living plants, and diverse crop rotations and the use of cover crops”. This may hold significant promise in addressing the issue of carbon losses in Irish soils and there may be some benefit in Teagasc undertaking research on the benefits of CA and how this may be integrated into Irish agriculture on a wider basis.

Role of the Bioeconomy

There was much focus on the bioeconomy from Science Foundation Ireland, with the following emphasised to the Committee:

“A well-functioning bioeconomy can solve the interdependent challenges of food, non-food products, sustainability and climate change. The bioeconomy will provide a bio-based replacement of current fossil-resource paradigms that can maximise output from raw materials, reduce GHGs and substantially break the link between human consumption and environmental damage, while maintaining increasingly high standards of living.”

The submission further highlighted the potential for creating value for traditional sectors, such as agriculture, the marine and forestry. Current examples of the bioeconomy include the growing of food and the making of products such as dyes and glues.

The bioeconomy offers significant opportunities to reduce reliance on fossil fuels while still achieving economic growth. However, it was also noted that a sustainable and profitable farming sector is required to underpin the investment and innovation required to successfully deliver a strategy for the bioeconomy.

Manure Management

Manure Management refers to the storage and treatment of animal manures, such as the spreading of slurry, and accounts for approximately 9% of Irish agricultural emissions.

An important feature of manure management is the control of nitrates. The use of nitrates is governed by the Nitrates Regulations, which stipulates that farmers must not apply more than 170 kg of nitrogen from livestock manure per hectare per year, including that deposited by the animals themselves. Farmers may, in certain circumstances, apply for a Nitrates Derogation of up to 250 kg. The purpose of the regulations is to protect water from nitrogen and phosphorus from agricultural sources. Additionally, there are also limitations on when slurry may be spread, called the prohibited spreading periods. Breaches may be sanctioned by a reduction in the basic payment.

125 BASE Ireland, Evidence to the Committee, 15 May 2018.
126 Science Foundation Ireland, Submission to the Committee
127 Irish Farmers’ Association, Submission to the Committee
128 Ibid.
129 S.J. No. 31/2014, European Union (Good Agricultural Practice for Protection of Waters) Regulations 2014, s.20(1).
130 Council Directive 91/676/EEC, Article 5(4)(a) referencing Annex III. Article 2(a) of Annex III provides for a derogation of up to 210 kg, though a Member State may apply for a different amount but must justify that amount to the European Commission. In Ireland’s case, this is 250 kg.
131 See generally Department of Agriculture, Food and the Marine and Department of Housing, Planning and Local Government, Nitrates Explanatory Handbook, December 2017
**Land Spreading**

The timing of land spreading, as well as the methods, were highlighted to the Committee as having a potential impact on the level of emissions. ICOS identified two mitigation measures:

1. The spreading of manure in spring instead of summer (which is understood to be more efficient for the emission of ammonia and GHG emissions for climatic and soil reasons).
2. Switching from a splash plate to trailing shoe equipment.

The submission also suggested the use of additives to slurry which could reduce emissions in the process of housing and storing slurry. The application of slurry in the spring was also supported by Dairy Industry Ireland in its submission, which stressed that “[o]nce spread, fertiliser and manure are either absorbed by soil and plants or lost to air and water”. The same submission also highlighted the need not to spread fertiliser on wet soil or ahead of heavy rainfall.

Nutrient management plans are central to alleviating the impact caused by slurry and other forms of fertiliser. The potential benefits of covered manure storage and low emission slurry spreading were also referenced by the ICMSA.

**Biogas and Anaerobic Digestion**

In its previous report on the Future of the Tillage Sector in Ireland, the Committee examined the potential for energy crops in some detail. Expanding on this work, the Committee sees a particular role in the production of biogas and the potential that this may have, with a particular method that could be expanded further being anaerobic digestion (AD). This is a process through which anaerobic bacteria break down substances producing biogas as a by-product.

The production of biogas represents a clean energy alternative to the use of carbon-based products, e.g. oil and natural gas. The process of AD involves the process of treating biowaste with a catalyst (e.g. grain) within the digestor, resulting in the formation of two products, biogas which can be harvested and used to generate energy through combined heat and power, and biofertiliser, which may serve as an alternative to nitrate-based fertiliser.

Macra na Feirme stressed the potential of AD during hearings:

“\[I\]n countries with that level of tariff, there is essentially no investment in AD. Macra recommends that AD plants should be encouraged by increasing the pay-in tariff. This goes back to the question of an auction-type system versus a feed-in tariff. We see nothing but benefits in reducing methane associated with manure management and in reducing the slurry that must be produced, because digestate is lower. This makes it a more productive fertiliser and helps to offset some of our fossil fuel emissions.”

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132 Irish Cooperative Organisation Society, Submission to the Committee
133 Dairy Industry Ireland, Submission to the Committee
134 Ibid.
135 Irish Creamery and Milk Suppliers’ Association, Submission to the Committee
136 Macra na Feirme, Evidence to the Committee, 13 February 2018
The Committee also heard that:

“There are approximately 20 biodigesters in the country. The area is not as developed as it is in other countries and further development is contingent on the rate of returns for renewable heat and so on ...”

The Committee agrees that the support and resourcing of providing AD warrants further consideration. For example, it heard that the use of agricultural products, such as slurry and silage (both grass and maize) can produce biogas in a renewable capacity, with the additional benefit of producing a good quality fertiliser in a lower carbon-producing manner. The Committee also heard that biogas can be used in the transport sector.

The process of AD is illustrated by the diagram below.

Figure 11 - Anaerobic Digestion Process

In its submission to the Committee, the Irish Organic Farmers and Growers Association (IOFGA) highlighted the potential of AD, particularly in the small-scale production of biogas, the by-product of which can be used as fertiliser. The submission of the Irish Natura and Hill Farmers’ Association (INHFA) highlights how the use of anaerobic digesters is essential, drawing particular attention to the impact of weather conditions:

“Average annual national rainfall has increased by approximately 60 mm or 5% in the period 1981 to 2010, compared to the 30-year period 1961 to 1990. (There is) more flexibility required at member state level to set slurry spreading dates that take into account local ground conditions and weather patterns.”

It was highlighted to the Committee that the application of EU regulations on the spreading of slurry are unworkable when combined with weather patterns. In the context of the upcoming negotiations for the post-2020 CAP, greater levels of subsidiarity for Member States may be needed in order make this work most effectively.

References:
137 Department of Agriculture, Food and the Marine, Evidence to the Committee, 14 November 2017
138 Macra na Feirme, Evidence to the Committee, 13 February 2018
139 Irish Grain Growers, Evidence to the Committee, 20 February 2018
140 See generally UK Government, Anaerobic Digestion Strategy and Action Plan, 2011
141 Irish Natura and Hill Farmers Association, Submission to the Committee
The Committee also notes the potential for biogas in the National Development Plan in electricity production and gas supply. Its potential is also included in the National Policy Statement on the Bioeconomy. This is significant in addressing food and agricultural waste:

“It is town-scale pilots of food and agricultural waste to gas in agricultural catchments for local gas networks supply and biogas production, and the piloting of climate smart countryside projects to establish the feasibility of the home and farm becoming net exporters of electricity. They are two potentially significant activities that could have a very positive impact for farmers, rural communities, towns and people living in single houses around the country. There are up to 500,000 such houses in Ireland.”

The potential of Combined Heat and Power (CHP) methods has been identified as a highly efficient source of energy by the Department of Communications, Climate Action and the Environment. At international level, its potential has been underlined by the UK Department for the Environment, Food and Rural Affairs, as well as the European Commission.

Manure Composting

The use of manure composting also has potential. It was submitted to the Committee that a key factor in reducing emissions from manure is how it is handled. Evidence to the Committee suggested that the use of manure composting could reduce nitrous oxide emissions by 50% and methane emissions by 70%, although this may also lead to an increase in both ammonia emissions and higher indirect nitrous oxide emissions.

Energy Production

The Committee notes the role for the agriculture sector and agricultural by-product in the production of clean and renewable energy.

In addition to biogas production, the Committee was advised of potential initiatives for farmers in the production of renewable energy. The issue of energy tariffs was explored and the Committee heard that the introduction of a premium tariff may assist farmers.

“From a renewable energy perspective, we believe there should be greater emphasis on farm families. The network is in place but grid connection needs to be practical and affordable. In terms of renewable energy generation, the installation of solar panels on the roofs of sheds...”

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142 Government of Ireland, *Investing in the Transition to a Low-Carbon and Climate-Resilient Society 2018-2027*, at p.17 and p.31
143 Department of the Taoiseach, *National Policy Statement on the Bioeconomy*, pp.8-9
144 Environmental Protection Agency, Evidence to the Committee, 6 March 2018
147 Irish Organic Farmers and Growers Association, Submission to the Committee
148 Ibid. However, it was also suggested that the indirect emissions from the application of manure compost may be much lower than normal manure, with the trade-offs considered from production to application offering the potential to reduce overall emissions.
149 This was also supported by environmental groups. See Stop Climate Chaos Coalition / Environmental Pillar, Joint Submission to the Committee.
would be to the benefit of the environment and also to the farm families that are trying to remain in farming and make a viable income in rural Ireland.\footnote{Irish Creamery and Milk Suppliers’ Association, Evidence to the Committee, 13 February 2018}

Micro-generation schemes allow for the installation of their own generators and the selling of excess electricity to the grid through what is known as an Import-Export Meter. It is understood that while suppliers still allow for the connection of micro-generators to the electricity network, the same level of support as previously is not provided.\footnote{https://www.electricireland.ie/residential/help/micro-generation/electric-ireland-micro-generation-pilot-scheme, accessed 9 July 2018} The Committee believes there is scope for reopening the micro-generation scheme to new customers in the agricultural sector.\footnote{The Department of Communications, Climate Action and the Environment has indicated the establishment of a Renewable Energy Support Scheme (RESS). See DCCAE Consultation at https://www.dccae.gov.ie/en-ie/energy/consultations/Pages/Renewable-Electricity-Support-Scheme-Design-Consultation.aspx, accessed 5 July 2018}

### Crop Management

The Irish tillage sector is one that experiences high yields, but also one that experiences high input costs and losses due to environmental conditions. In the context of crop production, one of the consistent challenges is Ireland’s temperate climate, which poses a high incidence of disease.\footnote{Science Foundation Ireland, Submission to the Committee} In order to control diseases, chemical fertilisers are used, but these are now decreasing due to the ability of plant diseases to adapt to the toxic effects of these chemicals, and to tighter EU rules.\footnote{Ibid.}

Nitrogen fertilisers contribute to the generation of emissions. Nitrogen fertilisers are the source of 40% of agricultural emissions in the EU. While such fertilisers maintain an important role in the control of pests and disease, there is evidence of a growth in new pests, such as “blackgrass” and sterile brome.\footnote{Teagasc, Submission to the Committee and Irish Grain Growers, Submission to the Committee, 6 March 2018}

### Organic Farming

The submission of the Irish Organic Farmers and Growers Association highlighted the potential for organic crops in this sector, stating the following:

> “Studies also show that organically grown crops have a higher resistance to pests and diseases, thanks to greater soil microbial biomass and improved soil quality, slower growth of the plants in organic systems (which allows the plant to develop its own chemical defences to prevent damage by pests and diseases), and enhanced biodiversity in organic systems, which leads to enhanced diversity of natural enemies (such as predatory birds and invertebrates).”\footnote{Irish Organic Farmers and Growers Association, Evidence to the Committee, 6 March 2018}

The Committee considered the possible benefits of Organic Farming, with the Irish Organic Farmers and Growers Association invited to make a submission on possible solutions within the organic sphere. The submission outlined a number of key benefits of organic farming, including:

- Adapting to climate change;
- Enhancing biodiversity;
- Better soil conservation;
- Reduced rates of eutrophication and water pollution; and
- Higher profitability.

In terms of adaptation, the argument was made by the IOFGA that organic farms “often sustain higher species diversity and cultivate locally adapted varieties” which would enhance “the resilience of agro-ecosystems against adverse climate conditions”. The example of organic systems out-producing conventional systems was also highlighted.

The organic sector may offer an alternative method for addressing the issue of emissions, but it was emphasised that there was no scheme in place for farmers moving to biological organic farming. The Committee notes that organic farming has shown food can be produced to the highest standard requiring a relatively low input, but the producer is not paid a premium. The submission of the IOFGA highlighted how certified organic farmers can sell their products for higher prices with relatively lower input costs, resulting in a higher net income. However, challenges may exist in some markets, for example the United Kingdom, where the emphasis is on cheap food as well as quality.

**Policy Measures and Schemes – Enhancing Biodiversity and the Environment**

The Committee heard that in the context of emissions, key policy measures are assisting in reducing agriculture’s contribution. In particular the role of European funding was noted, with 90% of the measures under Ireland’s rural development programme having elements focused on climate change.

One of the proposals made to the Committee was the establishment of a Climate Activation Programme, which would include a reopened GLAS and a farm-based, community energy tariff for farmers. The Committee believes that such a programme could also include incentives to install anaerobic digesters for the better management of manure and the encouragement of organic farming. As the establishment of eco-schemes are expected to feature prominently in the reformed CAP, establishing a Climate Activation Programme now could act as a co-ordinating mechanism for these schemes when this CAP enters into effect.

**GLAS**

GLAS (the Green Low-Carbon Agri-Environment Scheme) promotes the retention of soil carbon stocks, through the encouragement of climate friendly agricultural practices such as minimum tillage, green-cover establishment and low-emission manure spreading techniques. It has 50,000 farmer members, but is currently oversubscribed and not open to new applicants. The Committee heard that reopening the scheme should be an option as there is a high level of interest among farmers.

**TAMS**

The Targeted Agricultural Modernisation Scheme (TAMS) was also considered, with some focus on its role in low emission slurry spreading. The Committee heard that €710 million has been spent

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157 Irish Organic Farmers and Growers Association, Submission to the Committee
158 Ibid.
159 Irish Farmers’ Association, Evidence to the Committee, 13 February 2018
160 Ibid.
161 Ibid.
under TAMS on low emission slurry spreading, with 12,000 applications for spreaders.\textsuperscript{162} The Committee notes that allocating funding to ADs is an alternative which should be explored.\textsuperscript{163} The potential of expanding TAMS to a grazing infrastructure scheme to aid farmers to better utilise grass was also suggested, as was its potential benefits in minor investments such as roadways, water and fencing.\textsuperscript{164}

**Areas of Natural Constraint (ANCs)**

Managing areas of natural constraint (ANCs) is a key component for ensuring a broad biodiversity. However, the Committee heard of the need for farmers to be rewarded fairly for their delivery of eco-service, possibly extending to the ownership of a carbon credit by the farmer.\textsuperscript{165} Providing incentives to farmers to maintain a habitat management plan was also suggested.\textsuperscript{166} One possible solution is the formulation of a Strategic Plan by the Department which would include the following:

- The conservation of permanent pasture;
- The conservation of peatlands and wetlands;
- The maintenance and improvement of Natura and commonage farmland habitats;
- Maintaining agriculture in areas with natural constraints;
- Biodiversity-enhancing cattle grazing schemes, especially on the uplands where it is acknowledged that livestock manage the diverse plant life;
- A burning and land management scheme that reduces the risk of wildfires and their spread;
- No imposition of collective action clauses to gain access to schemes; and
- No collective agreement for commonage farmers to gain entry to any scheme.\textsuperscript{167}

**Biomass**

The previous report of the Committee on the tillage sector examined the issue of biomass, which identified eucalyptus, willow and miscanthus as primary crops for the production of biomass in Ireland, but noted the challenges posed by the Irish climate.\textsuperscript{168} During its hearings for this report, the Committee heard of the previous challenges in the biomass sector, particularly in the area of miscanthus, with the need for guarantees or returns for farmers who invest in biomass production.\textsuperscript{169}

**Bio-Plastics**

The Committee heard that the growing of hemp has the potential to replace plastics in certain circumstances, and along with sugar beet, could support the production of bio-plastics.\textsuperscript{170} This could

\textsuperscript{162} Irish Natura and Hill Farmers Association, Evidence to the Committee, 20 February 2018

\textsuperscript{163} Ibid.

\textsuperscript{164} Macra na Feirme, Evidence to the Committee, 13 February 2018

\textsuperscript{165} Irish Natura and Hill Farmers Association, Evidence to the Committee, 20 February 2018

\textsuperscript{166} Irish Cooperative Organisation Society, Submission to the Committee

\textsuperscript{167} Ibid.

\textsuperscript{168} Joint Committee on Agriculture, Food and the Marine, *Future of the Tillage Sector in Ireland*, November 2017

\textsuperscript{169} Irish Creamery and Milk Suppliers’ Association, Evidence to the Committee, 13 February 2018. See also, Department of Agriculture, Food and the Marine, Evidence to the Committee, 14 November 2017, when the Committee also heard that there is potential for 4 million m\textsuperscript{3} of biomass from forests in Ireland to provide material for energy production, with 1 million m\textsuperscript{3} currently being produced.

\textsuperscript{170} Irish Grain Growers, Evidence to the Committee, 20 February 2018
have a number of benefits, most notably in addressing the abundance of plastic wastes affecting the oceans.

**Beekeeping**

The Committee also heard of the negative impact of climate change on the bee population.\(^{171}\) This was highlighted by Teagasc.\(^{172}\) There are opportunities for a commercial beekeeping sector that is supported by a vibrant tillage sector. In this regard, the Committee heard that crops such as beans, peas, oilseed rape and cover crops are key to maintaining and expanding the bee population.\(^{173}\)

### Recommendations

<table>
<thead>
<tr>
<th><strong>Agricultural Soils, Manure Management and the Bioeconomy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>20. The Committee recommends that the potential of the bioeconomy be further explored.</td>
</tr>
<tr>
<td>21. The Committee recommends the development of a Climate Activation Programme, to include measures such as an enhanced GLAS Scheme and energy tariffs which incentivise the use of renewable energy by farmers. The Committee also recommends the introduction of a premium tariff or subsidy that encourages the use of renewable energy.</td>
</tr>
<tr>
<td>22. The Committee recommends that GLAS be reviewed to include requirements on the pH level of soils, with a view to making an increase in pH level a specific objective of the scheme. The Committee also recommends that consideration be given to bringing the use of lime within the scheme, as this is known to increase pH level.</td>
</tr>
<tr>
<td>23. The Committee recommends a scheme that promotes the increase in the number of anaerobic digesters among farmers and producers, noting its potential as an energy source and as a means of producing highly effective fertiliser. Any schemes should provide financial supports for the installation of such digesters, as well as reward the use of such equipment.</td>
</tr>
<tr>
<td>24. The Committee believes that the potential for bioplastics should be explored, and recommends that resourcing be provided to enhance research in this area and the potential of crops such as hemp to assist this area.</td>
</tr>
<tr>
<td>25. The Committee believes that the possible impacts on pollination should not be ignored and recommends that a scheme encouraging the growth of beans, peas, oilseed rape and cover crops be put in place by the Minister, as well as incentives to encourage a stronger beekeeping sector.</td>
</tr>
</tbody>
</table>

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\(^{171}\) Irish Grain Growers, Evidence to the Committee, 20 February 2018  
\(^{173}\) Irish Grain Growers, Evidence to the Committee, 20 February 2018
Carbon neutrality can be achieved through the offsetting of emissions by removing carbon from the environment. This is known generally as carbon sequestration. The offsetting of emissions through sequestration and increasing the prevalence of carbon sinks were considered by the Committee. Carbon sequestration and carbon sinks have implications for biodiversity, and most importantly, forestry.

**Afforestation**

The Committee heard that agriculture is the only sector that can sequester emissions of carbon.\(^{174}\) In its engagement with Coillte, the Committee was advised of the importance of Irish forestry to the economy:

- Forestry contributes €2.3 billion to the economy on an annual basis;
- Forestry supports 12,000 jobs; and
- There are approximately 40,000 truck movements between Ireland and the UK per annum which are related to the forestry industry.\(^{175}\)

In 2012, forests covered 731,650 hectares, or 10.5% of the land area in the State. The target is to increase this level to 18% by 2046, with the level currently at 11% cover. The role of Coillte is significant and the Committee notes that it sells 1.7 million m\(^3\) of timber annually to ten customers and in 2016 planted 18 million trees. Additionally, the Committee heard that Coillte’s estate stores 200 million tonnes of carbon dioxide, which also adds 1 to 2 million tonnes to this figure annually.\(^{176}\)

The sequestering potential of forestry is clear. Statistics held by Eurostat regarding land use, land use change and forestry (LULUCF) highlight this potential. In the below diagram, agriculture emissions are represented by the red columns, while carbon that is sequestered is represented by the blue columns. For some Member States, there is a negative measurement of agriculture emissions when LULUCF is included.

**Figure 12 - EU Member State Emissions - LULUCF & Agriculture, 2016 (kt CO\(_2\) eq)**\(^{177}\)

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\(^{174}\) Department of Agriculture, Food and the Marine, Evidence to the Committee, 14 November 2017

\(^{175}\) Coillte, Evidence to the Committee, 12 December 2017

\(^{176}\) Ibid.

The role of carbon sequestration through initiatives like forestry is demonstrated above, with the level of sequestration taking place through natural processes and forestry e.g. photosynthesis, having a profoundly offsetting effect in some EU Member States. For example, in Sweden and Finland, agricultural GHG emissions are completely offset by sequestration via LULUCF, with a high surplus which could also be offset against other areas.\textsuperscript{178}

Notwithstanding the potential of the forestry industry, some submissions indicated that new plants are falling below target. One example stated how in 2017, the planting programme was the lowest in over 60 years, establishing 5,500 hectares of new forest. This is well below the target of 7,400 hectares in the Forestry Programme.\textsuperscript{179} From the perspective of farmers, it has also been suggested that forestry is a permanent land use change, which could be restrictive for farm families.

According to the Department of Agriculture, Food and the Marine, public afforestation has declined in recent years, with greater reliance on private plantings, as illustrated below. This suggests the need to explore the scope for public plantings to complement the sequestration levels achieved from private plantings, as well as to ensure that Ireland remains on target for 18% forest cover by 2050. Additionally, consideration should be given to incentivising the practice of agroforestry in order to increase the number of carbon sequestering trees.

\textbf{Figure 13 - Afforestation Levels 1922-2017, Public and Private}\textsuperscript{180}

\textsuperscript{178} The non-ETS status of agricultural emissions may limit this however.
\textsuperscript{179} Irish Farmers’ Association, Submission to the Committee
The figure to the left shows the current level of forestry in Ireland. The Committee heard that this is currently at 11%, with the target set for 18% forest cover by 2046-2050.

A significant concern in meeting this target is the lack of incentives to take up forestry among rural communities. The Committee was also advised of the need for mixed forestry and plants, and the avoidance of monoculture (in the interests of achieving biodiversity).

While the Committee was particularly concerned at recent issues regarding farm partnerships undertaken with Coillte, the Committee is confident these issues can be resolved. Partnerships will assist in building a strong base for carbon sequestration in Ireland, and this requires a well-structured and functional scheme for engaging private landowners.

Agroforestry

Agroforestry is described as “a land use system in which trees are grown in combination with agriculture on the same land”. In contrast to afforestation, agroforestry refers to the planting of trees on agricultural land, as opposed to land designated specifically for forestry, whether this is in small scale clusters of trees, along hedgerows or as single additions on agricultural land.

For example, there are 137,500 farms currently operating in Ireland and if every farm planted at least ten trees, there would be a minimum yield of 1.375 million trees to sequester carbon from the atmosphere. While this number is quite low compared with the figure of 18 million trees planted

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183 Department of Agriculture, Food and the Marine, Agroforestry (GPC 11 of the Agroforestry Scheme), Leaflet No.9, available at https://www.agriculture.gov.ie/media/migration/forestry/grantandpremiumschemes/2016/AgroForestryWEB220816.pdf, accessed 9 July 2018

184 Number of farms based on Central Statistics Office, Farm Structure Survey 2016
in 2016, it represents approximately 7.6% of that figure and demonstrates the potential of agroforestry in providing a means of offsetting emissions.

One of the key issues highlighted to the Committee is the current level of support available to take up agro-forestry, which was described as “very poor”. An agroforestry initiative could address the need to increase planting from current levels and reach the required level of 450,000 ha of forest cover by mid-century. This could be further focused on native trees. The INHFA also expressed a preference to engage in planting quality forests and agro-forestry.

**Grasslands**

90% of Ireland’s agricultural lands are carbon sequestering grasslands. However, grasslands do not appear to be included for carbon accounting purposes. Also, some doubt was expressed as to the level of sequestration possible for the soils underpinning such grasslands, as many permanent pastures are at a saturation point, with accounting for net carbon emissions in farming systems also highlighted.

However, the Committee also heard that Meat Industry Ireland was undertaking a project with Teagasc to examine the sequestering potential of a soil carbon sink on Irish grassland. In terms of generally offsetting emissions against grassland management, bio-energy and forestry, the capacity was noted as being very limited.

**Clover**

The issue of including clover in swards was raised, with ICOS noting that this “has the potential to reduce nitrogen use resulting in less nitrous oxide emissions, while maintaining grass dry matter production per ha”. Teagasc, in its research, not only found that the use of clover corresponded to a much lesser use of nitrogen per hectare, but also resulted in higher milk production.

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185 Irish Natura and Hill Farmers Association, Evidence to the Committee, 20 February 2018. See also, Department of Agriculture, Food and the Marine, Evidence to the Committee, 14 November 2017, where the scope to make some designated land available for planting was discussed, as were current restrictions on the planting of forestry on hen harrier designated land as the hen harrier species is very vulnerable.
186 Irish Cooperative Organisation Society, Submission to the Committee
187 Irish Cooperative Organisation Society, Evidence to the Committee, 13 February 2018
188 Irish Natura and Hill Farmers Association, Evidence to the Committee, 20 February 2018
189 Irish Farmers’ Association, Submission to the Committee
190 Irish Natura and Hill Farmers Association, Submission to the Committee
191 Meat Industry Ireland, Evidence to the Committee, 20 February 2018
192 Environmental Pillar, Evidence to the Committee, 6 March 2018
193 Irish Cooperative Organisation Society, Submission to the Committee
### Forestry and Grasslands

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.</td>
<td>The Committee recommends a scheme that promotes agroforestry among Irish farmers through the provision of adequate supports and incentives, including that consideration be given to making designated land available for planting.</td>
</tr>
<tr>
<td>27.</td>
<td>The Committee recommends that consideration be given to resuming public plantings of new forests, in addition to current measures encouraging private planting.</td>
</tr>
<tr>
<td>28.</td>
<td>There is much opportunity in the area of biomass, and the Committee recommends that appropriate incentives are introduced to encourage and revitalise biomass production.</td>
</tr>
<tr>
<td>29.</td>
<td>The Committee recommends that no forestry scheme should focus on a single type of tree i.e. monoculture, and practices to ensure biodiversity should be encouraged. As part of this, the Committee suggests that current requirements for biodiversity (15%) be reviewed with consideration given to increasing this requirement.</td>
</tr>
<tr>
<td>30.</td>
<td>The Committee recommends providing support and guidance to farmers on the adoption and practice of organic and conservation agriculture.</td>
</tr>
<tr>
<td>31.</td>
<td>The Committee recommends a scheme to encourage the use of mixed swards and grasslands containing clover.</td>
</tr>
</tbody>
</table>
6. Climate Change in the Marine Sector

The Committee heard that oceans cover 71% of the planet, playing a critical role in climate regulation and in buffering the damaging effects of global climate change.\textsuperscript{195} It was further highlighted to the Committee that the ocean has absorbed more than 25% of the net CO2 emissions generated by humans and 93% of the additional heat arising from the greenhouse gas effect.\textsuperscript{196} This however, is not without consequences.

Climate Change is already having an impact on the oceans, including fisheries, aquaculture, coastal infrastructure and marine eco-systems. However, the forecasting and predictability of future impacts is far from certain, with a key issue arising being the support and need for additional research and climate monitoring.

Ireland’s climate is predominantly maritime-influenced, in particular by the North Atlantic Current and the prevailing south-westerly airflows. Ireland’s maritime territory is ten times the size of its landmass.

Changes to Maritime Climate

There are significant socioeconomic impacts associated with climate change from a maritime perspective, which extend to land-based industry and agriculture. Adverse temperature, wind and sea conditions have the potential to negatively impact recruitment in key shellfish and fish stocks.\textsuperscript{197}

Figure 15 - Headline Changes, Submission of the Marine Institute\textsuperscript{198}

\begin{table}[h]
\centering
\begin{tabular}{|l|}
\hline
Headline Changes \\
\hline
- Increase in sea surface temperature of 0.6°C per decade since 1994 \\
- Increase in wave heights of 0.8m off southwest Ireland \\
- Sea level around Ireland has risen by approx. 4-6 cm since early 1990s \\
- Surface waters have become more acidic at a rate of 0.02 pH units per decade (Rockall Trough) \\
- Increase in marine organisms which have public health implications: \\
  - Impact on fish species, including decreasing numbers of cod and haddock and increasing numbers of hake and monkfish. \\
  - Numbers of warm water fish species are increasing, including increased sightings of exotic fish species; \\
  - Salmon, trout and eel populations have declined since the 1980s \\
\hline
\end{tabular}
\end{table}

Oceanic Acidification

At first glance, it would seem that GHG emissions and other forms of carbon pollution are deposited into the atmosphere. However, there are a number of environments that function as carbon sinks. The ocean is one such example. The acidification of the oceans is the key climate change challenge in the marine sector, caused by the absorption of carbon dioxide by the oceans to form carbonic acid.

\textsuperscript{195} Marine Institute, Submission to the Committee
\textsuperscript{196} Ibid.
\textsuperscript{197} National Inshore Fisheries Forum, Submission to the Committee
\textsuperscript{198} Marine Institute, Submission to the Committee
One of the key sectors that could be impacted by oceanic acidification is the aquaculture sector. The Committee heard that it faces the risk of acidification which can damage oyster and mussel productivity.\textsuperscript{199} The disruptive impact on aquaculture of algal blooms was also highlighted.\textsuperscript{200} The increase in the abundance of phytoplankton was also raised, which has public health implications if contaminated shellfish are consumed.\textsuperscript{201}

**Coastal Erosion**

In its submission, the Marine Institute highlighted the need for further investment in harbour infrastructure and coastal flood defences due to rising sea levels and increased storm activity.\textsuperscript{202} Storm surges also present a potential issue for coastal industries, through wavetopping impacting premises, while agricultural land and drinking water in coastal areas could be affected by saline intrusion.\textsuperscript{203} The impact on drinking water and urban infrastructure was also highlighted to the Committee in hearings.\textsuperscript{204}

Coastal erosion also has an impact on farming communities, with many farmers having to resort to using landfill to build embankments / levees in order to keep sea and flood waters out of their land.\textsuperscript{20} Failing to do so could result in the land becoming unsuitable for farming and therefore impacting income supports available to the farmer, most notably the basic payment. However, building the levees can result in other areas flooding more and the land being deprived of nutrients as silt cannot be deposited on these floodplains. There is also an element of risk with the materials used in building embankments, e.g. asbestos, as well as a loss of visual amenity in the appearance of such embankments.

**Opportunities**

While Climate Change presents a number of adverse challenges, the Committee heard that it also presents a number of opportunities:

1. **Changes to Fish Stocks**

   The Committee heard that the impact of climate change is being observed through declining cod and haddock stocks and increasing hake and monkfish stocks, with the latter being more valuable.

2. **Renewable Energy**

   Marine energy or tourism can provide employment opportunities to sectors that could be adversely impacted by climate change in the long term. The Committee heard that the

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\textsuperscript{199} Marine Institute, Evidence to the Committee, 6 March 2018
\textsuperscript{200} Ibid.
\textsuperscript{201} Marine Institute, Submission to the Committee
\textsuperscript{202} Ibid. The potential difficulties these conditions may pose to small vessels, such as fishing vessels and harbour transfer craft, was also raised as an issue.
\textsuperscript{203} Ibid.
\textsuperscript{204} Marine Institute, Evidence to the Committee, 6 March 2018
\textsuperscript{205} Coastwatch, Submission to the Committee
combination of offshore wind, tidal and wave energy may be described as “Ireland’s oil for a future world”.\textsuperscript{206}

3. Marine Tourism

This potential is largely focused on activity based tourism, such as the Wild Atlantic Way brand, which the Committee heard has a low carbon footprint and potential for increases in tourism revenue.\textsuperscript{207} However, there is a possible issue arising from angling of wild salmon, with the species habitat moving north of Ireland due to warming waters. This may require the need for a plan to be put in place to mitigate this.

Inshore Sector

The Committee received a submission from the National Inshore Fisheries Forum (NIFF) setting out the main challenges it faces, in particular:

- The potential of climate change to contribute to significant capital losses;
- The potential of climate change to limit productivity by reducing the number of fishing days;
- The impact on key shellfish and fish stocks due to adverse temperature, wind or sea conditions; and

The issue of fuel efficiency and carbon emissions was also identified.\textsuperscript{208} However, it was also stated that the inshore sector has a relatively low carbon footprint and a lower environmental impact when compared with other sectors in the seafood and wider food production industries.

Recommendations

### Climate Change in the Marine Sector

32. The Committee is gravely concerned by the implications of plastic packaging and its impact on the oceans and recommends that measures are put in place to limit Ireland’s contribution to this issue.

33. The Committee recommends that the potential risks to aquaculture be monitored, particularly in the oyster and mussel sectors and the possible health impacts from algal blooms and phytoplankton.

34. The Committee notes that Climate Change may result in warmer waters and recommends that a study be undertaken on the likely economic advantages, for example hake and monkfish sectors where stocks may increase.

35. The Committee recommends that measures be taken to prepare for any adverse impact of Climate Change on stocks, such as cod and haddock in the fisheries sector and wild salmon in the angling sector.

\textsuperscript{206} Marine Institute, Evidence to the Committee, 6 March 2018

\textsuperscript{207} Ibid.

\textsuperscript{208} National Inshore Fisheries Forum, Submission to the Committee
7. Conclusion

In concluding this report, the Committee has examined the climate change issue in great detail, highlighting the scale of the problem, the comparison with other Member States, the scope for improvement, but also the importance of agri-food to the economy and in bolstering international trade. While there have been significant efforts from the agri-food sector as a whole, there is scope for further improvements to be made.

Agriculture is the largest contributor to Irish GHG emissions and while the point has been made that it is more challenging to lower emissions in that sector, there is scope for further improvements. A number of options exist, including forestry, organic farming, increased production efficiencies and current initiatives such as Origin Green. It is highly likely the next CAP will play an important role as well. However, balancing increased production with lower emissions is a very substantial challenge, and the Committee believes that an impact assessment of Food Wise 2025 must be very important. In line with the economic challenges, most notably Brexit, the issue of emissions could have significant long-term consequences.

Some of the consequences are already apparent, with the impact of heatwaves and winter storms both recently felt by farmers and the rural community. The need for early intervention is clear. Measures such as EU funding, Exchequer funding and schemes managed by the Department should be implemented. Additionally, support from expertise, the development of logistical channels and enhanced scientific and business supports should be of assistance.

There is much concern in the level of emissions coming from the livestock sector. However, unlike other sectors, the long-term goal is carbon neutrality. Already, very substantive programmes have been implemented, with particular focus in this report on Origin Green, Dairy Sustainability Ireland and the Smart Farming Programme. As research and knowledge develops, further opportunities measures and supports for addressing the level of emissions can also be developed. While Ireland is already demonstrating high levels of efficiency, there is always scope for improvement as technology develops and there is also scope to share this level of knowledge and efficiency more widely. There may also be merit in exploring Cross-border co-operation on reducing emissions.

Science too has a role to play, and initiatives such as the Beef Data Genomics Programme, as well as the potential of seaweed additives may mitigate climate change impacts. The Carbon Navigator is another tool that the Committee believes is vitally important in assessing the impact of farming on the environment at an individual level.

GHG emissions are not just confined to enteric fermentation. The Committee considered agricultural soils and manure management as a source of emissions, and believes a Climate Activation Programme enhancing existing schemes and including new incentives for the farming community should be explored. Simple actions such as the greater use of lime could have a beneficial impact on soil quality and the capacity of soils to store carbon. An area of particular interest, is the development of anaerobic digestion to a much greater level. This offers a means of producing an energy resource in biogas, with the by-product forming a nutrient-rich fertiliser.

There are also less obvious ways in which this sector could offer value, such as the potential of bioplastics and beekeeping as well as the planting of specific crops. Bioplastics offer a product that is
compostable, potentially addressing the challenges currently posed by conventional plastics. Enhancing beekeeping acknowledges an issue that may become more important in the years ahead, as plant life is heavily dependent on pollination.

In addition to the scope for mitigating emissions, the Committee noted that agriculture is the only sector that can sequester emissions through storing carbon. The primary methods explored in this report are forestry, agroforestry and grasslands. Central to this is the encouragement of biodiversity, with some specific recommendations such as conservation agriculture and the use of mixed swards and clover.

The marine sector has not been forgotten, and the Committee has examined issues on the level of plastics, ocean acidification, the possible economic opportunities and the potential implications from the decline in certain stocks. There is a strong relationship between the agriculture, food and marine sectors, with the ocean playing a substantial role in our climate.

Finally, as the climate change issue evolves, the challenges and potential solutions should remain under constant review.
Appendix 1: Orders of Reference

a) Scope and Context of Activities of Committees (derived from Standing Orders – DSO 84, SSO 70)

1) The Joint Committee may only consider such matters, engage in such activities, exercise such powers and discharge such functions as are specifically authorised under its orders of reference and under Standing Orders;

2) Such matters, activities, powers and functions shall be relevant to, and shall arise only in the context of, the preparation of a report to the Dáil/and or Seanad;

3) The Joint Committee shall not consider any matter which is being considered, or of which notice has been given of a proposal to consider, by the Committee of Public Accounts pursuant to Standing Order 186 and/or the Comptroller and Auditor General (Amendment) Act 1993;

4) The Joint Committee shall not consider any matter which is being considered, or of which notice has been given of a proposal to consider, by the Joint Committee on Public Petitions in the exercise of its functions under Standing Order 111A; and

The Joint Committee shall refrain from inquiring into in public session or publishing confidential information regarding any matter if so requested, for stated reasons given in writing, by—

(i) a member of the Government or a Minister of State, or

(ii) the principal office-holder of a body under the aegis of a Department or which is partly or wholly funded by the State or established or appointed by a member of the Government or by the Oireachtas:

Provided that the Chairman may appeal any such request made to the Ceann Comhairle, whose decision shall be final.

5) It shall be an instruction to all Select Committees to which Bills are referred that they shall ensure that not more than two Select Committees shall meet to consider a Bill on any given day, unless the Dáil, after due notice given by the Chairman of the Select Committee, waives this instruction on motion made by the Taoiseach pursuant to Standing Order 28. The Chairmen of Select Committees shall have responsibility for compliance with this instruction.
b) Functions of Departmental Committees (derived from Standing Orders – DSO 84A and SSO 70A)

(1) The Select Committee shall consider and report to the Dáil on—

(a) such aspects of the expenditure, administration and policy of a Government Department or Departments and associated public bodies as the Committee may select, and

(b) European Union matters within the remit of the relevant Department or Departments.

(2) The Select Committee may be joined with a Select Committee appointed by Seanad Éireann for the purposes of the functions set out in this Standing Order, other than at paragraph (3), and to report thereon to both Houses of the Oireachtas.

(3) Without prejudice to the generality of paragraph (1), the Select Committee shall consider, in respect of the relevant Department or Departments, such—

(a) Bills,

(b) proposals contained in any motion, including any motion within the meaning of Standing Order 187,

(c) Estimates for Public Services, and

(d) other matters as shall be referred to the Select Committee by the Dáil, and

(e) Annual Output Statements including performance, efficiency and effectiveness in the use of public moneys, and

(f) such Value for Money and Policy Reviews as the Select Committee may select.

(4) Without prejudice to the generality of paragraph (1), the Joint Committee may consider the following matters in respect of the relevant Department or Departments and associated public bodies:

(a) matters of policy and governance for which the Minister is officially responsible,

(b) public affairs administered by the Department,

(c) policy issues arising from Value for Money and Policy Reviews conducted or commissioned by the Department,

(d) Government policy and governance in respect of bodies under the aegis of the Department,

(e) policy and governance issues concerning bodies which are partly or wholly funded by the State or which are established or appointed by a member of the Government or the Oireachtas,

(f) the general scheme or draft heads of any Bill
(g) any post-enactment report laid before either House or both Houses by a member of the Government or Minister of State on any Bill enacted by the Houses of the Oireachtas,

(h) statutory instruments, including those laid or laid in draft before either House or both Houses and those made under the European Communities Acts 1972 to 2009,

(i) strategy statements laid before either or both Houses of the Oireachtas pursuant to the Public Service Management Act 1997,

(j) annual reports or annual reports and accounts, required by law, and laid before either or both Houses of the Oireachtas, of the Department or bodies referred to in subparagraphs (d) and (e) and the overall performance and operational results, statements of strategy and corporate plans of such bodies, and

(k) such other matters as may be referred to it by the Dáil from time to time.

(5) Without prejudice to the generality of paragraph (1), the Joint Committee shall consider, in respect of the relevant Department or Departments—

(a) EU draft legislative acts standing referred to the Select Committee under Standing Order 114, including the compliance of such acts with the principle of subsidiarity,

(b) other proposals for EU legislation and related policy issues, including programmes and guidelines prepared by the European Commission as a basis of possible legislative action,

(c) non-legislative documents published by any EU institution in relation to EU policy matters, and

(d) matters listed for consideration on the agenda for meetings of the relevant EU Council of Ministers and the outcome of such meetings.

(6) Where the Select Committee has been joined with a Select Committee appointed by Seanad Éireann, the Chairman of the Dáil Select Committee shall also be the Chairman of the Joint Committee.

(7) The following may attend meetings of the Select or Joint Committee, for the purposes of the functions set out in paragraph (5) and may take part in proceedings without having a right to vote or to move motions and amendments:

(a) members of the European Parliament elected from constituencies in Ireland, including Northern Ireland,

(b) members of the Irish delegation to the Parliamentary Assembly of the Council of Europe, and

(c) at the invitation of the Committee, other members of the European Parliament.

(8) The Joint Committee may, in respect of any Ombudsman charged with oversight of public services within the policy remit of the relevant Department or Departments, consider—

(a) such motions relating to the appointment of an Ombudsman as may be referred to the Committee, and

(b) such Ombudsman reports laid before either or both Houses of the Oireachtas as the Committee may select.
Appendix 2: Committee Membership

**Chairman:** Pat Deering (FG)

**Vice Chairman:** Jackie Cahill (FF)

**Deputies:**
- Marcella Corcoran-Kennedy (FG)
- Martin Kenny (SF)
- Charlie McConalogue (FF)
- Willie Penrose (Lab)
- Thomas Pringle (I4C)

**Senators:**
- Paul Daly (FF)
- Tim Lombard (FG)
- Pádraig Mac Lochlainn (SF)
- Michelle Mulherin (FG)
## Appendix 3: Glossary of Terms

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<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ANC</td>
<td>Areas of Natural Constraints</td>
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<tr>
<td>AD</td>
<td>Anaerobic Digestion</td>
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<tr>
<td>BDGP</td>
<td>Beef Data and Genomics Programme</td>
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<tr>
<td>CA</td>
<td>Conservation Agriculture</td>
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<tr>
<td>CAN</td>
<td>Calcium Ammonium Nitrate</td>
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<tr>
<td>CAP</td>
<td>Common Agricultural Policy</td>
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<tr>
<td>CHP</td>
<td>Combined Heat and Power</td>
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<tr>
<td>CH4</td>
<td>Methane</td>
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<tr>
<td>CO2</td>
<td>Carbon Dioxide</td>
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<tr>
<td>CSO</td>
<td>Central Statistics Office</td>
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<tr>
<td>DAFM</td>
<td>Department of Agriculture, Food and the Marine</td>
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<td>DSI</td>
<td>Dairy Sustainability Ireland</td>
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<td>EASAC</td>
<td>European Academies Science Advisory Council</td>
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<tr>
<td>EBI</td>
<td>Economic Breeding Index</td>
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<td>EEA</td>
<td>European Economic Area</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<td>ETS</td>
<td>EU Emissions Trading System</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>FTMTA</td>
<td>Farm Tractor and Machinery Trade Association</td>
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<td>GHG</td>
<td>Greenhouse Gases</td>
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<tr>
<td>GLAS</td>
<td>Green Low Carbon Agri-environment</td>
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<td>HFC</td>
<td>Hydrofluorocarbon</td>
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<tr>
<td>ICBF</td>
<td>Irish Cattle Breeding Federation</td>
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<tr>
<td>ICMSA</td>
<td>Irish Creamery Milk Suppliers Association</td>
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<tr>
<td>ICOS</td>
<td>Irish Co-operative Organisation Society</td>
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<tr>
<td>ICSA</td>
<td>Irish Cattle and Sheep Farmers’ Association</td>
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<tr>
<td>IFA</td>
<td>Irish Farmers’ Association</td>
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<tr>
<td>INHFA</td>
<td>Irish Natura and Hill Farmers Association</td>
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<tr>
<td>IOFGA</td>
<td>Irish Organic Farmers and Growers Association</td>
</tr>
<tr>
<td>K</td>
<td>Potassium</td>
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<tr>
<td>ktCO2eq</td>
<td>Kilotonnes of CO2 equivalent</td>
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<tr>
<td>LULUCF</td>
<td>Land Use, Land Use Change and Forestry</td>
</tr>
<tr>
<td>N</td>
<td>Nitrogen</td>
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<tr>
<td>NBPT</td>
<td>N-(n-butyl) thiophosphoric triamide</td>
</tr>
<tr>
<td>NF3</td>
<td>Nitrogen trifluoride</td>
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<tr>
<td>NIFF</td>
<td>National Inshore Fisheries Forum</td>
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<tr>
<td>NMP</td>
<td>National Mitigation Plan</td>
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<tr>
<td>N2O</td>
<td>Nitrous oxide</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>P</td>
<td>Phosphorous</td>
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<tr>
<td>SDAS</td>
<td>Bord Bia - Sustainable Dairy Assurance Scheme</td>
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<tr>
<td>SF6</td>
<td>Sulfur hexafluoride</td>
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<tr>
<td>SME</td>
<td>Small and medium-sized enterprises</td>
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<tr>
<td>TAMS</td>
<td>Targeted Agricultural Modernisation Scheme</td>
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<tr>
<td>UCD</td>
<td>University College Dublin</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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## Appendix 4: Links to Public Hearings

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<tr>
<th>Date</th>
<th>Discussion</th>
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<tbody>
<tr>
<td>14 November 2017</td>
<td>Discussion with Officials from the Department of Agriculture, Food and the Marine</td>
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<tr>
<td>12 December 2017</td>
<td>Discussion with representatives from Coillte</td>
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<tr>
<td>23 January 2018</td>
<td>Discussion with representatives from Bord Bia</td>
</tr>
<tr>
<td>13 February 2018</td>
<td>Discussion with representatives from the Irish Farmers’ Association; Irish Cooperative Organisation Society; Irish Creamery and Milk Suppliers’ Association; and Macra na Feirme</td>
</tr>
<tr>
<td>20 February 2018</td>
<td>Discussion with representatives from Meat Industry Ireland; Irish Grain Growers; and Irish Natura and Hill Farmers Association</td>
</tr>
<tr>
<td>6 March 2018</td>
<td>Discussion with representatives from the Environmental Protection Agency; Environmental Pillar; Stop Climate Chaos Coalition; Marine Institute; Dairy Industry Ireland; Irish Organic Farmers and Growers Association; Teagasc; and Irish Cattle and Sheep Farmers Association</td>
</tr>
<tr>
<td>11 April 2018</td>
<td>Discussion with the Minister for Agriculture, Food and the Marine</td>
</tr>
<tr>
<td>15 May 2018</td>
<td>Discussion with representatives from BASE Ireland</td>
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<tr>
<td>29 May 2018</td>
<td>Discussion with representatives from University College Dublin</td>
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<tr>
<td><strong>Submissions</strong></td>
<td>Consolidated Written Submissions to the Committee</td>
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